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RAILWAY ELECTRIFICATION IN JAPAN: A WELCOME CONTRACT.

At the annual meeting of the English Electric Company, Limited, reported in the ELECTRICAL REVIEW for May 19th, Sir C. E. Ellis, the chairman, was able to refer with satisfaction to the important contracts that the company had secured during the year, such contracts including important railway electrification work in Spain and in Japan. He added that on all sides there were signs that public works, too long delayed, were shortly to be put in hand, and in this respect the future was full of promise. Equally confident hopes have been entertained by other electrical manufacturing companies, and that there was very good ground for such expectations is proved by the announcement which we were able to make in our last issue of the placing of a very substantial contract for electric locomotives for the Imperial Government of Japan with the English Electric Co. Sir C. E. Ellis remarked in the speech referred to that railway electrification had made relatively slight progress in this country, less on technical than on financial grounds, but he proceeded to refer with pride to the main-line work that had been executed in England, namely, the L. and Y. and the N.E. electrified sections, by British concerns —Dick, Kerr and Siemens Bros.—and as evidence of the readiness and determination of the English Electric to continue to hold the position thus secured, he said that instead of continuing to manufacture such equipments in two works, they were now concentrating at Preston the whole of the output, with the technical experience and staff of both concerns.

He instanced this arrangement as one of the advantages following upon the existence of the combination. It is at the Dick, Kerr works at Preston that the important order from the Japanese Imperial Government Railways will be executed. The contract is for 34 complete electric locomotives, and its value is more than half a million pounds sterling. The receipt of this order comes at the best possible moment for several reasons. It will further impress the world (not excluding, of course, authorities connected with Home railways shortly to be electrified) with the technical ability of British electrical engineering concerns to carry out large electric railway equipment business; it makes known the fact that, in spite of all our difficulties, we can successfully cope with foreign competition, particularly that coming from America, and in a market where America has scored considerable successes of late: and it declares in a very emphatic way that the lock-out is a thing of the past and that British workers and British employers have settled down to business in earnest. Not less important than these considerations is the knowledge, which should be widely spread abroad, that the order was secured after the fullest investigation by Japanese engineers into the electric railway systems in operation in different parts of the world, owing to the confidence of these engineers in the excellence of British design and workmanship. The order represents the whole Japanese Government requirements for locomotives up to the end of 1923, for those main-line railway sections which are to be electrified at once. There is little doubt that the big things that are in prospect at home and abroad justify the view that we shall henceforth become accustomed to six and seven figure electrical contracts. May they speedily become as familiar and as common as the four and five figure orders have been in recent times.

Automatic Train Control.

The report of the Automatic Train Control Committee, which has just been issued, marks an important stage in the application of electrical control to railway operation in this country. Nowhere in the world has railway travel been raised to a higher degree of safety, but the human element has not been eliminated, and the most elaborate systems of signalling cannot afford protection against mistakes by enginemen. That such errors can be guarded against by automatic electrical appliances has been proved beyond dispute, and the Committee, after a full investigation, concludes that the case for automatic train control has been made out. If on account of the cost the complete system cannot be installed at present, the Committee recommends that a partial system be introduced at selected stop signals, and a committee of experts be formed immediately to standardise the apparatus. Apart from the gain in safety to passengers and *personnel*, this means work for the electrical industry, worth more than a million sterling, while the complete scheme would cost 4½ millions.

Proposed Visit to Gennevilliers

The important power station which is being erected by the Union d'Electricité for the supply of electricity to Paris, and of which we gave a brief account in our issue of April 14th, is of exceptional interest to British engineers, and is attracting a great deal of attention. As we indicated in the article above-mentioned, it is designed to contain generating plant of 200,000-kW capacity, with facilities for extension to 320,000 kW, and is therefore the largest undertaking as yet projected in Europe, if not in the world. The five generating sets already installed are rated at 40,000 kW each, and are supplied with steam at 355 lb. per sq. in. by 25 water-tube boilers; the air for cooling the generators is circulated through a closed circuit, and is itself cooled by the water of condensation, thus recovering the heat liberated in the alternators; the feed water is further passed through the oil-coolers and through heaters fed with steam from turbines, heating it nearly to boiling point; the distribution pressure is 60,000 volts; the switchgear and underground cables will work at this pressure; in the outer areas overhead mains will be used, comprising in all 250 km. of route. The design of the plant as a whole is unique, and will well repay the most careful investigation.

We feel sure that many of our readers would cordially welcome an opportunity of visiting this installation, and we propose to make the necessary arrangements to enable them to do so; for this purpose we have approached the Union d'Electricité, which has very kindly expressed its hearty approval, and suggests that the visit should be made towards the end of September next. Obviously it is important for us to ascertain, at the earliest possible date, the number of persons who would take part in the proposed excursion, in order to make due preparation for their comfort and convenience; we therefore invite all readers who are interested in the proposal to communicate with us as soon as possible. By doing so, they will not commit themselves in any way to participation in the visit; that will be a matter for them to determine after they have received particulars regarding the date, the period, and the cost involved, but none of these points can be settled until we have in our hands sufficient information to enable us to proceed with the preliminary arrangements.

Tentatively, to afford a basis for consideration, we suggest that the party might leave London on Friday, September 22nd, and return on Monday night, September 25th, and that the inclusive cost might be about 8 guineas, but it will be clearly understood that these suggestions are only a first approximation.

Besides Gennevilliers power station, there are other extremely interesting installations to be seen in France to-day, and some may wish to extend their itinerary to cover a few of these, such as the hydro-electric undertakings at Grenoble, and certain new steam power stations. Whether this is feasible or not will again depend upon the number desirous of taking part in the tour, and we invite readers who contemplate doing so to indicate their preference for either (1) a four-day excursion to Paris, or (2) an eight-day tour, including Paris, Grenoble, &c. Obviously arrangements can be made for all the visitors to take the former, and for those who so desire to prolong their stay and take part in the latter.

If our proposal meets with an adequate response, we shall at once proceed with the arrangements and publish the details in an early issue, so that ample time will be available for suggestions to reach us for the improvement of the scheme; and again we invite *immediate* reply from those who are interested.

The High Price of Coal.

There is a persistent call from all classes of consumers of electricity for lower charges, and, indeed, if electricity is to attain its proper position in modern civilisation, a considerable reduction in prices is imperative.

It cannot be said, however, that the present prices of electricity in this country are exorbitant, having due regard to the expense entailed in generating the energy. The remedy is therefore the lowering of production costs, and this may be achieved in a number of directions. Efficiency, thermal and managerial, must be improved, but every engineer already devotes constant attention to this point. Wages can be reduced; under the existing agreements the reduction is still in progress as the cost of living falls. Another method is to secure a fuller use of the generating plant, striving toward the 100 per cent. load factor; this is dependent upon lower charges and the development of the "off-peak" load. There remains yet another way in which production costs may be reduced—the obtaining of cheaper fuel.

Recently-issued annual reports of electricity undertakings show that in spite of reductions in this direction, ranging from 4s. to 10s. per ton, the price of coal remains at far too high a level. Although among the foremost in the upward race of prices, coal seems to be very tardy in returning to the normal, compared with other materials.

The electrical engineer of West Ham, Mr. F. W. Purse, reports that while the coal consumption per kWh sold has improved from 4.1 lb. in 1914 to 3.77 lb. at the present time, the fuel cost per unit has advanced from .31d. to .96d., the average price of coal per ton being 44s. 8½d., as compared with 13s. 11d. in 1914. Even at Cardiff, situated in the South Wales coalfields, the average price to the electricity works, during 1921-22, was 36s. 7d. per ton, representing .625d. per unit sold. At Manchester the fuel cost per unit was about .66d., a comparatively low figure which may have been due in part to the purchase of coal from the American continent.

The recent reductions in the price of domestic coal were so drastic that it has been suggested that they might have happened earlier and more gradually. Can it be that this is the case with the coal we use for the production of electricity? And may we suggest that an appreciable reduction in price is possible? The coal-owners usually counter any such suggestions with allegations of exorbitant rates against the railway companies, while the latter indignantly repudiate the charges. Having in view the position of Cardiff, we are inclined to think that perhaps the railway companies are not wholly to blame, and to look to the coal-owners for further justification of high coal prices.

220,000-VOLT TRANSMISSION CONSTRUCTION IN CALIFORNIA.

(Communicated).

The persistently increasing demands for cheap power by the residential, industrial, and agricultural interests of the State of California are being attended by many far-reaching developments in the economic generation and distribution of electrical energy, particularly that of hydraulic derivation. At the present moment interest is focused upon upon the construction of the 220,000-volt transmission system of the Pacific Gas & Electric Co. serving the San Francisco Bay country, which may be described as the gravity centre of power consumption of the State. The constructional work is being pressed forward with all speed so that it may be brought into service in anticipation of the coming winter load.



Fig. 1.—Pit River 220,000-volt Transmission Line, looking Towards Sacramento Valley.

Cheap power is the most critical issue confronting the varied interests of the State, and to-day hydro-electricity represents the cheapest and most efficient form of energy available. The State is deficient in domestic coal resources; it is dependent upon British Columbia and Australia for its supplies of this commodity, but the use of such fuel is handicapped by the import duty. The alternative, oil, though found in abundance throughout the State, is unable to extend any appreciable relief, while the apprehension that the oil-fields will become exhausted within the next two decades has rendered the economic outlook extremely precarious. When oil was first struck it became a formidable competitor to coal. It was sold in Los Angeles at 1s. a barrel, which was equal to the best bituminous coal at 4s. a ton. But as the means of storing the liquid fuel upon the fields and its cheap movement to the coast through pipe lines were improved, the price of this commodity rapidly rose owing to the higher figure which it could command in foreign markets. In 1916 oil commanded 3s. 3d. a barrel in San Francisco, but in July, 1920, it had soared to approximately 8s. a barrel, which was equivalent to bituminous coal at 32s. per ton.

Fortunately the State is richly endowed with extensive hydraulic resources, the adjacent Sierra Nevada mountain range acting as a huge condensing screen and catchment area, while, normally, the rain and snow precipitation is some-

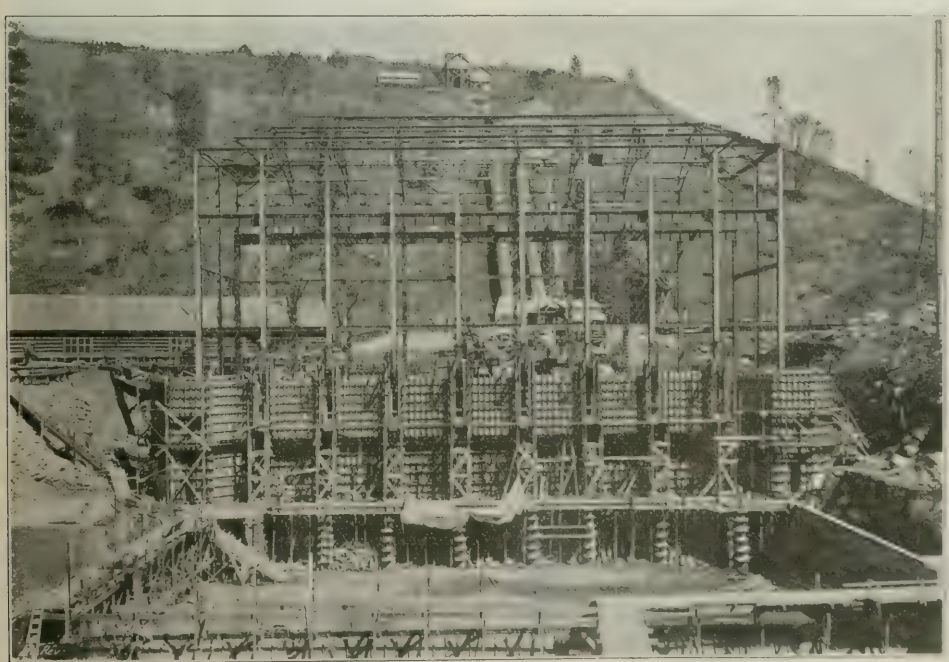


Fig. 2. Steel Frame of Pit River Power House No. 1.
The penstocks in the background are 96 in. in diameter, conveying 1,200 cusecs at a head of 174 ft. Two 7,000-kVA generating sets are being installed.

what heavy. During the past decade, however, precipitation has decreased, with the result that it has become necessary to venture upon extensive and costly conservation schemes for the storage of the water arising

the mountains, it being necessary in some instances to provide sufficient storage for about 200 days a year to ensure an adequate uniform flow to the power-houses. Conservation difficulties have compelled the various corporations to venture to more distant reaches of the mountain watershed to satisfy their requirements, and this action has, in turn, necessitated recourse to somewhat large installations and high transmission pressures to render the projects commercially profitable.

Some years ago the Pacific Gas & Electric Co. launched a huge and comprehensive project comprising what are known as the Drum, Spaulding, Stanislaus, Hat Creek, Wise, and Pit River projects. The schemes are distinct in that they represent individual developments, but, at the same time, are intimately interconnected. Exclusive of the Pit River scheme, this company, the largest organisation of its character in the State, is operating 28



Fig. 3.

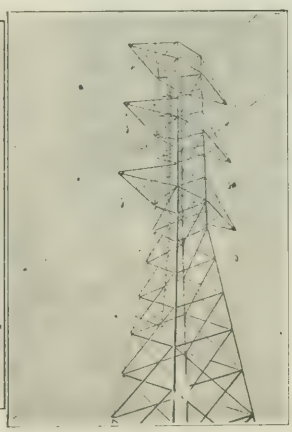


Fig. 4.

Fig. 3 Type of Suspension Insulator adopted on 220,000-Volt Line.

Fig. 4. Standard Type of Tower on Tangent Sections. Conductors for two circuits strung and temporarily supported on pulley blocks.

hydro-electric plants with an aggregate rated capacity of 325,000 h.p. In addition, it operates four steam stations situate in the heart of the San Francisco district, with a collective output of 156,836 h.p., bringing the grand total to 481,836 h.p. During the year 1920 this undertaking sold 1,042,265,939 kilowatt-hours—an increase of 19.97 per cent. over the preceding year—out of a total production of 1,475,678,673 kilowatt-hours, of which total, however, 126,063,215 kilowatt-hours were purchased from other sources. The connected load for the year was 817,049 h.p.: commercial and residential lighting, 326,992 h.p.; industrial,



Fig. 5. For [illegible] Steel Tower, showing ample [illegible].

198,813 h.p.; agricultural, 135,537 h.p.—with a system load factor of 64.9, an average daily load of 225,194 h.p., and 347,190 h.p. as the highest daily peak registered during the twelve months.

The necessity to reduce the purchase of power *en bloc* from other companies and to cope with the rapidly-rising demand, induced the company to commence operations upon the Pit River development in November, 1920. This hydraulic field, when fully exploited, will furnish over 350,000 kilowatts, but initial operations were confined to the completion with all speed of plant No. 1, with an ultimate capacity of 93,000 h.p. This is the most distant generating station of the company, being 250 miles north of the San Francisco Bay country, in which the company has to dispose of more than one-half of its total load. It is in the heart of the Cascades, 70 miles east of the town of Redding, and midway between Mounts Lassen and Shasta. The power-house carries two 35,000-kVA generators operating under a static head of 474 ft., the water being delivered through 96-in. penstocks under a pressure of 190 lb. per sq. in.

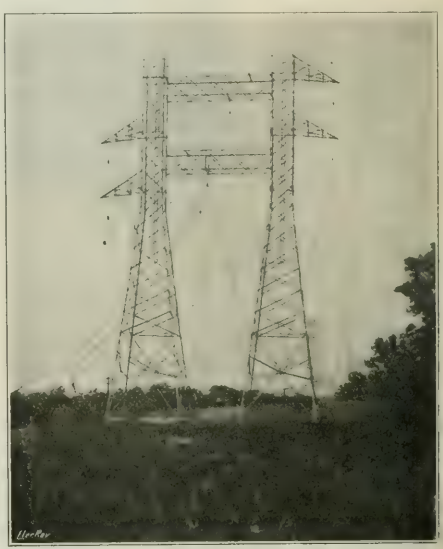


Fig. 6. Type of Tower used at Angle, showing Staggering of Cables.

The remote situation of the power-house and the necessity to transmit the power direct to the centre of demand, 250 miles to the south, occasioned considerable discussion and investigation of transmission pressures. The maximum hitherto attained upon this network has been 110,000 volts, but the success of the 242 miles transmission at 160,000 volts from Big Creek to Los Angeles, and the 165,000-volt line of the Great Western Power Co., 186 miles in length, from Caribou to the outskirts of San Francisco, led to the consideration of the possibility of venturing successfully beyond the last-named pressure.

Economic factors compelled such action if possible. The fact that the Pit River development would ultimately yield 350,000 kilowatts necessitated the reduction of the number of the transmission circuits to the minimum. If the pressure of 110,000 volts had been adopted, at least eight lines would have been required to conduct the energy to its destination, and the need to space the circuits an adequate distance apart would have precipitated complications and prodigious expense for right-of-way and patrolling, while the capital investment would have been decidedly heavy. As the result of the researches and calculations which were made, it was estimated that a 220,000-volt circuit would be able to carry a maximum load of 110,000 kW. with a transmission loss not exceeding 8 per cent., but, as the average load would probably not exceed 120,000 kilowatts, it was calculated that the loss could be kept down to 3.5 per cent. per 100 miles of circuit. Line construction would be appre-

ciably reduced because the capacity of one 220-kilovolt circuit would be equal to four lines at 110 kilovolts, while the capital cost and transmission losses of one 220-kilovolt line would be about one half of those incidental to four 110-kilovolt circuits having the same aggregate capacity. The conditions of the 165,000-volt line, such as the Great Western Power Co. had adopted, were also closely scrutinised, but it was ascertained that one 220-kilovolt circuit would be able to carry as much as two 165-kilovolt lines and show an appreciable saving in capital cost and maintenance charges, as well as in transmission losses.

The supreme problem with regard to the undertaking was the selection of the insulator to support the conductors and to withstand the electrical stresses, and before this part of the work was taken in hand elaborate researches were conducted. These are not yet wholly completed, but they were advanced to a sufficient degree to permit construction to be put in hand. The insulators favour the usual design with porcelain disks set in a string, except that the lower end, as may be seen from the accompanying illustration (fig. 3), is appreciably modified. The standard suspension type comprises 13 superimposed disk elements, but the second and fourth from the cable clamp are of larger diameter, thicker in section, and are practically distinct in themselves, being somewhat reminiscent of the cloche type, with heavier insulation between the two bottom units and the main suspension string above, the enlarged diameter of the second and fourth disks enabling them to act somewhat as a static shield and to prevent excessive leakage of electricity at the point of maximum electrical stress.

With the broad exception of the insulator, there has been no marked departure from the standard practice of the company as adopted upon its 110-kilovolt circuits, which, as the result of several years' service, have proved highly efficient. The towers on the tangent sections follow the usual design, except that they are larger, permitting the three conductors of each circuit carried on either side to be set more widely apart. On angles a new design, or rather, a modification of standard practice, has been introduced. Two standard towers are set side by side, but each has only two outwardly projecting conductor brackets, which are staggered in relation to one another. By reference to the accompanying illustration (fig. 6), showing the stringing of the conductors in position, it will be seen that the right-hand tower has the two top brackets retained, while on the left tower the two bottom brackets are preserved. The two towers are connected by two transverse trusses, from each of which the third conductor of each circuit is suspended, but these two cables are similarly staggered. The arrangement is somewhat interesting, because it provides an isosceles triangular disposition of the three wires of each circuit, with the one conductor passing through the tower forming the apex and the two outer conductors the base of the triangle. This disposition has not only permitted economical rigid construction, but has demanded less steel than otherwise would have been required. The guard wire is carried over the top of the tower in the usual manner.

Hard-drawn copper has been employed for the conductors, and it is interesting to remark that the contract for this part of the equipment represents the largest ever placed—11,000,000 lb. At the time this transmission line was taken in hand, the Anaconda Copper Co. had just completed the establishment of its refineries and finishing mills at Black Eagle, Montana, so that it was able to accept the fulfilment of this contract upon the spot, instead of transporting the copper matte to New Jersey for refining and re-shipping the finished product across the Continent as formerly.

Of the 11,000,000 lb. of copper strand for the two 220-kilovolt circuits ordered, 9,000,000 lb. was made up into rope strand of 500,000 circular mils. This is approximately equal to a diameter of 0.9 in., and is composed of seven copper wires stranded together, seven of which, in turn, are stranded to form the complete cable of 49 strands. Of the remainder, 1,200,000 lb. were made up into 250,000 circular mils standard strand, and the outstanding 800,000 lb. into cable of 4/0 and 3/0 B. & S. gauge, 7 strand, respectively. Each circuit is 201.5 miles in length, extending from the Pit No. 1 power-house to the special sub-station which has been built between Sacramento and Vacaville, and comprises 27.7 miles of 518,000 circular mils steel core aluminium cable and 173.8 miles of the 500,000 circular mils copper cable.

The manufacture of the copper cable occupied ten months, and 220 freight cars, each of 50,000 lb. capacity, were required to transport it from the Black Eagle mills to the railway stations adjacent to the route of the line. The copper conductors alone, as delivered at destination ready for stringing, represented an investment of nine million dollars—say £1,800,000—or one-fourth the total cost of the transmission line.

The special terminal which has been built near Vacaville occupies a plot of 90 acres of land. It has cost £250,000 to build and equip, and here the pressure is reduced from 220,000 volts to 110,000 volts, which is the standard maximum pressure of the company's high-pressure system. This station, in addition to dispatching the current at 110 kilovolts over the 50-mile transmission line to the Claremont sub-station at Oakland, where it is turned over to the general distribution system at 60,000 and 54,000 volts high-pressure and the varying low pressures, has also one incoming and one outgoing 110,000-volt circuit connecting to the 110,000-volt line extending from Drum to Cordelia, which passes a few miles to the north.

So far as the transformer equipment is concerned, both for stepping-up at Pit River and stepping-down at Vacaville, this does not show any marked departure from existing practice, except that the units are larger and of heavier construction. The most important equipment at the southern terminal is the 20,000-kVA, 11,000-volt, 3-phase, 60-cycle synchronous condenser operating at 60 revolutions per minute, with direct-connected exciter. There are two of these sets—one for each circuit and floating on the line to maintain the voltage. They are the largest sets of their type yet built, excelling those installed in the Eagle Rock station of the Big Creek, 240-mile, 150,000-volt transmission, which are of 15,000-kVA, 6,600-volt, 50-cycle capacity at 375 revolutions per minute. In the case of the Pit River installation, it is estimated that the cost of the transmission line, with the synchronous condensers, is approximately 25 per cent. less than what would have been incurred had the condensers been omitted.

It is computed that the present installation will meet the requirements of the company, owing to the provision of the two circuits having a combined normal carrying capacity of 240,000 kilowatts, until the final stage of the hydraulic development is taken in hand. Doubtless the 220-kilovolt pressure would have been adopted previously but for the fact that the generating units were considered to be inadequate. A very large unit is essential to bring the line up to voltage, and it is considered by the engineers responsible for the design and construction of the Pacific Gas & Electric development that the 35,000-kVA generators installed in the Pit River plant represent about the smallest units which should be used with a transmission line of the voltage and length adopted. Hitherto the demand for a 220-kilovolt pressure has not been experienced, but it is believed that it will now be extensively adopted. Already another Californian company has decided to convert its long-distance transmission to 232,000 volts, to reduce the capital investment upon transmission lines in connection with the big hydro-electric development which it has in hand, and the additional power-houses which are being brought into successive operation. Provided the load upon the line can be maintained at between 120,000 and 140,000 kilowatts, it is maintained that the cost per kilowatt-mile can be reduced below that of a lower voltage, although the total cost per mile for the 220,000-volt transmission line is about twice that for 110,000 volts.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

THE ANNUAL CONVENTION AT WOLVERHAMPTON.

(*Continued from page* 905.)

The New President.

We have pleasure in reproducing a portrait of Lieut.-Col. W. A. Vignoles, D.S.O., M.I.E.E., president of the I.M.E.A. for the year 1922-23. Col. Vignoles is well known as the electrical engineer to the Grimsby Corporation, and has taken a prominent part in promoting the development of electricity supply on commercial lines; in this connection he has furnished valuable data to the Institution of Electrical Engineers and the British Electrical Development Association, and his paper at the Convention gave rise to an interesting discussion, which is reported in this issue.



Lieut.-Col. W. A. Vignoles, D.S.O., M.I.E.E. [*H. E. Sherlock.*
President, I.M.E.A.

Col. Vignoles may be said to have inherited engineering gifts as a family characteristic, being the son of the late Mr. Hutton Vignoles, M.Inst.C.E., and grandson of the late Mr. Charles Blacker Vignoles, F.R.S., M.Inst.C.E., (a past-president of the Institution of Civil Engineers). He was educated in France, and received his technical training at the City and Guilds Technical College, Finsbury, under the late Dr. Silvanus P. Thompson, F.R.S. On leaving college in 1891, he entered the works of Messrs. W. T. Goolden and Co., electrical engineers, as apprentice, and worked through the various departments: in 1893 he was placed in full charge of an electrical coal-cutting installation at a Durham colliery, but in 1894 he returned to the manufacturing side of the industry as draughtsman at Messrs. Crompton & Co.'s works, Chelmsford; he became chief draughtsman in 1896, and for three years was responsible for the mechanical design of all the machinery manufactured there, both d.c. and a.c., besides preparing schemes for tenders. From 1899 to 1901 Mr. Vignoles was an assistant engineer with Sir A. B. W. Kennedy, preparing plans and specifications for various undertakings; he was resident engineer for Sir Alexander Kennedy at Grimsby, in charge of the erection of plant and the laying of mains, and in 1901 he was appointed electrical engineer to the Corporation, a position which he still occupies.

"Joining up" in September, 1914, he received a commission as Major in the 10th Battalion of the Lincolnshire Regiment, which went to France in January, 1916; on July 1st of that year Major Vignoles went "over the top" at the head of his company, and received a wound which brought him back to England, but in December he was in the field again, was promoted second in command of the battalion, and served with it until November, 1917, being in chief command for three months. He was then promoted Lieut.-Colonel, and appointed to command the 9th Battalion Northumberland Fusiliers, which was in action on March 21st and 22nd, 1918, during the great German offensive, and again in April, when for ten days it took part in the battle of the Lys.

Col. Vignoles was awarded the D.S.O. in 1917, and received a bar to it in 1918; he was also twice mentioned in dispatches.

Demobilised in February, 1919, Col. Vignoles carried out a scheme for the extension of the Grimsby electricity works, which he had submitted to his Committee in 1914; until then the whole of the supply had been direct current, but the new scheme provided for generation at 6,000 volts, a.c., and a 2,500-kW turbo-generator was installed, resulting in a large reduction in the cost of generation. His war experience has enabled him to import into commercial pursuits, particularly in relation to his staff and workmen, the virtues of a very good regimental officer, combining with a thoroughly democratic feeling a strong sense of discipline.

Besides articles contributed to the technical Press, Col Vignoles read a paper in 1906 before the I.M.E.A. on the efficiency of steam plant, and one in 1914 on the commercial development of electricity supply in moderate-sized towns. On the latter occasion he suggested that the I.M.E.A. should appoint a Committee with a view to formulating a scheme by which a co-operative system of publicity could be set on foot for the benefit of electricity supply generally; as a result an I.M.E.A. Electrical Development Committee was formed, but the war intervened, and he transferred his energies to a more strenuous occupation. In 1917 Mr. Wordingham formed an I.E.E. Committee which gave rise in 1919 to that most valuable institution—the British Electrical Development Association—which is destined to perform a great work for the electrical industry, and Col. Vignoles was certainly one of its progenitors. He is a strong advocate of the multipart tariff, and has done much to promote amendment of the law which compels electricity suppliers to offer a flat-rate tariff; his paper before the I.M.E.A. dealt with this and with many other aspects of the problem of extending the domestic applications of electricity, and we have no doubt that he will use his influence as president to keep this very important matter in the forefront during his year of office.

Friday morning, June 23rd, was devoted to a meeting of the Council and the annual general meeting of the Association. The report of the Council and the statement of accounts were adopted, and the following officials and members of Council were elected :—

President : Lieut.-Col. W. A. Vignoles, D.S.O.
Vice-President : Mr. S. E. Britton.
Hon. Treasurer : Mr. H. Faraday Proctor.
Hon. Secretary : Mr. A. C. Cramb.
Hon. Solicitor : Mr. P. M. Heath.
Councillor Members : Ald. A. Wilkinson and Ald. H. Leese.
Engineer Members—large towns : Messrs. R. B. Mitchell, W. J. H. Wood and H. R. Burnett.
Engineer Member—small towns : Mr. T. Hall.
Mr. F. Ayton was elected an honorary member of the Association.

A discussion took place on the subject of the payment of expenses of members attending Council meetings, ending in the postponement of the matter for 12 months. The question whether powers should be sought to enable authorities to make the observance of wiring rules compulsory was also discussed; Mr. F. W. Purse, who favoured the proposal, stated that company undertakers were solidly opposed to it, as also were many municipal authorities. Mr. N. Staniland proposed a resolution that the Electricity Commissioners should be informed that it was the wish of the Association that when the I.E.E. Wiring Rules were adopted by an authority, they should be enforceable on contractors; Mr. A. De Renzi seconded, and the motion was carried. Mr. L. L. Robinson suggested that an excursion to Paris, to visit the new power station at Gennevilliers, should be organised, and the President said the Council would consider the matter.

The allocation of the expenses of the Electricity Commissioners was discussed, and it was urged, on one hand, that the expenses ought to be a national charge, but on the other, the dangers of bringing the Treasury into the field were pointed out, and ultimately the matter was referred to the Council for consideration.



Messrs. H. F. G. Wood (centre), F. W. Purse (on C. W. Scott's left).



Messrs. [illegible] (left), [illegible]

AT APLEY TERRACE.



Mr. A. C. Cramb, Hon. Sec. and Past-pres. I.M.E.A.



Mr. H. F. Proctor, Hon. Treas. and Hon. Sec. and Past-pres., and Miss B. I. Lambert, Secretary, I.M.E.A.



Mr. S. L. A[illegible], Past-pres. I.E.E., and Mr. A[illegible] H. Leese, J.P., of Hyde, Past-pres. I.M.E.A.

By courtesy of Mr. C. H. Cl[illegible]



Returning from Apley Terrace.



At the Botanical Gardens, Birmingham.



[illegible]



Mr. R. A. Chattock, Past-pres., and Dr. S. Z. de Ferranti at Apley Terrace.



Leaving the Magnet Club, G.E. Co.'s Witton Works.



Mr. F. A. Kerr and Mr. H[illegible] at the Botanical Gardens

SNAPSHOTS AT THE CONVENTION

Votes of thanks were then accorded to the retiring President, Mr. S. T. Allen, and the officials, as well as to the Mayors and Committees who had entertained the Association—especially the Mayoress of Wolverhampton, who had done a great deal of work—and finally a vote of condolence with Lady Wilson was passed, the members standing in silence.

This concluded the formal programme, with the exception of a visit in the afternoon to the electricity works of Wolverhampton, of which a description was published in our pages last year. All were agreed that the Convention had been highly successful, and that the arrangements for its holding under rather difficult conditions had been admirably organised and carried out.

Discussion.

Mr. R. B. Mitchell (Glasgow) agreed with the author in everything he had said with regard to the desirability of encouraging the domestic load by all means in their power. He agreed also, with the author that the only way by which cookers could be brought into use was by hiring them out. He mentioned that in Glasgow they had gone to quite a considerable length in getting this business started, and his Committee had become quite confident as to the results expected. Complimentary letters which had appeared in the Glasgow Press from satisfied consumers were fair evidence of the good work the cookers were doing. Along with each cooker they supplied an electric kettle which helped a great deal. With respect to the development of the domestic load in small houses, Mr. Mitchell said the tenement dwellings in Glasgow offered an advantage from this point of view. They had experienced the "cold snap" peak in Glasgow. It came usually in the morning, and did not synchronise with the lighting peak in the afternoon. It was not, therefore, to be feared to the extent that otherwise might have been the case. After a brief reference to tariffs, Mr. Mitchell said he concurred with the author as to the use of electricity by the staffs of electricity supply undertakings. His own staff almost entirely used electricity very liberally, and he encouraged them to do so. He could not say, however, he had given them preferential treatment—he did not get preferential treatment himself. He found the results satisfactory, however, and he had no reason to complain of the cost. Because of the fact that it was an off-peak load he considered that a considerable profit was made at the figure charged in Glasgow, and he had no fear as to its development.

Mr. L. L. Robinson (Hackney) congratulated the author on his useful and inspiring paper. He inquired of the author how he arrived at the analysis of the load curve, and also how he arrived at the conclusion that the people of Grimsby managed to cook for 10 hours per day without suffering from indigestion. With respect to the "cold snap" peak, Mr. Robinson said they were all realising it. Was it really a thing they need be frightened at? He suggested in the case of a foggy neighbourhood that the difficulty might be met by having a small proportion of the boilers oil-fired. He agreed with the author that the flat rate should be kept high and that advantages should be given to consumers according to their deserts in the form of a multipart tariff. After referring to the author's observations on the loss of output due to industrial slumps, Mr. Robinson thought too much was made of the point of developing the power load. What they should endeavour to do in the future was to develop a well-mixed load. It would generally be found if one had all sorts of businesses that when one sort slumped the other would be booming. He regarded the development of the domestic load as of the highest importance. In a reference to dealings with the lower middle class and the artisan class, Mr. Robinson said they had to take a leaf out of the gas companies' books. They had beaten the latter in the cream of the business; now they had to tackle them in their stronghold—the pre-payment system. So far as cookers were concerned, they must be prepared to deal with the slightest emergency. With such a service behind them they would have no difficulty in rapidly spreading the use of the electric cooker. Col. Vignoles had dealt with the design of the electric cooker, and it was important that this question should be gone into. They could get a lot of information on this point from their consumers. The general tendency, he said, was to make cookers a little too small. It was not a bad idea to make a grill that would cook a ¾ lb. sole without cutting off its head or tail.

Alderman J. A. G. Beaumont (St. Marylebone) observed, with regard to the figure given by Col. Vignoles of 2,000,000 units sold in St. Marylebone in 1921 for heating and cooking on a flat rate, that it was domestic only. In addition, there were 12 millions sold on a flat rate for business purposes. Of the 7,000,000 units sold on a multipart tariff, half a million units were for small and medium business lighting, and half a million for domestic lighting. There were also included long-term agreements with large consumers for lighting, some 3,000,000 units, so that they were left with 4 million of the 7 million for heating, cooking, and other uses, making with the flat-rate figures already given 7¾ million units for heating and cooking. He had often been told that they were making a mistake in going in for this development of the domestic load. In 1910-11 the units sold for private supplies were roundly 11,000,000, of which 9½ millions was lighting. In 1921 the units sold increased to 21 millions, the number of consumers added in the interval being 5,000, yet the lighting output remained about the same, viz., 10,000,000 units. With the exception of two war years, profits had been recorded each year, and it clearly showed that their progress with heating and cooking, and to a small extent power—the total for power being only 2½ million units—had been profitable, with low prices. Therefore, why suggest charging more than the rate at which business was to be procured, viz., 1½d. as a maximum rate whether flat or multipart? In St. Marylebone a "cold snap" made a difference of anything up to 3,000 kilowatts to the peak. The design of cookers and the like might be considerably improved. Hot plates and radiator elements should be so designed that they could be replaced by any user in the same way as lamps. They had in Marylebone 1,300 cookers and other appliances on hire, and some 2,000 heaters. These were maintained by a staff of eight to nine men. They preferred to hire instead of to sell, as this kept the undertaking in touch with the users, and the apparatus in working order—otherwise it might be allowed to go out of use on account of the renewals required. Col. Vignoles had alluded to the question of buying in bulk. That seemed to him an important point. All supply authorities should encourage the use of electrical appliances by their staffs, and by electricity contractors, by offering a specially low experimental rate for this purpose.

Mr. Charlesworth (Wolverhampton) said the underlying idea of Lieut.-Col. Vignoles's paper was one with which he entirely agreed—that there was an enormous future before the domestic load, from the points of view both of the supply undertakings and public health; that in the majority of cases the output would rival, if not exceed, the industrial demands; and that the cultivation of this outlet for extensions would, if properly handled, prove profitable. Colonel Vignoles had touched upon probably the most important question awaiting solution, not only in electricity supply circles, but throughout every industry at the present time—over-capitalisation due to the necessity of extensions to increase output during the war, when the cost of plant was at its highest level; and he suggested that to place undertakings which had been affected materially in this way in a sound financial position, it was necessary to write down the capital expenditure. If that could be done, well and good, but, said Mr. Charlesworth, the ways and means would seem to present a little difficulty. To write this capital down must involve maintaining prices beyond the immediately necessary level till the surplus required had been obtained. Whether this was possible at the present time, having regard to the grave difficulties in the way of reducing prices to keep pace with the reduction of wages and certain other items, seemed to be very problematical, and it was by no means easy to see how a municipal undertaking could deal with the position. If an adequate reserve fund were available this could be utilised for the purpose, but this would not really help in the long run, as the reserve would have to be built up again for the numerous other purposes it served. Personally, he felt that the most fruitful field for municipal undertakings at the present time was to increase their output. It must be borne in mind that in dealing with the domestic field the distribution side of the business would increase in importance, not only so far as administration and service were concerned, but on account of demands which would be made for extra capital to deal with the increasing load. "Cold snap" peaks should not interfere with the overall efficiency of production. Tariffs should be made as simple and easily explainable as possible, and for this reason he did not agree with Colonel Vignoles as to the necessity for a three-part tariff. It seemed to him that all the needs of the case would be met by averaging the consumer charge with the demand charge for the different classes of consumers. In Wolverhampton the rateable value system had been popular, and deservedly so. They charged 15 per cent. per annum on the rateable value of the house, plus ½d. per unit, this being, of course, increased by the general percentage advances. He would add a third to the two essentials given for the development of the heating and cooking load—that the consumer should be educated to understand how to use electrical appliances. This was an important point, and much work remained to be done in this direction.

Mr. C. H. Wordingham, C.B.E., commenting on the importance of the domestic load, directed attention to the need for suitable tariffs. He had always advocated the Hopkinson system as the only logical basis, to which basis, he said, people were gradually coming round. It was greatly to be deprecated that there was such a large number of different scales and charges. In some towns there were 9 or 12 different rates. What was wanted was a scheme which would adapt itself to every class of load. After a reference to the need for a cheap reliable indicator in connection with tariffs, Mr. Wordingham deprecated the introduction

of new terms, such, for instance, as the "cold snap" peak.

Councillor A. Sinclair (Swansea) called attention to the paragraph in Col. Vignoles's paper to the effect that in the domestic field the largest consumers had been connected up, and the demand for electricity for lighting purposes now came from the smaller houses, which might easily become a source of loss to the undertaking. He would like to see the word "easily" deleted, and the word "not" put in its place.

Mr. Hoadley (Maidstone) regarded the field of domestic supply as one worth cultivating, and quoted some interesting statistics bearing on the subject in relation to Maidstone. He expressed agreement with Col. Vignoles as to hire and maintenance, and spoke of the great advantages accruing from prompt and efficient service—the putting right immediately of anything that went wrong.

Mr. Poole (Durban) said Col. Vignoles had rightly placed the two essentials to success in their proper order—tariff and apparatus. He felt that the introduction of low tariffs was bound to bring about apparatus which was not too expensive or too troublesome. He quoted statistics showing the financial position of the electricity undertaking in Durban, where there was no competitor in the shape of gas.

Mr. J. W. Beauchamp asked [illegible] the cooking in relative terms [illegible] facts and figures relative to the domestic load. He suggested that they should think about heat accumulation problems.

Mr. Shaw (Ilford) mentioned the experience of Ilford with regard to the hiring-out of cookers, and said they hoped to embark on a further scheme. It was impossible, he suggested, to fix a tariff that would suit every town. Wolverhampton, for instance, was different to Ilford.

Mr. Wilkinson (Harrogate) thought that with better cooking apparatus, easily manipulated, they could go forward with a greater degree of success.

Lieut.-Col. Vignoles, in the course of his reply, said if they waited till they had apparatus that was absolutely perfect before they introduced electric cooking, they would not make the progress desired.

On the motion of Major Attlee, Col. Vignoles was thanked heartily for his extremely interesting, informing, and stimulating paper.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—II.

ANNUAL CONGRESS AT BOURNEMOUTH.

Railless Electric Traction.

By E. M. Munro, M.I.E.E.

(*Abstract.*)

Railless electric traction offers a possible solution to some passenger transport problems not readily met by the older established methods; its reliability and cheapness were demonstrated at a time when it became clear that the increased costs of constructing new tramways and, in some cases, the outlay necessary to rehabilitate existing routes could not be undertaken on a remunerative basis.

The number of seats in a mechanically-propelled road car is limited by the axle loads permitted and the width and length of bodies allowable. The average unladen weight of a s.d. railless electric car is 355 lb. per seat and of a d.d. one 297 lb. per seat. The corresponding figures for tramcars are 896 lb. (s.d.) and 440 lb. (d.d.) respectively, and for petrol 'buses 296.9 and 256.4 lb. That the d.d. petrol 'bus has the lightest weight per passenger seat of any type of vehicle considered is in part due to the inclusion of the latest form of 'bus designed for service in the metropolitan area.

As to capacities, the railless car has increased from 28 to 59 seats, at which figure it must stand if the five-ton axle load is to be the maximum. From the following table the approximate cost of energy per passenger mile can be ascertained:—

Type of car.	Energy per car-mile.	Average passengers carried per mile on 38% seats.	Cost of energy per car-mile at 1½d. kWh.	Average speed m.p.h.	Cost of energy per pas.-mile.
Railless S.D.	1·00 kWh	11	1·5d.	8·0	·136d.
Railless D.D.	1·66 kWh	20	2·19d.	8·0	·125d.
Tramcar ...	2·00 kWh	24	3·0d.	7·5	·125d.
Petrol 'bus...	0·166 gal. petrol.	13	4·359d.	8·0	·335d.

The energy consumption represents an expenditure of from 190 to 195 watt-hours per ton mile, which includes line losses. The actual energy consumed at the car should not exceed 150 watt-hours per ton mile on a good average road surface, and with the improved bearings now being incorporated in the latest designs it is not expected that more than 140 will be recorded on the car if the line voltage is well up and the number of stops per mile is not excessive.

The railless car carries its passengers at about the same cost for energy as the tramcar, and much less than the petrol car, and its capacity has reached the point where it can in this respect be considered in connection with all but the densest traffic, also the average speed is a quite satisfactory feature. Thus, the railless car is an economic high-speed vehicle of adequate capacity, and the cost of installation and operation is lower than for other forms of road traction within the limits of its economic application.

On less than a certain length of headway railless cars can operate more economically with their overhead line equipment than the petrol 'bus does without this expense. The location of the critical point where the advantage is neither to the tramcar or railless vehicles has been worked out by Mr. R. H. Wilkinson (general manager of the Bradford Corporation Tramways) as follows:—

(*a*) Between single-line tramway and railless traction it is in the neighbourhood of a 3-minute service.

(*b*) With a 2-minute headway railless traction is more economical than a double-line tramway, but more costly than a single-line tramway.

The point at which the railless car ceases to be more economical than the petrol 'bus in regular service has been variously estimated at between 30 and 45 minutes' headway. Between the 3-minute and 45-minute headway railless cars have the advantage in economy of operation—on longer headways the petrol car, and on shorter headways the tramcar, is more economical. The factors from which these calculated results proceed are: High average speed of railless cars and longer life as compared with the petrol 'bus; saving of cost of track, notwithstanding increased cost of overhead line, as compared with the tramcar.

Operating costs for railless cars as compared with petrol 'buses are lower on account of high average speed; smaller cost for power; relative simplicity of construction; high overload capacity. If petrol costs 2s. per gallon, and six miles per gallon is the work it does, the railless car at 150 watt-hours per ton mile costs 50 per cent. less with energy at 2d. per kWh. The increase in average speed is due to higher acceleration and extra power available on grades and under overload conditions as compared with the petrol 'bus. And in the case of the tramcar the higher travelling speed results from the absence of checks due to slower moving traffic encountered. The simplicity of construction lies in the employment of the electric motor as the propelling agent, and the accompanying speed control, which is devoid of mechanical transmission of power. For the rest, the chassis of a railless car is no more complex than that of the petrol vehicle. Recent designs indicate that the adaptation of the chassis perfected for petrol drive for use on railless cars is expected to cheapen the latter vehicles up to a certain size.

In an actual railless schedule which is shortly to be operated the power to be taken by each car varies from 40 to 100 kW on the level and on maximum grades under full-load conditions in order to maintain an average eight miles per hour, with seven stops per mile, the maximum variation in rate of expenditure of energy under all conditions is from 25 to 100 kW—58.8 h.p. being the continuous rating of the motor equipment; 84 b.h.p. is the power at the one-hour rating, but if this conventional measurement is reduced to continuous rating the range of power as actually needed for the performance of the vehicle is more easily compared with the range of power available from the internal-combustion engine as a propelling agent. It is this natural range of power which enables railless cars to maintain a schedule speed not [illegible] with petrol 'buses fitted with any commercial size of engine.

The single motor chassis as a [illegible] with the two motor equipment. It does in a number of cases offer advantages over the more economic series-parallel control, chiefly owing to its [illegible] becomes effective where the [illegible] stops per mile. Other claims for superiority are put forward on its behalf, such as a reduction in [illegible] convenience in readily obtaining spare parts at low costs, the single motor being [illegible] petrol chassis, and, further, greater comfort when riding is claimed and a longer life is assured for the [illegible] desirability of controlling the whole range of speed on one motor is not questioned where but few service stops are made, but if the stops are frequent rheostatic losses are likely to be heavier. With two motors the rheostatic losses are at least one-half the losses in a single motor. In regular service of average character the ordinary rheostatic losses with two motors in series-parallel control may [illegible] of the total energy consumption on the car. If [illegible] doubled, the disadvantage of the single-motor system would be about 15 per cent. increase in energy consumption. In addition, it is often necessary to run [illegible] parallel control—motors in series—this is effected with but the small reduction in motor efficiency due to [illegible] drop across each motor, but with a single [illegible] must be got by inserting resistance in the [illegible]

For the same pull produced by the [illegible]

latter control of a single motor. The input to the equipment is just the same whether the motor is running at full or at half-speed. If the efficiency at full speed is 80 per cent., at half-speed it is only 40 per cent.

Railless cars requiring motors of more than 40 h.p. have chassis specially designed for the transmission to the wheels of power not as yet usually required on petrol chassis; moreover, with the limited headroom from roadway to floor of the car it is very doubtful if a single motor could be conveniently got in. With the two-motor equipment mounted upon the chassis frame a convenient low floor is available, a straight drive to each rear wheel is effected, and the front of the car left clear for the standard front axle and steering gear.

Whilst cars of moderate seating capacity will no doubt continue to be employed on routes running through more or less thinly-populated areas, it is confidently expected that much larger cars will be offered for public service in the near future.

With regard to the power actually taken by railless cars, some misconception existed when this form of traction was first projected in this country, it being thought that the increase in energy consumption would be comparable to the increase in the resistance to traction upon the surfaces of public roads over that upon the grooved tramway rails, between which there is a great difference. No such differences exist if considered upon the basis of passenger miles, which seems a fair method of comparison. The resistance to traction may well be a varying factor as between one route and another, at any rate until roads are constructed upon some standarised plan, and so maintained that the surface can be anticipated to offer a resistance varied only by weather conditions. For this reason, where possible, voltage conditions should be variable between some narrow limit such as may be practicable, although the selection of a sound figure to cover road resistance will always put this matter upon a safe basis.

Overhead line equipment is on all fours with that used for tramways. The apparent difficulties of running an earthed negative through complexities of 550-volt positive wires were not so real as they looked. Two-pole overhead lines can be constructed with the same facility as the single-pole line for tramways by due observance of a few essential matters.

As to current collection, perfect contact with both wires can be maintained with any well-made trolley of a suitable form up to deviations of, say, 10 ft.; for wider reach-outs a special trolley has been designed, which would operate with poles at right angles if necessary at any speed without de-wirement, *e.g.*, used with 20-ft. poles, 17 ft. or more on either side of the trolley wires can be reached with ease, giving free control of a 40- or 41-ft. road. This is all the mobility required of any route-bound vehicle. By this means an on-coming car can pass any slow-moving or stationary vehicles, if necessary running as much as 34 ft. away from the kerb of the footpath; also these deviations can be made acutely if so required. Hitherto such wide reach-outs have not been necessary, but with the employment of railless traction in the main thoroughfares of big cities more scope will be required in this direction.

In general, the characteristics of the railless car appear to be: (1) Low dead weight per passenger. (2) Low cost for energy per passenger mile. (3) High average speed. (4) Low capital charges. (5) Low operating costs. (6) Ability to operate on heavy grades. (7) High overload capacity. These advantages may not appear in violent contrast when compared with those of other systems of road transport in every case, but it seems certain they will exist in some degree between wide limits of application; whether or not that degree warrants the adoption of this form of traction is a matter for consideration after careful scrutiny of all the conditions of the undertaking.

Discussion.

Mr. R. G. Cunliffe pointed out that the author had set down the rate of consumption for tramcars as two units per car-mile, which he himself believed to be too high. The average for the whole country, including both large and small systems, would be nearer 1.6. The author had also given an average speed per hour for the railless vehicle and for the petrol 'bus of 8 miles, and for the tramcar 7.5 miles; but 8 miles would be more applicable to the speed of the tramcar also. He (Mr. Cunliffe) looked at trackless trolley vehicles from the manufacturers' point of view. In the past their failure had been due very largely to the unsuitability of their equipment. The vehicles had followed motor 'bus lines, and the electrical equipment had been added to vehicles not designed for the use of such equipment. He had been impressed with the large number of tramway authorities which possessed railless powers but were not using them. There was waiting for a lead, and also for the evolution of a type of equipment suitable for such conditions. The design was affected by traffic and engineering considerations. Points to be settled were the design of the body, the distribution of the weight, and the seating capacity; also, from the manufacturing point of view, the type of chassis, and the very debatable question of the one *versus* the two-motor drive.

Mr. H. England said that a year or two ago many of them formed the opinion that the cost of reconstruction of tramways was such as to put tramways out of court when the time came to reconstruct. But since then conditions had changed enormously, and were changing still, and the change was entirely in favour of tramways. The tramway reconstruction which was impossible two years ago was now a feasible proposition. Nevertheless, he thought there was an opening for railless vehicles on worn-out tramways which, on economic grounds, should never have been constructed as tramways originally. As a counsel of perfection he would say that in provincial districts the tramway was only permissible when it was possible to run, at the longest, a ten-minutes service, and that railless traction was called for when anything from that up to a thirty-minute service could be run. He was not speaking of London conditions, and perhaps not of big city conditions. The railless system was particularly adapted to supersede an existing tramway, but if it were necessary to start *de novo* and put up overhead cables and obtain Parliamentary powers, &c., it was a different matter.

Mr. C. J. Spencer believed that the era of railless construction had only just dawned. With a headway of ten minutes or less the tramway would hold its own, both on grounds of economy and convenience. With a slower headway, say half an hour, it was doubtful whether the capital charges did not become so high that the motor 'bus, with its rather higher operating expenses, was the preferable vehicle. In travelling about England and Scotland he had found the opinion very general among tramway men that on a reasonably short headway the railless car system could be operated at 60 per cent. of the cost of the motor 'bus system. That was the opinion expressed at York, where there were all three systems in being. Contrary to what Mr. Cunliffe had said, the lightest vehicles he had seen, which gave great satisfaction, were vehicles whose designs might have been for petrol traction; the engine and gearbox had been taken out, and the motor put in their place. The best railless car he knew had a chassis designed for a petrol 'bus. He could not understand why, in Mr. Munro's paper, the railless car should be put down as heavier than the petrol 'bus; it should be lighter.

Mr. J. S. Hamilton said that in Leeds tramways had been operated since 1895, the motor 'bus since 1905, and the railless vehicle since 1911, and the three systems had parcelled themselves out into separate spheres. It was found that the tramways could be operated most economically up to a quarter of an hour service; the railless vehicle from a quarter to three-quarters of an hour; and the motor 'bus from three-quarters of an hour onwards. His experience of railless traction was that it was much more economical to run than the motor 'bus.

Alderman R. A. Smithson bore out Mr. Hamilton's statement with regard to Leeds, which, with some 110 miles of tramways, had spent over £150,000 last year on tramrail renewals, and had budgeted for a similar sum this year, which did not suggest a loss of faith in the tramways.

Mr. E. H. Edwardes said that the tramway was, except for the track, still the cheapest form of traction, and, as for the track, was not the wear and tear largely due to other vehicles?

Mr. Richard Humphries thought that the discussion had narrowed itself down to the single point of whether the advocates of railless traction could show anything better than the motor 'bus for a service of between ten and thirty minutes.

Mr. Munro, replying to the discussion, said that the figures for energy consumption given in his paper were the average of several systems. His tramway speed of 7.5 miles per hour was on the low side, but, desiring to compare like with like he had taken it from routes where railless traction was going to supersede the tramcar. With regard to single *versus* double-motor equipment, he had found on some tests that on a straight line without stops the one-motor was very slightly more efficient than the two-motor arrangement, but where three stops were made to the mile there was a considerably greater consumption with the one-motor than with the two-motor system. It was true that the costs of tramway construction were now falling, but so were the costs of railless traction, so that the relative result was the same.

Magneto Drives.—The object of the recently issued report, No. 21, I.C.E. 160, November, 1917, of the Internal Combustion Engine Sub-committee of the Aeronautical Research Committee, is to draw attention to some of the effects on the synchronism of the sparks of a magneto produced by various types of drive used in coupling a magneto to the engine. It indicates that the use of a *very* flexible coupling to drive the magneto is not to be recommended, as its elasticity and the drag of the magneto field cause a marked retard in the spark. It also causes a serious disturbance of the spark at some particular speeds depending upon the free periods of the coupling. The maximum retard observed was 5½ deg. The magnitude of the effect increases with an increase of magneto field, and is practically non-existent when a battery and coil set is used. The use of the Wolseley Hispano Suiza reinforced coupling reduces these effects to about one half, but in certain cases the disturbance is still serious. An optical method of measuring the angular oscillation was devised and the results agreed substantially with the spark tests.

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

Electricity (Supply) Bill.—This Bill came before a Standing Committee of the House of Commons on June 29th.

On Clause 1, which deals with the power of authorities to borrow, Mr. G. Balfour moved an amendment to give Parliament control over the borrowing powers of the joint electricity authorities through Provisional Order instead of Special Order procedure. The Provisional Order method would ensure the presentation of a Provisional Order Bill, instead of the passing of a resolution of the House. The Provisional Order Bill would have to go through the ordinary Bill procedure. He claimed that if delay was involved, that delay was necessary to protect the interests of the public.

Mr. Neal, Parliamentary Secretary to the Ministry of Transport, in resisting the amendment, said that Mr. Balfour was desirous of securing that Parliament should have the final and effective word with reference to borrowing powers, and he (Mr. Neal) accepted that position at once. The only question was as to procedure. He urged that there should be no unnecessary delay in these cases, and defended the method of procedure by Special Order, which, he said, was adopted in 1919, in order to avoid the expense of Private Bill procedure. Every day that the passage of the present Bill was delayed, every day that it was made more difficult for the electricity schemes to proceed, so every day the present state of unemployment was continued and accentuated. He suggested that Mr. Balfour should withdraw his amendment, and he (Mr. Neal) would then propose an amendment to provide that, as to subsequent borrowing powers, after the first Special Order had been approved, the procedure should be by way of Provisional Order.

Mr. Balfour's amendment was rejected by 14 votes to nine, and Mr. Neal's amendment was afterwards agreed to. The Clause, as amended, was also agreed to. A number of minor amendments were agreed to in Clauses 2 and 3, Clause 4 was also agreed to, and the Committee adjourned.

Ayr Burgh (Electricity) Bill.—On June 28th, Mr. A. Shaw moved the rejection of this Bill in the House of Commons. He said the Bill contained a scheme to procure electrical power by draining Loch Doon, which was situated some 16 miles from the Burgh of Ayr. The scheme was necessary, in the opinion of the promoters, in order to provide additional electricity for the Burgh of Ayr. The present electrical installation was of an extremely extravagant kind, and very limited in its output. The present price of electrical energy, for power purposes, as apart from light and heat, charged by Ayr was about 3½d. per unit, as against the 1½d. which was charged by the neighbouring installation of Kilmarnock. One amazing feature of the Bill was that it actually sought power to increase this already exorbitant charge which Ayr levied on its consumers. The cost of the new scheme was estimated at £250,000, but he was informed that it was likely to be nearer £400,000 or £500,000. The promoters sought to set up, on an acre of ground only, an installation, using water power, of a capacity of 3,000 kilowatts. This worked out at a cost of £80 a kilowatt, and, on the basis of a continuous supply, at an enormously enhanced figure. The present population of Ayr was about 33,000, and an estimated cost of £250,000 for the scheme was a very serious burden on a burgh of those dimensions. The large users of electricity in the neighbourhood had petitioned against the scheme, and their fears had in no way been met. They looked rather to a large and comprehensive scheme than to a small and highly expensive local scheme. The larger scheme was, he claimed, one situated at the pit's mouth at Kilmarnock; the most economical scheme in Scotland. The total capacity of the Kilmarnock scheme, which could be enormously enlarged, was at present 22,500 kilowatts, and the actual output now possible was 38,000,000 Board of Trade units per annum. Since the Bill passed the Committee there had been a complete change in the whole situation. On May 12th, Kilmarnock offered to include Ayr in a joint electrical board if a joint scheme was brought into operation, and to give it extremely favourable treatment. This project for a Joint Board had been welcomed and endorsed by the Electricity Commissioners. The Ayr Burgh scheme would prejudge and prejudice the action of the new Joint Board.

After much debate, Mr. Neal urged that the Bill should be read a second time and referred to a Standing Committee. On the question as to the utilisation of the waters of Loch Doon for the purpose of this electricity supply, he reminded the House that the Water Power Resources Committee, which was presided over by Sir John Snell, who happened also to be the Chief Electricity Commissioner, recommended it as one of the water-power schemes that might usefully be entertained. The matter would require detailed consideration at the hands of a committee of the House, but the Electricity Commissioners saw no insuperable difficulties in the scheme. It would in no way prevent the development of the area which they had delimited, and he would vote for the Bill.

On a division the motion for the rejection was defeated by 129 votes to 75, and the Bill was read a second time and committed to a Standing Committee of the House.

Private "Underground" Bill.—On June 28th the [illegible] Electric and City and South London Railway Company's Bill was read a third time in the House of Commons.

Broadcasting Weather Bulletins.—On June 28th Mr. Malone asked the Minister of Agriculture whether he was aware of the extent to which wireless telephony was being utilised in France to assist agriculture by broadcasting a weather bulletin twice daily from the national meteorological office; and whether any similar schemes were in contemplation for this country.

Captain Guest, Secretary of State for Air, who replied, said that, pending the result of inquiries which were being made, he had no information, other than that which had appeared in the Press, as to the French arrangements for issuing weather forecasts to agriculturists by wireless telephony. The feasibility of using wireless telephony for this purpose in this country was at present under consideration. The Air Ministry issued daily, by means of wireless telegraphy, a number of weather reports which could be of considerable use to agriculturists and, with a view to meeting the case of agriculturists and others possessing, or about to install wireless receiving apparatus, a pamphlet giving particulars regarding these messages and instructions as to their reception and utilisation had been prepared, and would be issued in the course of a few days. In addition, the pre-war arrangement by which afternoon forecasts were issued during the harvest season was extended two years ago, so as to enable a farmer, on payment of the cost of telegraphing, to obtain a special forecast at any time which suited his individual need.

Royal Assent.—On June 29th the Royal Assent by Commission was given to the Nottinghamshire & Derbyshire Tramways Bill.

THE LONDON FAIR AND MARKET.

As we mentioned in a recent note, the exhibition of articles made by our former enemies has been allowed in this year's fair by the management, and it goes without saying that the removal of the ban has resulted in a flood of German goods of which the chief feature is their cheapness—not their finish. Only the smaller products of the electrical industry find their way into an exhibition of this nature, and the occasion is not usually employed for the introduction of new "lines." The exhibition opened at the Agricultural Hall, Islington, on Tuesday last, and it remains open until the 14th.

The number of purely electrical firms which have arranged exhibits is very small. The principal electrical display is that of the Cable Accessories Co., Ltd. This firm has endeavoured to present typical examples of all its numerous products. There are fans, fires, pedestal heaters, kettles, and other domestic appliances, all bearing the "Revo" trade-mark. The fire elements are mounted in a way which ensures safety under rough treatment. The wire ends are jointed to pieces of spring copper which bear the porcelain base, and these are fixed to the frame. A number of street-lighting lanterns are shown, including the type used at Westminster—an installation described in our pages a short time ago. These are fitted with a special anti-vibration device employing phosphor-bronze springs, and of great strength. The chief point of the electric irons shown is the cord-grip connector, with a strong porcelain interior and drilled sockets. A range of colliery lighting fittings with machined and faced joints is exhibited, as well as examples of ironclad fuse and switchgear, including distribution boards, and semi-indirect fittings of handsome appearance for lighting offices and factory interiors.

The Excelsior Shade Manufacturing Co. has its usual ornate display of silk lamp shades of all shapes and colours.

Messrs. Standen & Perks represent "Welco" Patents and, in addition to examples of slotted steel constructional work, have a range of the firm's domestic appliances—kettles, irons, bowl fires, &c. The elements used in most of these devices are mounted in rings of brass-bound mica. They are mounted by means of plugs, two "live" plugs on one side, and a single "dead" plug diametrically opposite. This arrangement makes removal and replacement of the elements a simple task. The "Welco" toaster is fitted with a retainer for the bread which does away with springs, as springs subjected to high temperatures are apt to be rendered useless. The "tripod" design of the bowl fires enables them to be used in a vertical or a horizontal position.

The Wholesale Fittings Co., Ltd., has a very large display of small electrical appliances, as toasters, kettles, irons, &c. Many patterns of tumbler switches—plain and artistic—are shown. The display of lighting fittings is particularly good, and includes bowls of marbled composition, crystal glass, alabaster, &c., as well as lanterns for industrial lighting.

Messrs. Kenneth Campbell & Co., Ltd., also have a [illegible] variety of lighting fittings, and show floor and table standards fitted with beautifully-coloured shades.

Messrs. S. Faulkner & Son have a stand full of well executed statuary, and amongst this are several designs for use

with electric lighting. Figures bearing flambeaux, carved from Italian marble and other materials, and others in bronze make an excellent show.

Messrs. W. Knowles & Co., show two or three sizes of rapid ice-cream mixers and freezers, suitable for electric motor drive.

The exhibit of the Rawlplug Co., Ltd., consists, as usual, of examples of applications of the plugs to various materials, and complete sets of tools. The plug is now made for screws as large as No. 24 (wood), and also for coach screws.

The Indian & Colonial Supply Association, exhibits a collection of small electrical novelties. There are numerous motors and generators of a few watts capacity, small induction coils, pocket lamps, batteries, &c. Wireless receiving sets for amateurs, bell pushes, and switches are also displayed. This stand also bears, among other articles of German manufacture, some well-finished electric kettles and saucepans.

Messrs Henry Wolff & Co., have a comprehensive display of electric light shades of London manufacture.

The Rogers Electrical Sales Co., shows electro-medical apparatus, blowers, "violet-ray" outfits, vibrators, &c., and also the "Rogervac" suction cleaner of light construction.

Messrs. Enstone & Lilienfeld exhibit numerous articles of foreign manufacture. Among these are small electric fans, 7 in. diameter blades, with remarkable power for their size; there is also a type of electric iron, the top half of which is of marble.

German electric irons arranged for pressures of from 120 to 240 V are exhibited by the Reed Manufacturing Co.

Upon the whole it can be said that the electrical trade, as represented at the exhibition, has little to fear from the German, but keen competition is very apparent in the toy and fancy goods departments.

LEGAL.

North Metropolitan Electrical Power & Distribution Co., Ltd., *v.* Purity Laundry, Dyeing & Cleaning Works.

As briefly reported in our last issue, Mr. Justice Roche, in the King's Bench Division, heard an action, on June 27th, in which plaintiffs claimed from the defendants £179 for electricity supplied.

Mr. Craig Henderson, appearing for the plaintiffs, said that his Lordship would be asked to construe the meaning of a contract between the parties. It appeared that in June, 1914, plaintiffs agreed to supply defendants with electricity at special rates, and there was a clause in the contract to the effect that at the end of seven years the defendants had the option of extending the contract for another three years. When the end of the seven years came the defendants made no effort to extend by exercising their option, and the plaintiffs omitted to tell defendants that the contract was at an end. Later, however, they wrote that the agreement of June, 1914, was at an end, and that the defendants not having exercised their option to extend the agreement, the plaintiffs were willing to continue the supply at their standard rates. If the defendants could not agree then the supply would be discontinued. Correspondence ensued, in which the defendants said that as the plaintiffs had not given them notice of expiry of the contract they took it for granted that they were within their rights in exercising their option. The plaintiffs replied to the effect that defendants had not exercised their option because they had given no notice, and that they were now out of date for so doing. Eventually, it was agreed that plaintiffs should continue to supply electricity to the defendants at the old rate, without prejudice to their right to charge the standard price, if his Lordship decided in plaintiffs' favour.

For the defence, Mr Alfred Thorp, a chartered accountant, said he managed the laundry business after the death of its proprietor. He read the agreement with the electrical company, and came to the conclusion that he exercised his option to extend the contract if he continued to take electricity after June, 1921. He, therefore, gave the plaintiffs no formal notice of his intention to exercise the option, thinking it was unnecessary.

Mr. Cotes Preedy, for the defendants, adopted Mr. Thorp's evidence as his argument. The fact that the defendants continued to take electricity after the end of the seven years was an intimation to the plaintiffs that they desired to exercise their option. It was the duty of the plaintiffs, he said, to inquire of the defendants about the option if there was any doubt, because it was naturally to be anticipated that defendants would not continue to take supply unless they expected to pay the old rates. Counsel remarked that it was not for three or four months after the termination of the seven years that plaintiffs drew defendants' attention to the matter, and all the time they had supplied the defendants with power ostensibly at the contract price. In these circumstances, he contended that the defendants had a right to believe that the option had been automatically accepted by the plaintiffs.

Mr. Craig Henderson contended that such a proposition was untenable. The fallacy, he said, lay in the suggestion that because the plaintiffs continued to supply electricity they would do so at the old rates. The plaintiffs, by Act of Parliament, were bound to continue to supply, but defendants were not bound to pay any price imposed, and it was up to them to inquire what they were expected to pay.

His Lordship, in giving judgment, said he had some sympathy with the defendants, but he could not find in their favour if he acted consistently with the law. He was of opinion that the option to continue the contract should have been exercised during the currency of the agreement, and that the defendants should have acquainted the plaintiffs of their intention to exercise it as from June 24th, 1921. No inference could be drawn in defendants' favour from the mere fact that the plaintiffs continued to supply power after the contract expired. Consequently, judgment must be given the plaintiffs for the amount claimed, with costs.

Aldershot Tenants' Electric Light Bills.

The *Aldershot News* reports a case which recently came before the magistrates, in which a tenant of the Aldershot Council was summoned for not paying his electric lighting account. The collector stated that the amount due for six months was £4 0s. 2d. The defendant (Sullivan) wrote a letter to the Bench stating that when he moved into the house he was under the impression that light would be supplied for 1s. weekly, payable with the rent, but after a few weeks he was surprised to receive a bill for £1 odd. He eventually agreed to the current's being cut off, because a wage of £3 10s.—when in work—with a wife and eight children, and a father-in-law and widowed mother to assist, and paying rent of 17s. 4d., would not permit him to run up electric light accounts.

The Magistrates made the order for defendant to pay £4 0s. 2d., with 5s. 6d. costs, and left it to the collector to arrange how the money should be paid.

A. A. Kinnear was summoned in respect of an account for £1 8s. 2d. Defendant said his wages were £2 12s. 6d., less stoppages due to wet weather, and his rent 17s. 4d. He was ordered to pay within six weeks.

J. R. Kavanagh, who owed £2 4s. 10d., was ordered to pay, with 5s. 6d. costs. He wrote that he was paying 15s. 9d. in rent, and 3s. weekly off arrears. His wages were £2 10s., which left him with £1 4s. to keep himself, his wife, and four children.

Similar orders were made against W. Price, owing £1 5s. 2d. and T. R. Evans, £2 11s. 6d.

Burke *v.* Menlemans & Dufrasne.

In the Mayor's and City of London Court, on June 29th, an action was brought by Mr. Stephen J. Burke, trading as Burke Electrical Manufacturing Co., 6, Francis Street, Westminster, against Mr. A. Menlemans and Mr. Dufrasne, trading as General Electric Trading Co., St. Dunstan's Hill, E.C., to recover £11 15s. 11d. for the price of an electric motor supplied complete with pulley, less 30 per cent. discount.

Mr. Stollard, plaintiffs' solicitor, said that the goods were ordered by both defendants, and supplied to their customers, who had paid the defendants' account, but defendants had not paid the plaintiffs. There was a defence by Dufrasne that he was not a partner in the business. The documents, however, showed the contrary. Only Dufrasne had been served with the Court's process. The other man had left the country.

Harry Penny, plaintiff's manager, said that the goods were supplied at defendants' orders to the Sun Electrical Co. on September 2nd, 1921.

Judgment was given for the plaintiff against Dufrasne only, with costs.

A South African Libel Action.

Our South African correspondent states that judgment has been given by Mr. Justice Watermeyer in the libel action brought by Mr. C. O. Wilkinson, engineer, of Beaufort West, against Mr. Charles G. Trevett, consulting engineer to the Municipality of Beaufort West, and the individual members of the Municipality. In connection with the Municipality's electric lighting scheme, tenders were called for by Mr. Trevett for wiring consumers' premises, and by the terms of the advertisement Mr. Wilkinson was debarred from tendering. Mr. Wilkinson then wrote to the local newspaper protesting against the tenders being restricted to a few contractors. The alleged libel was contained in a letter which Mr. Trevett wrote in reply to Mr. Wilkinson's letter. Mr. Trevett's letter was submitted by him to the Council before insertion in the newspaper. Considerable expert and other evidence was called and the case occupied the Court for nine days in all.

His Lordship awarded Mr. Wilkinson £100 damages and costs against Mr Trevett, and gave judgment for the Councillors in Mr. Wilkinson's claim against them.

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XC. of the Electrical Review, which will shortly be printed, will be supplied only to those who through the post specially apply for it. To them it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—Wm. Henry Roslington, dealer in electric motor accessories, 240, High Holborn, W.C. A receiving order was made against this debtor last April at the London Bankruptcy Court, under which accounts were lodged showing total liabilities £1,725 (unsecured £1,375) and assets nil. A sitting of the Court was held on June 27th, before Mr. Registrar Mellor, when the debtor, replying to Mr. Warren, Official Receiver, stated that in December, 1919, he and another person, with £100 capital, commenced business as dealers in electric motor accessories under the style of Greenling Electric Supplies, at 61, London Road, Twickenham, where they traded until May, 1920, when they dissolved partnership. Witness took over the assets and undertook to discharge the liabilities. He realised the assets and paid some of the liabilities of the business, and he then removed to 240, High Holborn, W.C. In June, 1920, witness formed the Greenling Electric Supplies, Ltd., subsequently changed to Comyns, Ltd., with offices at 240, High Holborn, and a nominal capital of £5,000. For services rendered he was allotted £1,000 in ordinary shares and was appointed governing director at a remuneration of £500 per annum. Last September, in pursuance of a verbal arrangement with a co-director, witness transferred to the latter his shareholding in the company, and had since acted as secretary without remuneration. In August, 1921, he formed Mervan, Ltd., with offices at 240, High Holborn, and had since acted as director of that concern. The debtor attributed his failure and insolvency to his household and personal expenses having exceeded his income owing to the long illness of his wife, and to interest on borrowed money.

Thomas Carter, Dorchester and Swanage, electrical engineer.—At the Dorchester Bankruptcy Court it was stated that the total liabilities of this debtor amounted to £2,303. The assets were estimated at £1,998. The claims of preferential creditors left the total deficiency at £391. The causes of failure were stated to be bad trade, heavy stock, and being unable to proceed with works owing to dislocation of business caused by the recent disposal of the undertaking of the Dorset Electric Supply Co., at Dorchester, Swanage, and Wareham. In the course of replies to the Official Receiver, debtor said that he always worked on an overdraft. There had been a scheme to purchase a mill at Charminster in 1920 in order to provide an electrical installation there, but they could not get Parliamentary powers at the time. In June, 1920, there was a property bought at Wareham for the Wareham Electrical Supply Co., and he was to be the contractor. It was thought that an installation at Wareham would be a profitable thing, and the plant which the Disposal Board had for sale at Swanage was purchased, but they had not been able to find enough capital to complete it. He had been pressed by creditors all the time. Much of his difficulty had been caused by the delay in the disposal of the undertaking of the Dorset Electric Supply Co. at Dorchester and Swanage, as the result of which he had not been able to put in services. He was insolvent in June, 1918, and a large number of executions had been paid out since then. If he had been given a chance he could have pulled through now that the bad time was over. The examination was closed.

Gideon George Grieve and Archibald Arthur Manges, trading as The Up-to-date Electrical and Mechanical Engineers, 14, West Bute Street, late 236, Bute Street, Cardiff, electrical and mechanical engineers.—The first meeting of the creditors of the above was held on June 27th at 34, Park Place, Cardiff. The statement of affairs showed liabilities of £617, against assets £112, or a deficiency of £505. Debtors attributed their position to depression in trade, keen competition, and high rent. It was decided that the Official Receiver should remain as trustee of the estate.

Aneurin Tudor Williams and William John Bevan, trading as the Electrical and General Engineering Co., 49, Commercial Street, Aberdare, electrical engineers.—The adjourned public examination of these debtors was held recently at the Temperance Hall, Aberdare. According to the statement of affairs, there was a deficiency disclosed of £1,272. It appeared that the debtors commenced business in 1919 with £100 capital, each partner putting £50 into the concern. They had experienced considerable difficulty in obtaining materials in 1920, owing to the moulders' strike, and had lost orders in consequence. The debtors had furnished the amended deficiency account required, and the examination was closed.

W. W. Threapleton, electrical and mechanical engineer, Thornbury Road, Bradford.—Last day for proofs for dividend, July 19th. Trustee: Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford.

J. J. Symons (Zodiac Peerless Electric Lamp Co.), 25, Denmark Street, Charing Cross Road, W.C. Trustee: Mr. A. H. Partridge, 3, Warwick Court, Grays Inn, W.C.) appointed March 28th.

W. Hill, seedsman and electrician, 3a, Leigh Road, Leigh, Lancs. Last day for proofs for dividend, July 14th. Trustee: Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Wyness & Ball, electrical engineers, 13, Commercial Street, Brighouse. First meeting, July 7th, public examination, July 21st; both at the Court House, Halifax.

J. W. Hodgson and N. Hodgson, Hodgson Bros., electricians, Norton Street, Middlesbrough.—Receiving order made June 29th on debtors' own petition.

P. M. Rogers (Longbridge Engineering Co.), electrical engineer, Great Darkgate Street, Aberystwyth.—First meeting, July 12th; public examination, August 3rd; both at the County Court Office, Aberystwyth.

Company Liquidations.—Roberts Bros. & Holloway, Ltd.—Winding up voluntarily. Liquidator: Mr. R. Hooper, 1, Cheapside, Bradford. Meeting of creditors, July 13th, at 14, Piccadilly, Bradford.

Grimsby Electric Vehicle Co., Ltd.—Winding up voluntarily. Liquidator: Mr. W. M. Dawson, 103, Victoria Street, Grimsby.

C. Santler & Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. H. Weller, Edith Walk, Malvern. Meeting of creditors, July 10th.

Tredegars, Ltd., 7, Brook Street, Bond Street, London, W., lighting specialists, &c.—The creditors of the above were called together on June 30th, when it was reported that the liabilities amounted to £34,786. The assets were estimated to realise £20,015, from which had to be deducted £635 for preferential claims, leaving net assets of £19,380. The assets consisted of book debts, £8,237, expected to produce £7,122; plant, £575; work in progress £771; patents, £50; stock in trade, £8,885; office furniture, £400; leases, £2,000; and cash in hand and deposits, £212. It was reported that the company was registered in December, 1914, taking over from Messrs. Perry & Co. (Bow), Ltd., a department of the business there which had been carried on in a small way for about three years previously. The company removed from Victoria Street to Brook Street. At the outset the capital consisted of 10,000 6 per cent. preference shares of £1 each and 10,000 ordinary shares of 1s. each. Seven thousand shares were issued to Perry & Co. for the assets they transferred. The goodwill was only valued at £197. In 1917 the capital was increased and 7,000 shares were issued for cash, while in 1919 the capital was further increased to £100,000, divided into 60,000 participating preference shares of £1 and 40,000 ordinary shares of a similar face value. The issued capital consisted of 23,000 preference shares and 500 ordinary shares. The principal shareholders in the company were the late Sir Herbert Bartlett and Messrs. Perry & Co. After the removal to Brook Street in 1915 the company's business greatly extended, mainly as a result of Government contracts. Considerable profits were made during the war, and additional departments were commenced. The company was interested in some subsidiary concerns, in one of which £11,000 was lost. In 1916 the manufacture of acetylene lighting and welding plant was taken up, and the business transferred to a subsidiary company. Through the activities of the Government Disposal Board, that subsidiary company did not do so well as was anticipated, and Tredegars, Ltd., lost about £5,000. A wholesale electrical fitting department was also opened and transferred to a subsidiary company in April, 1919. In 1920 the subsidiary company went into voluntary liquidation, and Tredegars lost a further £4,000. In connection with the subsidiary companies there had been losses totalling over £20,000. The capital required to finance the subsidiary companies was obtained through a cash loan of £10,000. Some of the people who advanced money had since taken preference shares in settlement. Originally interest at the rate of 10 per cent. was paid, but that had been reduced. The company during 1919 and 1920 entered into a large contract to the extent of £29,000. They completed the work, but in payment had to take second debentures in another concern for £19,000. The liquidators had continued the business since their appointment. There had been inquiries for the sale of the business as a going concern, but no definite offer had yet been received. After a short discussion the creditors decided to confirm the voluntary liquidation of the company with the liquidators appointed by the shareholders, and a committee was also appointed, consisting of Messrs. Elliott & Sons, Perry and Co. (Bow), Ltd., Bingham & Sons, the cash creditors, and the representative of the bank. The principal creditors are:—

	£		£
Elliott & Sons	240	Perry & Co. (Bow), Ltd.	[illegible]
Bidding (John) & Son	147	Hughes & Co.	[illegible]
Riley, Ltd.	104	Middleton & Co.	[illegible]
Ellis, Sampson & Sanders	141		

Private Arrangement.—W. D. Reddy, trading as W. D. Reddy & Co., 37a, Fountain Street, Manchester, [illegible] ing electrical engineers.—The creditors interested herein were

[illegible] recently, when a statement of affairs was presented showing estimated liabilities of £187, of which £142 was due to the bank, whose the bank was creditor for £50. There were contingent liabilities amounting to £125, and preferential claims in respect of rent, rates and wages of £71. The assets totalled £235, from which the preferential claims had to be deducted, leaving net assets of £164, or a deficiency of £8 2s. It was reported that the debtor had not kept proper books of account, but from figures prepared it was estimated that at June 1st there was an excess of assets over liabilities of £103. Debtor commenced business in July, 1921, in partnership with another, the joint capital being £130. It appeared that the business was successful until January of this year, when it began to decline. In March last efforts were made to obtain [illegible] capital, but these proved unsuccessful, and in May the partnership was dissolved, debtor taking over the liabilities and assets. Debtor attributed his position to lack of capital, bad debts and insufficient trade. The matter was discussed at some length, and it was eventually decided that the estate should be dealt with under a deed of assignment to Mr. Arthur T. Eaves, accountant, of Manchester, and a committee of three of the principal creditors was nominated. Debtor was urged to make endeavours to put forward an offer of composition to the creditors. The following are creditors:—

	£		£
A. & A. [illegible] Ltd.	28	Cowan & Fox	14
A. [illegible] Supply Co.		Wood, J. C.	13
[illegible]	11	[illegible]	34
J. [illegible] & A. M.		[illegible] Co.	17
[illegible] D. C. Ltd.	15	Brokers	47
H. [illegible] & Co.	80	[illegible] W. L. & Co.	10
[illegible] Electric Lamp		[illegible] & Hirst, Ltd.	10
[illegible]	17	British Diesel Horns Co., Ltd.	10

Trade Announcements.—The Ideal Service Wiper Co., of 295, Claremont Road, Moss Side, Manchester, has just installed a special plant for the washing and sterilising of wipers, duster cloths, white stockinette cloths, &c., for machine and motor cleaning and polishing.

The Bedford Electrical & Radia Co., Ltd., has opened showrooms at 7, St. Peters's, Bedford.

British Insulated & Helsby Cables, Ltd., has removed its London office from Lennox House to Surrey House, Victoria Embankment, W.C.2.

The sales department of British Electric Vehicles, Ltd., has been transferred from Hamilton House, Bishopsgate, E.C., to the Head Office, 1, Queen Victoria Street, E.C. Communications should be addressed either to the head office or to the works at Southport.

Mr. A. L. Button, late of W. J. Cannon & Co., electrical engineers, of King Street, Margate, has commenced business on his own account at 1c, Cliftonville Parade, Margate.

Mr. H. A. Mumford has been appointed district manager at 6, 7 and 8, Albion Place, Leeds, for the Edison Swan Electric Co., Ltd., succeeding Mr. J. D. Chisholm, resigned.

Catalogues and Lists.—The Horseley Bridge and Engineering Co., Ltd., Tipton, Staffs.—A well-illustrated brochure entitled "A Century of Progress," giving particulars of the firm's numerous achievements in bridge-building, &c., during that period.

The Porter Patent Safety Seals, Ltd., 7 & 9, Belfast Road, Stoke Newington.—An illustrated booklet dealing with the firm's lead seals.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Catalogue Section L (1).—An illustrated catalogue dealing with electric bells, batteries, indicators, bell-pushes, telegraph instruments, lightning conductors, &c. Fully priced. Catalogue Section L (3), giving prices and illustrations of colliery signalling apparatsu—bells, relays, indicators, &c., miners hand lamps, primary and secondary batteries, and spare parts.

Messrs. Watts, Fincham & Co., Ltd., 22, Billiter Street, E.C.3.—An illustrated pamphlet describing the "Wefco" patent gas-proof safety electric hand-lamp.

Messrs. Cole, Marchent & Morley, Ltd., Wakefield Road, Bradford.—Pamphlet No. 69, illustrating and describing central exhaust (uniflow) steam engines, with views of installations. Pamphlet No. 70, an illustrated brochure descriptive of the firm's works and products.

Cryselco, Ltd., Kempston Works, Bedford.—A folder advertising and giving prices of Cryselco "half-watt" vacuum-type lamps.

Messrs. Rayner & Heald, Ltd., Duke Street, Derby.—Leaflets G 101 and 105, describing two- and three-phase induction motors, and giving outputs and prices. Also a list of customers who have purchased these machines.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 365, giving a fully-illustrated description of the "Seewer" governing device for impulse turbines.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—A catalogue illustrating and giving full dimensions, &c., of insulators, ironwork, and fittings, for overhead transmission lines and poles.

The Hotpoint Electric Appliance Co., Ltd., 21, Berners Street, W.1.—Three coloured showcards 29 in. long and 6 in. wide, advertising the "Premier" electric suction cleaner, the "Hotpoint" iron and "Hotpoint" appliances generally. Blank spaces are left for the overprinting of contractors' names, &c.

Messrs. Ruston & Hornsby, Ltd., Lincoln. Mailing Card 42-6, dealing with the "Ruston" patent gas producer for operating on wood refuse, &c., and giving a comparison of costs of a gas engine and producer with other forms of motive power.

Messrs. William Beardmore & Co., Ltd., Parkhead, Glasgow.—Two illustrated pamphlets advertising pumps; one of them deals with semi-rotary wing pumps for hand or power working, and is fully priced.

The Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W.1.—Catalogue No. 12E, an illustrated list of electrically-operated tools, including drills, blowers, welding machines, &c. Also catalogue No. 42, dealing with pneumatic tools.

The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—A collection of illustrated leaflets advertising "Benjamin" electric horns, "Tip-Top" push-buttons, the "Boyce Moto Meter," &c.

The Runbaken Magneto Co., Ltd., Derby Street, Manchester.—An illustrated and priced booklet describing a new pattern of magneto commutator and other electrical ignition apparatus.

Book Notices. *Journal* of the Institution of Electrical Engineers, Vol. LX, May, 1922, No. 309.—This issue contains the following papers: "Rotary Converters, with special reference to Railway Electrification," by Mr. F. P. Whitaker; and "An Investigation of Transmitting Aerial Resistances," by Mr. T. L. Eckersley; the address by the President (Mr. J. S. Highfield) to the London Students' Section; also the Report of the Council for 1921-22; and the annual Benevolent Fund Accounts for 1921.

The Summer Number of *Punch* (1s.) has been issued this week.

"The Electrical Power Engineer," June, 1922. London: The Electrical Power Engineers' Association. Price 6d.—This issue contains the usual record of events and proceedings at the Association's headquarters and provincial centres; a review of Sir John Snell's "Power House Design"; "Some Notes on Power Factor," by J. D. Watson, &c.

South African Railways and Harbours Magazine, Electrification Number, May, 1922.—In view of the attention that the subject of railway electrification is receiving, not only in South Africa, but generally, the data assembled in this special number is of sufficient importance to warrant careful reading. The present issue heralds a new era in the history of South African railways; they have reached a crucial stage in their development when the administration "figuring the nature of the times deceas'd" must "prophesy with a near aim of the main chances of things." In it will be found full details of the various phases of this great problem and of the great engineering schemes that have been designed to combat it. It is excellently written throughout, and all concerned in its production are to be congratulated. The whole of the articles deal with the electrification of a portion of the South African railways from a variety of standpoints, but not in a too technical manner; consequently the information given will be readily assimilated by the public. The sum of money which the scheme involves is of itself sufficient to arouse attention; there is also the added interest which the overturning of time-honoured ideals in railway practice affords, and the whole railway world will follow with keen interest the fortunes of the South African railways in "dropping the old pilot." Great as will be the benefit to the railways of the electric locomotive in Natal, the possibilities to the country generally in having a "cheap and abundant" supply of electricity available in the heart of this rich Dominion are even greater. It is more than gratifying that, in spite of the fiercest competition from all quarters of the world, the bulk of the orders for the material needed have been placed in Great Britain.

Electric Railway and Tramway Journal.—The June 16th Special World Issue of our excellent contemporary, which has been preaching electrification for so many years and has each year told what has been done all over the world in this respect, shows that the electrification of existing steam railways has at length assumed the importance to which it has always been entitled, and has become a very live issue indeed in many parts of the world, and not the least so in Great Britain. The contents of the present issue serve to demonstrate that a large amount of work is on the verge of being initiated.

Copper and Lead Prices.—Messrs. F. Smith & Co. report July 5th:—Copper (electrolytic) bars, sheets and rods, no change.

Messrs. James & Shakespeare report July 5th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £25 15s., 5s. decrease.

Chinese Notes.—The Ming Ming Electric Co., of Chinhai, has been registered in the Ministry of Agriculture and Commerce.

An electric light plant was established at Hungkiang Hunan in February.

E.D.A. Activities.—In addition to the publicity matter relating to electric fans, mentioned in our last issue, the Electrical Development Association has issued a pictorial poster (20 in. x 30 in.). This is entitled "A Breath of the Open Road," and depicts a girl facing a stiff breeze in open country. In the lower half is shown an electric fan, "a summer boon for the home, office, store, and factory."

The Japanese Government Contract for Electric Locomotives.—The contract which the Imperial Government Railways of Japan have just placed with the English Electric Co. for their Dick, Kerr works at Preston, is for 31 complete electric locomotives, of the total value of upwards of £500,000. Eight of the locomotives are for heavy express passenger service. They are of the 2 C C 2 type. Their weight is approximately 96 tons, and they are designed to haul a 415 ton train at a balancing speed of about 60 miles per hour. Each locomotive is equipped with six D.K. 86-A. motors, rated at 306 h.p. at 500 volts, the motors being connected in two groups of three in permanent series on a trolley voltage of 1,500 volts. The control equipment is of the standard "English Electric" cam-shaft multiple unit type. Of the remaining locomotives, 9 are for local passenger service, and 17 are for heavy freight service. These 26 are all of the B-B. type, and will weigh approximately 56 tons each. They are equipped with four D.K. 86-A motors, similar to those on the express passenger locomotives, but in this case the motors will be connected in two pairs in permanent series. Here, too, the control is the standard "English Electric" multiple-unit type. The locomotive for local passenger service is designed to haul a 315-ton train and the freight locomotive, a 600-ton train, the balancing speeds being about 55 and 40 miles per hour respectively.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—October 13th to 23rd, Commercial Motor Exhibition; November 2nd to 11th, International Motor Show; November 14th to 24th, Marine and Small Craft Exhibition; November 27th to December 2nd, Motor-cycle and Cycle Show.

MANCHESTER.—October 6th to 20th, Textile Machinery Exhibition.

BELGIUM (*Liége*).—September 2nd to 26th, Commercial Fair.

FRANCE (*Lyons*).—October 1st to 15th, Sample Fair; (*Paris*) December, Aeronautical Exhibition.

JAVA (*Bandoeng*).—September 18th to October 8th, Netherlands East Indies Fair.

LITHUANIA (*Kovno*).—September 10th to 20th, Industrial Fair.

LUXEMBURG.—August 14th to 22nd, Fair.

NORWAY (*Christiania*).—September 3rd to 10th, Industries Fair.

Local Electrical Exhibitions.—In view of the great revival of interest in, and value of the local electrical exhibition and the number which are being provisionally arranged, it is important that dates should be fixed early and so far as possible to avoid clashing, in order that the task of manufacturers and others in supporting these displays may become as easy as possible. The E.D.A. is endeavouring to collect dates for these displays, and will be very glad to hear from engineers or contractors intending to promote local exhibitions in order that a list may be made as complete as possible and information given with regard to dates already booked.

An important electrical exhibition will be held in the Drill Hall, Swansea, from October 2nd to 14th. This display will cover the domestic, industrial, and trade fields.

The Housing and Health Exhibition at Manchester.—The numerous domestic uses to which electricity can be applied were very aptly suggested at the Manchester Housing and Health Exhibition, held at the City Hall, Deansgate, and brought to a close on July 5th, after being open for a fortnight. The dominant interest in the exhibition was undoubtedly electrical, and no matter in which direction one turned, it was impossible to get out of range of the pleasant hum of electric motors. Immediately on entering the exhibition hall, the visitor was confronted by the stand of the Manchester Corporation Electricity Department, which has resumed the propaganda, that was in abeyance during the war period, to popularise the use of electricity in the home. Theirs was really a composite exhibit of appliances and fittings supplied by the following firms: Jackson Electric Stove Co., Ltd.; Electric Supplies, Ltd.; Falkirk Iron Co., Ltd.; Carron Company; the British Electric Transformer Co., Ltd.; the General Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; the Northern Steel and Hardware Co., Ltd.; Hotpoint Electric Appliance Co., Ltd.; Berry's Electric, Ltd.; British Thomson-Houston Co., Ltd.; the Arora Co.; Belling & Co.; the Edison Swan Electric Co., Ltd.; Simplex Conduits, Ltd.; Western Electric Co., Ltd., &c. These names are sufficient indication of the range of appliances on view. Part of the stand was arranged as a breakfast room, and interested spectators were invited to participate in an acceptable cup of tea and light refreshments, prepared with the aid of electric heaters. Incidentally, it may be mentioned that Manchester has over 6,000 domestic power consumers. The Liverpool Electrical Accessories Co. made a good display of "Rawlplugs," which have now almost become a domestic necessity. Electric cooking stoves, radiators and irons were "featured" by the Gem Labour-Saving Device Co., of Manchester, whilst a washing machine (designated the "Time Saver"), whose electricity consumption was said to cost no more than 2d. per hour, was the star attraction of Alfred William & Son (agents for Beatty Bros., Ltd., of London). The Hoover electric suction

[illegible] Paul paraffin engine was used, incidentally for the illumination [illegible] useful in power stations and other places where transmission is prevented [illegible] trical fittings and domestic appliances also loomed large. The big stand of the [illegible] ment succeeded in giving one the impression that it was a rival concern to the electricity department, whose well-arranged exhibits [illegible] B.T.H. X-ray lights told a story that spoke louder than words.

Consumers and the Minimum Charge.—The existence of the minimum charge, which is a feature of practically all electricity supply undertakings, has to be justified to the consumer lest he should think that he is paying for energy he has not used. In this connection the Woking Electric Supply Co., Ltd., has issued a pamphlet in which the necessity for the arrangement is explained. The leaflet, however, goes further and recommends to the consumer's notice ways in which he may obtain the full advantage of electricity by ensuring, at least, the consumption of the energy for which he pays in any event. Illustrations of an electric kettle, an iron, and a toaster, appear in the leaflet, and other appliances are suggested in a well-written [illegible]

Annual Outings.—On June 28th, the staff and employés of the Tunbridge Wells electricity works went for a motor charabanc tour to Worthing, *via* Ashdown Forest, Haywards Heath and West Grinstead. Lunch was served at Khongs' Eastern Café, Worthing. After a short stay, the next move was along the coast to Brighton, passing close by the Mystery Tower at Shoreham. Tea was partaken of at Brighton, and afterwards the party soon found themselves in the height of the Carnival.

On Saturday last the employés of the Wallasey Corporation electricity department revived the pre-war custom of holding an annual picnic. A party numbering nearly 60 went by charabancs for a drive through Leasowe, Thornton Hough, Quensferry, Mold, and Loggerheads, on to Ruthin. At Ruthin, lunch was partaken of at the Wynnstay Arms Hotel. Afterwards the party boarded the charabancs again for a drive through Nant-y-Garth and the famous Horse Shoe Pass to Llangollen. Unfortunately, whilst at Ruthin rain began to fall, and continued incessantly until 8 p.m. At Llangollen tea was served, and afterwards the party was invited to a special performance at the local kinema. At tea, Mr. J. Longden proposed a vote of thanks to the joint secretaries, Messrs. G. Starkey, W. Brock and J. Hodgson. Mr. E. C. Lloyd seconded the proposition. Mr. Starkey tendered an apology for the unavoidable absence of Mr. Hawkins, the electrical engineer and manager. The journey home was made *via* Wrexham and Chester.

The Germans in Russia.—It is reported from Moscow that the Siemens-Schuckert Co., of Berlin, and the A.E.G., in the near future will each establish a branch in Moscow in order more easily to be able to transfer capital in small amounts to Russian industry and to ensure that the capital is invested in a safe manner.

G.E.C. Travellers.—The annual [illegible] G.E.C. travellers took place on Saturday last, when a party of about 60 journeyed to Maidenhead and thence [illegible] to Henley by the launch *He Must*. After a short stay at Henley the party returned to Maidenhead. Lunch and tea were served on board, and the outing was much enjoyed despite the somewhat wet and cold weather. Mr. Hugo Hirst, Mr. L. C. Gamage, Mr. H. W. Roberts, and other officials of the company accompanied the party, which was successfully organised by Mr. E. A. Joyce.

Lead.—In their report, dated July 1st, Messrs. [illegible] and Co. state: "Closing prices last week were £23 5s. for June and £23 10s. for September, [illegible] respectively yesterday. A considerable [illegible] lead is arriving this week-end, and further steamers are due to arrive next week, while there is a prospect of better supplies from Spain, from whence there is about 3,000 tons of soft pig lead afloat for this country, so that the position should shortly ease off. Consumption is [illegible] tile trade continuing very [illegible] demand to suppress remaining [illegible] wondered at, considering the price of manufactured lead."

Russian Platinum Industry.—According to the *Morning Post*, a movement is being made to re-establish the Russian platinum industry, and some important [illegible] with the enterprise. A private [illegible] in a few days with a small capital [illegible]

Latin-American Electrical Notes.—*Cuba.*—It is proposed to apply electric power to the entire line of railway, already constructed or in course of construction, owned by the Herschey Cuban Railroad, from Matanzas to Habaña. The main line, 100 km. in length, extends from Matanzas to Regla, a small suburb of Habaña, and opens up a country not previously provided with railway transport. At Jibacoa, approximately 60 km. from Habaña, there is a junction from which a branch, 7 km. in length, will work to Santa Cruz-del-Norte, an undeveloped port with a good harbour situated on the north coast. Another branch line, 20 km. in length, will operate from a point near Jibacoa, on the main line, to Bainoa, where it will be connected with the United Railways of the Habaña. Central Herschey is the site of a large sugar mill owned by the company which developed the railway, and is on the main line, equidistant from the Regla and Matanzas terminals. Electric operation will also be applied to the mill, a power plant sufficient for the purpose being already in operation at Central Herschey.

Peru.—The Peruvian Government proposes to publish, as soon as possible, a report upon the water-power resources of the Republic, in order to encourage the further undertaking of hydro-electric enterprises. It is known that at least 13,000,000 h.p. could be adapted for development, without provision for extensive storage. Of this total no more than 50,000 h.p. is at present developed, with limited storage capacity.

Honduras.—A contract has been granted for the construction of a wireless station near Tegucigalpa (Republic of Honduras). There will be two towers, each 458 ft. in height, and direct communication will be furnished with the United States. It is expected that the station will be in operation by next October, while the total cost is not expected to exceed 350,000 gold dollars (£70,000).

Argentina.—The National University of La Plata (Argentina), now engaged upon constructing a hydraulic laboratory on the waterfront at La Plata, is about to electrify the entire building, and for this purpose will introduce an electric power plant and erect an electrical laboratory for the use of students in that branch of engineering. The construction work, apart from the cost of the electric power plant, will involve an expenditure of 350,000 pesos.

Brazil.—The electrification work, which has been proceeding for some time on the Paulista Railway (Brazil), between Vallinhos and Jundiahy, has now been completed, and trains have commenced running between the two terminals. Electrification as far as Campinas is almost completed, and trains were expected to be in operation by the end of June between Campinas and Rio Claro. So far, the experiment has proved sufficiently encouraging to induce the company to apply for authority to continue the electrification of its lines between Araraquara and Rincao, at the same time increasing the gauge of the track from one metre to 1.7 metres. The Paulista Railway Co. is likewise installing a large and powerful electric furnace in the railway workshops at Rio Claro for the preparation of industrial steel.—*Reuter's Trade Service.*

Large Machines in Finland.—The first of three three-phase generators of 3,600 kW, which is the largest size so far made in Finland, was recently completed by the Finnish Electrical Co. for the Kymmene A.B., of Voikka.

French Railway Electrification.—The *Financial News* states that the French Thomson-Houston Co. has, in conjunction with the concern of Schneider, formed a company to electrify the French railways. This new company has just obtained orders from the State, Orleans, Midi, and P.L.M. lines for rolling stock and other material amounting to over 200,000,000 fr.

Brighton Carnival.—At the ball held in connection with the Brighton Carnival on June 28th, Mrs. Jonas, of Brighton, represented "Aladdin Up-to-date." The costume, which was worked out in red and green, was of the distinctive Chinese cut, and attracted much attention. The lady carried a 4,000-c.p. Royal "Ediswan" gasfilled lamp, and her hat was fringed with a number of miniature "Royal Ediswan" lamps, which were illuminated.

LIGHTING AND POWER NOTES.

Australia. SYDNEY, N.S.W. *Bulk Supply.* The Municipal Council has had a letter from Mr. Henry Daly, stating that he is associated with an undertaking that is prepared to consider the supply in bulk of electricity to the Council at an attractive figure, delivered at the City boundary, which will be generated at some distance from Sydney, within a reasonable period from the date of acceptance of any mutually-agreed contract.

Barnstaple.—LOAN.—The Town Council has applied to the Electricity Commissioners for a loan of £1,300 for extensions to the plant.

Canada.—NEW BRUNSWICK.—*Hydro-electric Plant.*—The Canadian *Electrical News* reports that the Musquash hydro electric installation has been completed. The scheme is believed to be unique in that two rivers, two miles apart, are used, the pipe lines converging on one station, in which the generating plant is situated. The west and north-east branches of the Musquash River provide the power. The working head of the first branch is 117 ft., and that of the north-east branch is 95 ft.; the respective developments amount to 1,450 and 1,550 continuous h.p. The generators, supplied by the Canadian General Electric Co., are of 2,900-kVA capacity, generating at 13,200 V. Each machine has a directly-connected exciter capable of supplying d.c. to two machines. This is a provision against the breaking down of one of the exciters. The transmission system consists of two circuits, each capable of carrying half the total output. The cables are of aluminium, and are mounted on galvanised steel towers.

Chesterfield.—PRICE REDUCTIONS.—The Town Council has reduced the price of electricity for lighting by 25 per cent. for small power consumers; heating by 25 per cent.; and tramway supplies by 25 per cent.

Continental.—LATVIA.—The Government has under consideration the erection of five hydro-electric stations on the Dvina at a total cost of 53,600,000 Russian roubles. The two marked down for early erection are those at Kokenhusen (80,000 kW), for railway electrification purposes, and Dahlen (24,000 kW), which will supply the Riga district. The other three will be at Stockmannshof (36,000 kW), Keggum (36,000 kW), and Ascheraden (16,000 kW). Doubts are entertained in some quarters if the large expenditure involved can be justified by the magnitude of the probable demand.

CZECHO-SLOVAKIA.—Tenders are now being invited for the machinery for the new power station which is to be built by the Zentral Elektricitätswerke Aktien Gesellschaft at Seestadtl, near Komotau, with the financial help of the provincial administration, which has invested 4,000,000 kronen in the company. The province has agreed to guarantee a loan of 25,000,000 Czech kronen, to be later raised to 38,000,000. Apart from its wide field of supply, this station will furnish motive power for the railways, the conversion of which is expected to be undertaken in five or six years' time. The first section to be taken in hand, according to the *Ceské Slovo*, will be the Prague-Pardubitz line.

A Franco-Swiss company has been formed to utilise the falls on the Rama River, near Jablonica, by the erection of a hydro-electric station. It proposes to obtain an output of 40,000 h.p., rising to 63,000 or 65,000 h.p., the electricity generated being supplied to the towns of Konji and Prozor; to the Metkovic-Mostar-Sarajevo railway line and the projected line from Konjic to Dubrovnik; and also to supply various industries. The cost of the scheme is estimated at 11 million kronen.

Coventry.—PRICE REDUCTIONS.—The following reduced scale of charges has been adopted by the Town Council, from the reading of the meters for the March quarter: Power, flat rate, 1½d. per unit; heating, flat rate, 1¾d. per unit; lighting, maximum demand rate, 1st hour per day, 8d., 2nd hour per day, 6d., above this consumption, 1¾d.; flat rate, 6d. per unit; by prepayment meter, 8d. per unit.

Croydon.—PRICE REDUCTIONS.—The Town Council has reduced the charges of electricity for lighting from 8d. to 7d. per unit, subject to a minimum annual payment of £2 13s. 4d., and for power, during certain hours, from 2d. to 1½d.

Darwen.—PRICE REDUCTIONS.—The Electricity Committee has decided to reduce the charges for lighting by ½d. per unit, and for power, heating, &c., from ¾d. to ½d. per unit.

Denny (Stirlingshire).—PRICE REDUCTION.—The Town Council has reduced the price of electricity for lighting by ½d. per unit; the charge for power will remain unaltered.

Douglas (Isle of Man).—LOAN SANCTIONED.—The Tynwald Court of the House of Keys has granted the Town Council sanction to borrow £62,000 for carrying out work authorised by the Corporation Electric Light & Power Act, 1921.

Dumfries.—JOINT ELECTRICITY SCHEME.—The Town Council is to purchase the electricity undertaking in the burgh, belonging to the Dumfries Electricity Supply Co., Ltd. The purchase price is £60,000. The Maxwelltown Council is also purchasing the electric lighting undertaking in Maxwelltown at a cost of £8,000, and it will be carried on under a joint scheme with Dumfries.

Halifax.—LOAN SANCTIONED.—The Tramways and Electricity Committee has received from the Electricity Commissioners sanction to the borrowing of £4,045 for high-pressure switchgear.

Heston and Isleworth.—ELECTRICITY FROM REFUSE.—The Electricity Committee of the Urban District Council is in favour of closing down the refuse destructor, as experience has shown it to be uneconomical in generating steam for the electricity generating plant. The Committee has now had the destructor closed down for six months, and reports that as a consequence of the generating plant being supplied with steam from coal-fired boilers, greater flexibility in the con-

trol has been effected, and also a distinct improvement in the efficiency and maintenance has been obtained.

Year's Working.—The annual accounts of the electricity undertaking for the year ended March 31st last, show a net profit of £3,244.

Kettering.—Year's Working.—The accounts, for the year ended March 31st, 1922, of the electricity undertaking (Engineer; Mr. W. A. Walker) show a total income of £37,841, as compared with £42,156 in 1920-21. Working expenses amounted to £21,265, as against £29,723, leaving a gross profit of £16,579 (£12,433). After crediting bank interest and defraying capital charges, the result was a net profit of £5,618; the previous year's profit was £3,738. Capital expenditure totalled £37,009; this included an item of £31,798 for machinery. The total number of units sold increased from 2,853,445 to 3,035,475, and the maximum simultaneous demand from 1,752 kW to 2,000 kW.

Leyton.—Loan Sanctioned.—The Urban Council has received sanction to a loan of £4,000 for services.

London.—Fulham.—*Year's Working.*—The accounts of the electricity undertaking show a credit balance of £9,710 for the year ended March 31st, 1922. This, with a balance from the previous year, makes a total of £18,277. The Electricity Committee has recommended that £4,000 be contributed to rate relief, and £5,000 to the Machinery Maintenance Reserve Account, the remainder to be retained on current account as a working balance. *Commissioners' Expenses.* The Council's contribution to the expenses of the Electricity Commissioners for the year 1922-23 amounts to £200.

Extensions.—The Electricity Committee has approved the expenditure of £2,875 upon mains and switchgear for the West Kensington district; and also £1,750 for additions to the linking-up plant. Application is being made to the Electricity Commissioners for sanction to borrow £20,148 for these and other extensions.

Mansfield.—Price Reduction.—The Electricity Committee has recommended that the price of electricity from July 1st next be at the rate of 100 per cent. above pre-war charges instead of 150 per cent., as at present.

Norwich.—Year's Working.—The annual report upon the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £147,930, as compared with £135,499 in 1920-21. Working expenses amounted to £100,220 (£94,692), leaving a gross profit of £47,710. After deduction of capital charges, the sum of £17,452 was carried to the appropriation account; £13,668 was transferred in the previous year. The number of units sold increased by 16 per cent., to 12,700,713. In order to meet the increased demand for electricity that is anticipated during the coming winter, a new boiler has been ordered and will shortly be delivered.

Reigate.—Plant Extensions.—The Town Council has received the Electricity Commissioners' consent to the extension of the generating station by the installation of three 350-kW, single-phase Diesel sets, and sanction has been obtained to loans of £3,000 for building work, and £30,000 for plant. A further loan of £6,000 in connection with the extensions has been applied for.

Sandgate.—Electricity Charges.—The Folkestone Electricity Supply Co. has informed the Urban Council of its intention to apply for powers authorising the company to continue to charge 8d. per unit, with a minimum of 10s.

United States.—Water-power Development.—The Senate, on June 27th, voted an appropriation of 7,500,000 dollars for the resumption of the construction of the Wilson Dam at the Muscle Shoal Rapids on the Tennessee River, which Mr. Henry Ford is seeking to purchase. Various speakers argued that the voting of the appropriation would not be prejudicial to the acceptance of Mr. Ford's offer, if that course were found to be desirable.—*Reuter* (Washington).

Watford.—Loan Sanctioned.—The Urban Council has received sanction to borrow £35,000 for additional plant for the electricity works.

West Hartlepool.—Year's Working.—The annual accounts of the electricity undertaking for the year ended March 31st last show a total revenue of £52,796. Working expenses amounted to £46,516, as against £44,356 in the previous year, leaving a gross profit of £6,280. Interest, repayment of loans, &c., absorbed £13,650, leaving a net deficit of £7,370. In the previous year there was a surplus of £15,645.

West Kilbride and Seamill (Ayrshire).—Electricity Supply.—A new company has recently been formed with a view to supplying the district with electricity.

West Ham.—Year's Working.—We have received from the engineer and manager (Mr. F. W. Purse) a copy of the report and accounts of the Corporation Electricity Department for the year ended March 31st last. The total revenue amounted to £409,242 and the working expenses to £319,424, comparing with £456,505, and £374,441 in the previous year. The gross profit was thus £89,818, as against £82,064. The capital charges were higher, due to the repayment of a larger proportion of borrowed capital, and the net result was a profit of £23,472; the profit in 1920-21 was £22,456. The capital expenditure during the year totalled £138,935, the principal item being £107,091 for machinery and plant. The total capital expenditure on the undertaking now stands at £920,493.

The total sale of energy decreased from 45,065,784 to 40,505,500 kWh, and the maximum simultaneous load from 14,970 to 13,865 kW. The cost of fuel per kWh sold fell from 1.13d. to 0.96d. The average price obtained per kWh increased from 2.25d. to 2.28d. The report compares the present-day fuel costs with those of 1914. It is shown that while the fuel used in generating a kWh has decreased from 4.10 lb. to 3.77 lb., the cost of fuel per kWh has risen from .31d. to .96d. The report also states that it is hoped to have a second 10,000-kW set available for the winter load of 1922-23.

Wrexham.—Loans.—The Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £6,586 in connection with an electricity scheme, and for £5,000 for the laying of cables in various parts of the town

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Fares Revision.—The Tramways Committee has recommended the following revision of tramway fares:—From October 1st next, all the present 2d., 2½d., 3d., and 3½d. fares for ordinary passengers should be reduced by ½d., workmen's return fares for the new 2d., 2½d., and 3d. fares should be 3d., 4d., and 5d. respectively; and from August 1st next a minimum single fare should be fixed of 1d. up to and including 2½d. stages, with a minimum of 1½d. for the remainder of the existing stages for children.

Bradford.—Year's Working.—The annual report on the working of the tramway undertaking for the year ended March 31st last shows a total revenue of £721,547, as compared with £718,539 in 1920-21. Working expenses amounted to £588,803 (£653,903), leaving a gross profit of £132,744 (£64,636). Capital charges absorbed £76,127, leaving a net surplus of £56,617. In the previous year there was a deficit of £22,245. The income per car mile was 28.44d., and on the railless system 13.83d.

London.—New L. & N.W. Electric Service.—Commencing on July 10th, the stations at Kilburn, South Hampstead (formerly called Loudoun Road), and Chalk Farm will be reopened for passenger traffic, and from that date the electric line from Watford to Queen's Park will be opened to Euston. A frequent service of electric trains will be run during the rush hours, every 15 minutes from Watford to Euston, to Broad Street, and the Elephant and Castle, and, of course, in the opposite direction.

Oldham.—Application for Extension of Time.—The Corporation and the Chadderton U.D.C. have applied to the Ministry of Transport for an Order under Section 18 of the Tramways Act, 1870, to extend the time for the completion of certain tramways in White Gate Lane, Thompson Lane, Butler Green, Washbrook, and Block Lane, Chadderton, and in Oxford Street, Oldham, which were authorised by the Oldham and Chadderton Tramways Order, 1919, for a period of two years from August 15th, 1922.

Southport.—Track Renewals.—The Highways and Works Committee has under consideration a report submitted by the borough engineer for the renewal of tramway track in the town. The engineer suggests that the worn track be replaced by a heavier type of rail, and that a double line be constructed. The estimated cost of carrying out the work is £24,250, and application to the Ministry of Transport for sanction to borrow that amount is recommended.

Twickenham.—Railless Traction.—The London United Tramways, Ltd., propose to relay some of the track in the district. With regard to the spur line from York Street Junction to Richmond Bridge, it is proposed to seek powers to run railless vehicles on this section and to discontinue the ordinary tramcar service.

Sunderland.—Year's Working.—The annual report on the working of the tramway undertaking for the year ended March 31st last shows a total income of £158,820, as compared with £158,165 in the previous year. Working expenses amounted to £118,156 (£136,668), leaving a gross profit of £20,664 (£21,497). After payment of capital charges, &c., there was a net profit of £311. In the previous year there was a profit of £8,017

United States.—Oklahoma City.—The *Railway Review* reports that the Board of City Commissioners of Oklahoma City has adopted an ordinance requiring steam railroads entering the city to electrify their properties within the city limits. Oklahoma City is the second large municipality to adopt such an ordinance. The city of Buffalo, N.Y., recently passed a similar measure, which is now being contested in the Courts.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—Wireless Broadcasting.—An example of receiving wireless news broadcasted by subscription has been set by the German Post Office, which has arranged for the circulation of market prices of stocks, materials, &c., supplying and maintaining a single-wire aerial one-valve receiver to subscribers for an inclusive annual fee. The figures broadcasted have to be decoded, the code being supplied only to subscribers, so that others cannot take advantage of the service. The subscription includes a news service.—*Daily Mail.*

Ireland.—Interrupted Communication.—In connection with the fighting in Dublin, on June 30th, the Postmaster-General stated that the cable from Anglesey to Kingstown had been cut, presumably near the Irish coast, and that telegraphic communication between Great Britain and Southern Ireland therefore ceased. The cable to Belfast was the only means of communication with Ireland, telephony having been stopped early on the morning of June 29th. Later it was announced in the Press that the cable had been restored, but the whole of the telegraph, telephone and postal services are thoroughly disorganised.

Portugal.—Higher Tariff.—The Anglo-Portuguese Telephone Co. announces that the Portuguese Government has authorised an increase in the company's present tariffs, amounting to 75 per cent. in the case of commercial users, and 50 per cent. in the case of private houses, says the *Financial Times.*

Scandinavia.—Wireless Telephony.—The radio-telephone service between Copenhagen and Bornholm is to be opened immediately. The Waldemar Poulsen system has been used, and the fees charged will be lower than for telegrams. This is the first Scandinavian overseas radio telephone service.—*Reuter's Trade Service* (Stockholm).

Wireless Telegraphy.—International Federation.—An international meeting of marine wireless operators, attended by British, Belgian, Danish, Greek, Italian, Dutch and Swedish representatives, has just been held at Brussels. The formation of an International Federation of Wireless Operators, with its headquarters in London, was decided upon. The gathering adopted various resolutions dealing with technical and professional questions.—*Financier.*

Time Switches.—Mr. W. D. Owen, of Jesmond, Newcastle, has successfully applied a Venner time switch so that it can be set to switch on and off a wireless receiving set three times daily for any periods, and for any scheduled signals. At present it is set to take the Eiffel Tower weather reports, and automatically switches on when these signals are sent out, and switches off again when they finish.—*Newcastle Chronicle.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—September 1st. Victorian Electricity Commissioners. Rate-of-flow controller. (Spec. 268.)
September 16th. Victorian Electricity Commissioners. Strain and pin-type insulators. (Spec. 261.) (June 30th.)

Belgium.—July 15th. Municipal authorities of Ixelles, Brussels. Four new boilers, with economisers, at the central electricity generating station.

Cheadle and Gatley.—July 10th. Urban District Council. A.c. meters and maximum demand indicators. (June 23rd.)

Connah's Quay.—July 14th. U.D.C. Sub-station equipment, overhead and underground mains, public lighting and consumers' services. (June 23rd.)

Gravesend.—July 17th. Electricity Department. One 5,000 kW turbo-generator, condensing plant, switchgear, mains, artesian well, automatic stokers. (June 23rd.)

Ilford.—July 10th. Education Committee. Electric light installation, Chadwell, Cleveland Road and Valentines Schools. Mr. A. H. Shaw, electrical engineer, Ley Street.

India.—July 14th. Bombay, Baroda, and Central India Railway Co. Metallic-filament lamps. (June 23rd.)
July 14th. High Commissioner's Department. Submarine cable, v.i.r. insulated and lead-sheathed cable, and braided wire. (June 23rd.)
July 21st. Automatic telephone sets, desk and wall cords for switchboards, &c., cells for accumulators. (June 30th.)
July 28th.—High Commissioner for India. Telephone Switchboards and desk and wall sets. (See this issue.)

London.—L.C.C. July 24th. H.p. switchgear for the Central Repair Depôt, Charlton. (June 30th.)
Metropolitan Asylums Board.—July 19th. Installation of the internal automatic telephones at the River Hospital, near Dartford; installation of electric lighting in ward blocks, boiler-house, &c., at the Grove Fever Hospital, Tooting, &c. (June 30th.)
Fulham.—July 13th. Electricity Department. One 1,500 kW Scott connected transformer; 5,000 yd. .1-h.p., 3,000-V concentric cable. (See this issue.)

Manchester.—July 11th. Education Committee. Electric lighting installations at Mulberry Street, Southall Street, Duke Street, Waterloo Road, Sunnyside, and Johnson Street Municipal Schools. Specifications (£1 1s.) from Director of Education, Education Offices, Deansgate, Manchester.

Navan.—July 24th. Electricity Department. D.c. main switchboard, d.c. generators, overhead mains, &c. (June 23rd.)

Torquay.—July 12th. Electricity Department. One 3,000-kW turbo-alternator and condensing plant. (June 23rd.)

Wimbledon.—July 10th. Electricity undertaking. Four 1,000-kVA, 10,000/2,000-V transformers. (June 23rd.)

Wrexham.—July 13th. Board of Guardians. Electric light installation, block of buildings adjoining Croesnewydd Hospital. Mr. J. D. Bury, clerk, 23, Chester Street.

* A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Seven concerns submitted tenders last week to the municipal authorities of Ixelles, Brussels, for the supply of 1,000 electricity meters, the lowest offer being that of M. Bornheim, of Brussels, who quoted 52½ fr. per meter.
There was keen international competition last week for a Belgian telegraph and telephone department's contract for the supply of 1,847 metres of lead-covered paper-insulated cables, no less than nine concerns—five Belgian, two German, and one each French and Austrian—submitting tenders. The lowest was that of M. Janssens, of Schaerbeek, Brussels, who quoted 62,071 fr.

Dover.—Accepted:—
Electric light installations at St. James' Vicarage and 16 houses, for W. Bromley.—Gordon C. Lent, of Dover.

Edinburgh.—Tramways Committee. Recommended:—
Thirty car-top covers (£6,600). McHardy & Elliot, Ltd.

Guildford.—Town Council. Accepted:—
Boiler and induced draught plant, for the electricity works (£3,035).—Babcock & Wilcox, Ltd.

London.—L.C.C. Establishment Committee. Accepted:
Storage battery in connection with the electric annunciators and division bells.—Chloride Electrical Storage Co., Ltd. (£133).

Manchester.—Electricity Committee. Accepted:—
Cable: W. T. Glover & Co., Ltd.; Macintosh Cable Co., Ltd.
Switchgear panels: Park Royal Engineering Co., Ltd.
Electrically-driven auxiliary pumping plant.—Mather & Platt, Ltd. Sub-contractors for switchgear and motor: Metropolitan-Vickers Electrical Co., Ltd.

Metropolitan Asylums Board.—The following tenders have been received for installation of electric lighting and power, telephones, fire alarms, and domestic bells at Tooting Bec Mental Hospital extension:—

	£
T. Clarke & Co., Ltd.	5,300
S. Reed & Sons	5,778
G. E. Taylor & Co.	5,990
Alpha Manufacturing Co.	6,160
Malcolm & Allan, Ltd.	6,416
H. J. Cash & Co., Ltd.	6,638
Beaven & Sons, Ltd.	6,722
Lund Bros. & Co.	7,150
A. V. Gilkins & Co., Ltd.	7,256
County of London Electric Supply Co., Ltd.	7,465
Pinching & Walton	7,812
Cox-Walkers, Ltd.	8,040
Tov & Winslow	8,200
Strode & Co., Ltd.	8,242
J. Scott, Ltd.	8,314
Hall & Stinson, Ltd.	8,526
Mann, Egerton & Co., Ltd.	8,655
"Watt" Electrical Co., Ltd.	10,000
Electrical Contracts & Maintenance Co., Ltd.	11,926
G. N. Haden & Sons, Ltd.	13,500
J. R. Dunkley & Co.	17,500

Extensions to the electric lighting installation in the new offices, caretakers' quarters, and stores at Mead Works:—
Tov & Winslow, (£180 accepted)

Maidstone.—Town Council. Accepted:
Boiler, mechanical stoker, &c., for the electricity works (£11,783).—John Thompson, Ltd.

Portsmouth.—Board of Guardians. Accepted:—
Electrical fittings, for three months.—H. A. Evans (Southsea).

West Ham.—Town Council. Accepted:—
Electrical plant (£45,030).—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear (£4,008).—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Electrical Power Engineers' Association (Derby and District Branch). Saturday, July 8th. At the Queen's Hotel, Bridge Street, Burton-on-Trent. At 5 p.m. Lecture on "Economy in Mains Laying," by Mr. T. A. G. Margary.

Electricity District Inquiry. Tuesday, July 11th. At the Guildhall, Nottingham. At 10.30 a.m. Inquiry by the Electricity Commissioners as to the area to be included in the proposed East Midlands Electricity District and to consider a scheme for the establishment of a Joint Electricity Authority.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of

Vitreous enamelled iron pipe (inside and outside), 1 in. diam., lengths about 8 ft. 9 in., screwed one end.

A white ink for stamping numbers on electric lamps.

NOTES.

The I.E.E. Conversazione.—On Thursday last week the annual Conversazione of the Institution of Electrical Engineers was held at the Natural History Museum, South Kensington; the president (Mr. J. S. Highfield) and Mrs. Highfield, with the council, received the guests, over 1,700 in number. An excellent programme of music was performed in the Central Hall by the string band of the Royal Engineers, under the direction of Lieut. Neville Flux, F.R.A.M., and successive concerts were given in the Reptile Gallery by the Misses Phyllis Carey-Foster and May Peters, and the Philharmonic String Quartet. The function was, as always, in every way enjoyable and successful. Amongst the principal guests were Viscount Dillon; Lord Parmoor, K.C.V.O.; the Maharajah of Gwalior; the Hon. A. H. Ashbolt, Agent-General for Tasmania; Sir Acton Blake, K.C.M.G., K.C.V.O.; Lieut.-General Sir Travers Clarke, K.C.B., K.C.M.G.; Sir Robert Elliott-Cooper, K.C.B.; Sir W. Brandford Griffith, C.B.E.; Admiral of the Fleet Sir H. B. Jackson, R.N., G.C.B., K.C.V.O., F.R.S.; Sir Herbert Jackson, K.B.E., F.R.S.; Judge Jackson; Mr. Henry Savage Landor; Mr. W. W. Lackie, C.B.E.; Sir William J. Larke, K.B.E.; Sir E. Humphrey Leggett, D.S.O.; Sir Oliver Lodge, F.R.S.; Sir William Mackenzie; Sir Oswyn Murray, K.C.B.; Major-General Sir Philip Nash, K.C.M.G.; Sir Cooper Perry; Sir Ernest Pollock, K.B.E., K.C.; Sir Arthur C. Roberts, K.B.E.; Sir Edward Smith; Sir Aubrey Symonds, K.C.B.; and Mr. W. B. Worthington. Past Presidents: Mr. Ll. B. Atkinson; Col. R. E. Crompton, C.B.; Messrs. W. M. Mordey; Roger T. Smith; C. P. Sparks, C.B.E.; and C. H. Wordingham, C.B.E.; Members of the Council: Messrs. J. R. Beard; J. R. Cowie; F. W. Crawter; Sir James Devonshire, K.B.E.; Dr. W. H. Eccles, F.R.S.; Messrs. F. Gill; P. V. Hunter, C.B.E.; A. C. MacWhirter; Sir William Noble; Col. Sir A. M. Ogilvie, K.B.E., C.B., T.D.; Dr. A. Russell; Messrs. W. M. Selvey; A. A. C. Swinton; P. D. Tuckett; and Dr. W. M. Thornton; and Mr. P. F. Rowell, Secretary.

Coolidge Tube Research.—The Research Department at Woolwich Arsenal has recently undertaken an investigation to ascertain the cause of the rapid decrease in output of the radiator-type of Coolidge tube when continuously operated with a constant filament current. The problem becomes important when this type of tube is used in an X-ray outfit designed for constant routine examination of large quantities of articles, when it is usually desirable so to simplify the system of control that the whole operation may be carried out by comparatively unskilled labour in workshops. The investigation has shown that the surface-charge theory does not account for the diminution in current through the tube, and the experiments suggest that this phenomenon is due to the liberation of gas, probably from the copper, causing a reduction of electron emission, as observed by Langmuir. The remedy for the trouble is to prevent this liberation of gas, which is the result of a rise of temperature of the copper anticathode, the rate of heating being more rapid than the rate at which the heat can be conducted along the copper rod to the radiator cooling fins. The problem, therefore, resolves itself into that of adequately cooling the anti cathode.—*Journal* of the Rontgen Society.

Screening an Oscillator.—The results of experiments on the electro-magnetic screening of a triode oscillator, described by Mr. R. L. Smith-Rose, A.M.I.E.E., &c., in the *Proceedings* of the Physical Society of London, show that the most complete method of screening a valve set is to enclose it in a box made of metal of suitable thickness for the frequency used, and to seal hermetically all joints in the box and its lid. The smallest crack or hole is sufficient to allow of the escape of a detectable amount of high-frequency energy, and iron is far more effective than copper of the same thickness in preventing direct penetration of the electro-magnetic fields through the metal. The experiments were carried out at the National Physical Laboratory in connection with investigations undertaken for the Radio Research Board, and the practical problems arose from the necessity of screening local oscillating generators for use in comparing wave reception on a number of stations simultaneously. The local oscillations were conveniently generated by a portable form of triode oscillator operating entirely from a 6-volt battery, and the problem was to protect the receiving coil system from induced oscillations, which might be fed to the required point in the circuit by a purely conductive connections. The principles involved [illegible] however, be applied to other purposes than the above. It is, for example, a very necessary appliance for certain methods of measuring the strength of received radio signals. The problem may be considered correctly as the limiting of the high-frequency magnetic field around the oscillator by induced eddy currents in the screening body. Some experimental work on screening has been carried out at the R.A.F. Instrument Design Establishment at Biggin Hill and at the Army Signals Experimental Establishment at Woolwich, but no details of this work have been published. The results of the work at Biggin Hill are already being used, however, in the design of wireless instruments.

Supply Works in Italy.—The Association of Italian Electricity Supply Undertakings recently issued a report in connection with the annual conference held at Milan, dealing with the supply industry in Italy. At the outset the report expresses regret at the diminution of capital investments in electricity supply undertakings, and that too, at a time when the latter need a large influx of capital, not only for the purpose of fully equipping existing works, but also for the establishment of new works, so as to meet the growing demand on the part of consumers. As to the reasons for the abstention of investors, the report states that the latter now prefer Treasury bonds and similar securities, which yield a higher return than industrial papers. Before the war holders of shares in electricity supply works received dividends of about 6 per cent., but investments in public funds only yielded 4 per cent. At present, however, this situation of affairs has been reversed. A second series of reasons is found in unfortunate State legislation in the fixing of charges for supply, and unless an alteration is made the situation of an economic paradox will soon be reached, under which the charges for lighting and heating will be lower than those for energy for power purposes. In order to promote the financing of works the report suggests that facilities should be afforded for the issue of guaranteed loans, either to be raised abroad or by the discontinuance of legislation which would prevent the influx of foreign capital, as, for instance, the exclusion of foreigners from the boards of directors or management of undertakings working under concessions. Coming to consider the abnormal drought in the past winter, the report states that this put the works to a hard test, and led to the recognition of the necessity for the hydro-electric works also to have steam sets installed. It had been thought in recent years that this problem had been solved, but the experience of the past year had demonstrated that steam sets must be included in hydro-electric works.

B.T.H. Magnetos.—In addition to helping to create the ten world's records recently established by Sunbeam cars at Brooklands, B.T.H. magnetos were further honoured by being fitted to the Sunbeam cars driven by Jean Chassagne and Major H. O. D. Segrave, who gained first place and the cup for the fastest lap, respectively, in the Senior International T.T. Race. It is interesting to note that the only cars in the T.T. Races to abandon dual ignition in favour of a single ignition system were the 8-cylinder Sunbeams, each of which relied on two 4-cylinder B.T.H. magnetos. The remarkable performance of these magnetos is emphasised by the fact that when the Sunbeam engine is running at its maximum speed each magneto is producing about 8,500 sparks per minute. Thus Jean Chassagne's car, in achieving its historic success on June 22nd, required, during its run of 5 hrs. 24 mins. 50 secs., approximately 3,000,000 sparks! In addition to the above successes, B.T.H. magnetos were also fitted to the Triumph machine that gained second place in the Senior Motor Cycle T.T. Race, and to the 11.9 Bean car which was awarded the Vase [illegible] trial run of the Sutton Coldfield and North Birmingham Automobile Club.

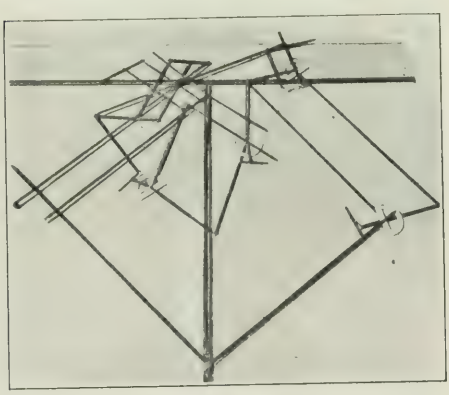
Electricity Costs and Expenses Rules. The Ministry of Transport has brought into immediate operation the "[illegible] (formerly Ministry of Transport) Costs and Expenses Rules, 1922," dated May 19th, 1922, under the Acts of 1919 and 1921. These Rules [illegible] that all costs and expenses which the Minister may order to be paid by any applicant for an order made or placed into force before the date shall be agreed to or determined by the parties concerned.

Engineering Trade Negotiations.—On Wednesday Sir Allan Smith, M.P., presided at Westminster over a conference of representatives of the Engineering and National Employers' Federation and the A.E.U. and other unions respecting the proposed reduction of the war bonus.

Appointments Vacant.—Plumber-jointer, for the Loughborough Corporation Electricity Department; working assistant engineer (£200 and house), for the Knowle Mental Hospital; [illegible] superintendent for the Edinburgh Corporation Electricity Department; chief assistant for the Belfast Corporation Electricity Department. (See this issue.)

Automatic Train Control.—The Automatic Train Control Committee, appointed by the Ministry of Transport, under the chairmanship of Col. J. W. Pringle, C.B., has presented its report (H.M. Stationery Office; price 9d. net). After reviewing the various ways in which railway accidents might be reduced: the several systems of control in use or suggested for use; and other relevant matters, the Committee arrives at the following conclusions: Automatic train control presents the only reliable method of preventing a large proportion of train accidents directly occasioned by failures of engineman to obey signals, which amount to about one-third of the total. The system should be gradually adopted on British railways. The form likely to prove most suitable in this country is the contact type, designed to operate in conjunction with existing signalling methods. The system should be uniform in character, and all working parts should be of standard design, to facilitate replacements and to ensure interchangeability. A complete system of control should include a train-stop device at selected stop signals, and train control generally at distant signals. If, owing to financial considerations, it is found impossible to carry out the complete scheme, a preliminary step should be made by introducing control at selected stop signals. It is recommended that the railway companies immediately form a committee of experts to determine and standardise track and locomotive apparatus, having regard to differences in structural and loading gauges, and the position of conductor rails on electrified railways.

The "Indumor."—A kinematic device, the name of which is an abbreviation of the words "induction motor," is described an dillustrated in No. 2, Vol. XLI, of the *Journal* of the A.I.E.E. by Prof. Vladimir Karapetoff, Professor of Electrical Engineering at the Cornell University, which represents the vector diagram of a polyphase induction machine. The parts are made to assume at will different positions corresponding to different loads of an induction motor or generator. The primary and the secondary constants, the magnetising current, and the core loss, are also adjustable at will. The device permits the visualisation of the performance of an induction machine, and can be used



The "Indumor."

for a study of a given machine or for a selection of the constants to give the desired performance characteristics of a new machine. The input, output, torque, speed, power factor, &c., can be read off on the device as in an actual brake test. The kinematic connections consist mainly of generalised proportional dividers and of parallel tongs, so combined as to satisfy a system of simultaneous vectorial equations which represent the properties of the machine. Further applications of the device to polyphase commutator motors are suggested.

An Electricity Supply Association for Ireland.—We have received from Mr. E. C. Handcock, M.I.E.E., of Dublin, a copy of a circular which he has issued to the managers of more than 70 small electricity supply undertakings in the Irish Free State, advocating the formation of an association for the protection of their rights and the furthering of their interests. Amongst the objects of such an association would be the reduction of running costs by interchange of information; obtaining coal and materials at low prices by collective buying; protection of legal rights, and so on. But a more pressing reason for its immediate formation is the probability that as soon as a definite Government takes over control, it will proceed to make regulations controlling the generation and supply of electricity; the Committee formulating such regulations might be content to consult city electrical engineers only, and the rules made in conformity with urban conditions might bear very harshly on supply undertakings in small towns. The standardisation of voltages, frequency, &c., is also likely to be dealt with, and the position of unauthorised undertakers in small towns will have to be regularised. Mr. Handcock, who was formerly manager of the B.T.H. Co. for Ireland, but has severed that connection, desires to hear from engineers who are interested in the matter, with a view to the formation of a provisional committee as early as possible; the managers of several Irish undertakings have endorsed his proposals.

Irish Water Power.—The report on water power just issued by the Commissioner of Inquiry into the Resources and Industries of Ireland deals extensively with the power sites and the utilisation of the powers, and recommends that all water-power resources and rights should be vested in the State, that the State should establish a hydrometric survey which would be entrusted with specified duties; that the State should encourage sound water-power schemes by paying a bonus on every horse-power developed; that the State should exercise sufficient control over the development of water-powers to ensure that the proposed schemes are economic; and that all schemes should tend to give the best total output. It also recommends that, as far as possible, the current generated in hydro-electric stations should be of a standard type, and that the mineral resources of certain districts mentioned in the report should be fully investigated.

Wireless Apparatus Fraud.—On June 29th, at the Marylebone Police Court, William Parsons, dental mechanic, was sentenced to six months' imprisonment for obtaining money by fraud. Police witnesses stated that the defendant, under another name, advertised for sale "ten-guinea wireless sets for two guineas." Inquiries showed that he was apparently not in a position to supply any apparatus.

The Rutenberg Concession.—On Tuesday last, in the House of Commons, moving a reduction in the salary of the Colonial Secretary, Sir W. Joynson-Hicks urged that the contracts entered into by the High Commissioner for Palestine with Mr. Pinhas Rutenberg should be referred to a Select Committee for consideration and report. He declared that previous applications for concessions for electrical projects during and since the war had been rejected by the British Government, yet the electrical development of the whole country had been handed over to Rutenberg, and it was not provided that contracts for machinery should be placed in this country. He was not at all sure that the Rutenberg scheme was a good one; Sir Alexander Kennedy had said that the figures connected with electrical distribution, on which financial success depended, were absolutely childish, and could never have been put in honestly by anyone with any knowledge or experience. The inhabitants of Palestine were opposed to the handing over of the development of the country to Rutenberg. Lord E. Percy said that Sir W. Joynson-Hicks's case broke down if he could not show that there was a competitive offer. Sir J. Butcher drew attention to the long duration of the concession (70 years) and the power given to the High Commissioner to extend it indefinitely, as well as to authorise increased charges enabling a dividend of 8 per cent., tax-free, to be paid. Mr. Churchill, in reply, said that the rights of the Arab population must be safeguarded, and the Rutenberg scheme of irrigation and electrical power distribution would supply the means of creating new wealth and affording employment without doing injustice to any individual. The concession was framed in accordance with the Colonial Office procedure, and provided for strict Government control and limitation of the profits. The motion was rejected by 292 votes to 35.

At the annual convention of the Zionist Organisation of America, over a million dollars was promised for the scheme.

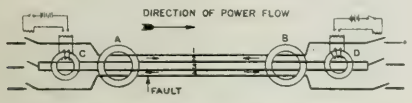
Workmen's Compensation.—In the Mayor's and City of London Court, on Monday, Albert H. Timcke, calenderman, of Canning Town, claimed compensation against the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., for injuries resulting from an accident that he met with on December 21st at its premises at Silvertown, while working at a machine. His left leg went down a hole in the concrete. Defendants had offered £100, which plaintiff accepted. The Court approved.

The Telegraph and Telephone Services.—The Postmaster-General announced in Parliament recently that Mr. R. A. Dalzell had been selected for the post of director of the telephone and telegraph services, and would take complete charge of both services.

"Arethusa" Night.—The ball which is to be held at the Hyde Park Hotel on Friday next, in aid of the Shaftesbury Homes and *Arethusa* Training Ship, has been favoured with the patronage of the Duke of York and Prince Henry, the Princess Louise, Duchess of Argyle, and Princess Helena Victoria, as well as many distinguished public men and women. Tickets can be obtained from the secretaries, 164, Shaftesbury Avenue, W.C.2, or Mr. H. H. Millett, 7, Brook Street, W.1, and it is hoped that there will be a large attendance, in view of the worthy object of the promoters.

The Ljungström Turbine Locomotive.—*Dagens Nyheter* learns that the tests in connection with the Ljungstrom turbine locomotive have been suspended for the time being. The results, as far as passenger express trains are concerned, were good; the locomotive also proved superior to ordinary types when pulling goods trains, but in order to increase this superiority the company is constructing a new turbine, which will be fitted to the same engine, and tests will be resumed in the autumn.—*Reuter's Trade Service* (Stockholm).

The Hunter Cable-protector System.—In connection with the protection of a.c. systems, a serious drawback, for economical reasons, to the installation of many systems is the necessity for the provision of pilot wires. Mr. R. W. Biles explains in the *Faraday House Journal* that Mr. P. V. Hunter, C.B.E., however, has produced a new scheme, the "Hunter Four-Core Pilotless Protection," which is a combination of the Merz-Price and split conductor systems, obtaining the advantages of the former without the use of pilot wires. As shown below, it requires a four-core cable, one



Hunter Four-Core Pilotless Protection.

phase of a three-phase cable being split; A and B are two balancing transformers; the two outer phase windings are in opposition to the centre or split-phase windings, and are also in opposition to each other, C and D are two split-conductor transformers with secondaries connected up through a trip circuit to the switch. Normally, superimposed voltages are produced in the splits by the balancing transformers which are opposing each other, and no current circulates. With a fault in the position shown on No. 4 outer, balancing transformer A produces a higher voltage than B, with a resultant circulating current in the splits Nos. 2 and 3. This affects split-conductor transformers C and D which operate the relay and open the switch at both ends. The centre phase is protected on the split-conductor principle, while the outer phases are protected on the Merz-Price system utilising the splits as pilot wires. The system operates for a fault to earth or between phases. With a good design the operating current is approximately 100 amperes on a 10-mile line for an earth fault on the outer, with "dead ended" feeder, which is the worst condition. It is more economical that the Merz-Price arrangement on lines above three miles in length, and than the split conductor method when above seven miles in length, and is essentially a cable-makers' solution of the problem. The system is most suitable for use on long-distance transmission lines, and the balancing transformers also have the inherent characteristic of acting as feeder reactances, which limit the short-circuit current. This apparatus is at present on trial and it is anticipated that extensive use will be made of it in future installations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. J. W. Meares, C.I.E., M.Inst.C.E., electrical adviser to the Government of India, and chief engineer to the Hydro-Electric Survey of India, leaves for England on August 26th. The post of Electrical Adviser will be abolished on the termination of his leave, and in the meantime the Department of Industries will carry it on. The post of Chief Engineer, Hydro-Electric Survey, will be abolished when Mr. Meares leaves India, and the Public Works Department will settle up any outstanding matters of correspondence.

As briefly announced in our issue of June 9th, Mr. Howard Marryat, M.I.E.E., M.I.Mech.E., has been elected the new president of the Electrical Contractors' Association. Mr. Marryat is a member of the firm of Messrs. Marryat & Place, electrical contractors, of 28, Hatton Garden, London, which was founded by him in 1891. At that time there were few provincial contractors, and the firm quickly obtained business in all parts of England and many places in Scotland, Ireland, France, and Belgium. As competition arose and grew, the firm devoted special attention to power installation work, and pioneered many advances in this department, especially in the electrification of printing works. In 1908 the firm purchased the goodwill, patents, patterns and drawings, and took over part of the premises and staff, of the old-established firm of engineers, Jas. Richmond & Co. Mr. Marryat is chairman of Marryat & Scott, Ltd., lift engineers, and of Dewhurst & Partners, Ltd., manufacturing engineers, which are closely associated with Marryat and Place. The united firms hold considerable property in the



Mr. Howard Marryat

The new President of the Electrical Contractors' Association

Hatton Garden district in which Mr. Marryat takes an active local interest. Mr. Marryat is an ardent mountaineer, while watch-making and collecting is his hobby.

The *Manchester Guardian* states that Mr. J. McElroy, who recently retired from the position of manager of the Manchester Corporation Tramways through ill-health, was presented by the staff on Saturday with an inscribed gold watch, and Mrs. McElroy with a gold brooch. Mr. Wood, the assistant manager, made the presentation. Mr. Mattinson, the new general manager, was present, and addressed the gathering. In the evening Mr. McElroy was entertained to dinner at the Queen's Hotel.

Mr. Chas. F. Wade is terminating his engagement with Messrs. Vickers, Ltd., as steam plant and fuel economy specialist, and is setting up in business privately at 171, Warminster Road, Norton Woodseats, Sheffield, to carry out work in connection with the efficiency of steam, furnace and producer plants.

Mr. George Stevenson, having received an appointment on the staff of the Chloride Electrical Storage Co., Ltd., has severed his connection with the British Thomson-Houston Co., Ltd., London.

The resignation of Mr. Harry Richardson, engineer and general manager of the Dundee Corporation Electricity Department has been accepted by the Town Council. Regret was expressed that the city should lose the services of such an efficient official, and a committee was appointed to look for a successor. Special consideration is to be given to men already in the employ of the department.

Mr. J. F. Cowan, the late secretary of the Cardiff Electricity Co., Ltd., has been awarded £5,000 compensation for the loss of his position upon the acquisition of the undertaking by the Corporation.

The marriage took place at Chorlton-cum-Hardy, on June 27th, of Mr. John Davidson Pratt, A.M.I.E.E., of Dundee, and Miss Doris May Walker, B.A., eldest daughter of Alderman and Mrs. Walker, of Chorlton-cum-Hardy.

On Tuesday last says the *Times*, Sir William Noble, who recently retired from the position of Engineer-in-Chief to the Post Office, was presented by the engineering staff with a gold watch and [illegible] pen, [illegible] ring, a set of silver spoons and forks and several books. The presentation was made by Major T. F. Purves, the new Engineer-in-Chief.

Mr. C. F. Jamieson has been appointed manager for Glasgow and district for the Chloride Electric Storage Co., Ltd. Mr. Allan C. Rogers has been appointed by the company to [illegible] for Newcastle and district. Offices and stock rooms are to be opened shortly in each of these cities.

Will.—The late Mr. James Mackay, [illegible] of Mackay, Sons & Co., Ltd., of Camden Street, left £178,415 gross.

NEW COMPANIES REGISTERED.

Chudleigh Electric Light and Power Co., Ltd. (182,694).

[illegible] Capital £100 [illegible] to carry on the business of electricity suppliers [illegible] purposes as defined by the Electric Lighting Act, 1882, [illegible] within the district of Devon, and [illegible] Solicitors: [illegible] Secretary: [illegible] Chudleigh, Devon.

Guy Chantrill & Co., Ltd. (182,779).—Private company. Registered June 27th. Capital, £2,000 in £1 shares. To adopt an agreement with Guy Chantrill, and to carry on the business of electricians, electrical engineers, machinists, fitters, founders, millwrights, wire drawers, tube makers, metal workers, and founders, &c. The first directors are: G. Chantrill, 7, Princes Park Avenue, N.W.11 (chairman and permanent director); L. A. [illegible] Hugo, W.14. Registered by F. S. Page, 104, High Holborn, W.C.1.

Robert Barron, Ltd. (182,766).—Private company. Registered June 28th. Capital, £10,000 in £1 shares. To acquire the business of an electrical engineer carried on by R. Barron at Albert Street, Fleetwood, as "R. Barron." The first directors are: J. A. Robertson, "Skerryvore," Cleveleys; M. R. J. Wedan, "Arne," The Esplanade, Fleetwood; R. Barron, "Elswick," Alfred Terrace, Fleetwood. Qualification: £500. Remuneration as fixed by the company. Secretary: T. L. Barron. Registered office: 39, Albert Street, Fleetwood.

F. Geere Howard, Ltd. (182,676).—Private company. Registered June 24th. Capital, £10,000 in £1 shares (8,000 10 per cent. cumulative preference and 2,000 ordinary). To take over the businesses of electrical engineers [illegible] 29, Berners Street, W., as "F. Geere Howard" and the "Electrical Sundries Co.," and to acquire all the issued shares of Wells, Reeves & Co., Ltd. To enter into [illegible] agreements with A. W. McClellan. The subscribers (each with one preference share) are: F. Geere Howard, 59, Berners Street, W., electrical engineer; A. W. McClellan, 56, Paddington Street, W.1, electrical engineer. The first directors are: F. Geere Howard, A. W. McClellan, and W. G. Dashwood. A. W. McClellan is permanent chairman and managing director, with £1,000 per annum as remuneration as managing director, free of income tax. Registered office: 59, Berners Street, W.

F. Yates & Son, Ltd. (182,799).—Private company. Registered June 30th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in all kinds of electrical, mechanical and scientific apparatus and fittings, mechanical, electrical, motor, gas, hydraulic, railway, marine, constructional, civil, consulting and general engineers, &c. The subscribers (each with one share) are: A. F. Yates, 20, Felsberg Road, Brixton Hill, S.W., timber merchant; H. S. Sheffield, 17, Finchley Road, N.W., accountant. The first directors are not named. Solicitor: M. Moseley, 20, Bucklersbury, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lord Howe Electrical Engineering Co., Ltd.—E. Vickers, of 13, Harrington Street, Liverpool, was appointed receiver and manager on June 23rd, 1922, under powers contained in debentures dated May 14th, 1914.

Todman, Ryall & Co., Ltd.—Issue on June 19th, 1922, of £250 debentures, part of a series already registered.

Cantie Switch Co., Ltd.—Satisfaction in full on May 31st, 1922, of mortgage debenture dated February 23rd, 1912, securing £700.

Creed & Co., Ltd.—Satisfaction to the extent of £7,000 on May 22nd, 1922, of debenture dated December 10th, 1920, securing £35,000.

Wrexham Motor and Electrical Engineering Co., Ltd. (4406).—Return dated December 31st, 1921 (filed March 18th, 1922). Capital, £5,000 in £1 shares. 1,428 shares taken up. £1,428 paid. Mortgages and charges, nil.

National Electric Construction Co., Ltd. (53,364).—Return dated May 11th, 1922. Capital, £125,000 in 10s. shares. 170,000 shares taken up. £75,374 10s. paid. £9,425 10s. considered as paid. Mortgages and charges, £75,000.

Isle of Thanet Electric Tramways and Lighting Co., Ltd. (49,978c).—Return dated January 24th, 1922. Capital, £300,000 in 30,000 preference and 30,000 ordinary shares of £5 each. All shares taken up. £150,000 paid on the preference. £150,000 considered as paid on the ordinary. Mortgages and charges, £204,300.

Melton Mowbray Electric Light Co., Ltd. (53,018).—Return dated April 12th, 1922. Capital, £25,000 in £5 shares. 4,000 shares taken up. £20,000 paid. Mortgages and charges, £19,100.

Waste Heat and Gas Electrical Generating Stations, Ltd. (91,738).—Return dated April 14th, 1922. Capital, £350,000 in £1 shares. 320,000 shares taken up. £320,000 paid. Mortgages and charges, nil.

P. R. Jackson & Co., Ltd. (35,232).—Return dated May 10th, 1922. Capital, £60,000 in £1 shares. All shares taken up. £1 per share called up on 11,410 and 8s. per share on 19,000. £17,110 paid. £42,890 considered as paid, being £1 per share on 29,590 and 14s. per share on 19,000. Mortgages and charges, £60,000 debentures (created in March, 1922, to pay off 60,000 preference shares, thereby reducing the capital from £120,000 to £60,000).

British Insulated & Helsby Cables, Ltd. (52,285).—Return dated April 10th, 1922. Capital, £2,000,000 in 500,000 preference, 1,000,000 ordinary, and 500,000 unissued shares of £1 each. All the preference and ordinary [illegible] taken up. £372,350 preference and 700,325 [illegible] £427,650 on 127,650 preference and 299,675 [illegible] £500,000.

Alderley and Wilmslow Electric Supply, Ltd. (47,663).—Return [illegible] May 30th, 1922. [illegible] £40,000 in 20,000 ordinary and 20,000 [illegible] £1 each. Issued [illegible] 10,000 preference shares [illegible] £20,000 [illegible] £15,000.

Scintillating Sign Co., Ltd.—Particulars of £10,000 debentures [illegible] November 21st, 1922, charged on the company's undertaking and property, including uncalled capital; present issue £3,160.

Cuba Submarine Telegraph Co., Ltd. (4,710c).—Return [illegible] May 17th, 1922. [illegible] £250,000 in 150,000 ordinary and 6,000 preference shares of £10 each. £250,000 paid. Mortgages and charges, nil.

London Platino-Brazilian Telegraph Co., Ltd. (12,093).—Return dated June 7th, 1922. Capital, £400,000 in £10 shares. 37,480 shares taken up. £374,800 considered as paid. Mortgages and charges, nil.

CITY NOTES.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on June 20th. Mr. P. D. Tuckett, who presided, said it was a great satisfaction to be able to present accounts showing so substantial an improvement, despite the coal strike and industrial depression. The improvement was due to an increased sale of lighting units and to the greater measure of freedom in the commercial conduct of the business for which they had been so long struggling. It was true that in 20 of their undertakings they were still hampered by the senseless restrictions imposed by the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, but the injustice and absurdity of those restrictions were now so generally recognised that he thought they might expect to secure their removal at a comparatively early date. They had already lodged applications with the Electricity Commissioners with this object in view, and the Electricity (Supply) Bill now before Parliament also provided machinery for the purpose. In the profit and loss account the gross trading profit showed a drop of £2,600. The present outlook was a little more encouraging, but the large reduction in "work in progress" reflected only too clearly the conditions which had recently prevailed. During the year they had taken an interest in the Tisbury Electric Supply Co., the Whitchurch & Pangbourne Electric Supply Co., and the undertaking at Southwold. The last two undertakings were small concerns, which had been established for some years and had got into difficulties, with the result that they were able to acquire the Southwold undertaking on very favourable terms, whilst the Whitchurch Co. very wisely gave them a half interest in their undertaking in return for their assuming responsibility for its management. Both undertakings were now doing quite well, and promised to be highly successful. Tisbury was a new undertaking near Salisbury, which had been established under their advice and management, a large part of the capital having been found locally. Within the next few years a number of the smaller towns throughout the country were likely to embark on electric lighting schemes, and provided they were undertaken with a knowledge and experience of the inherent difficulties, such as the company possessed in a unique degree, there was no reason why they should not be undertaken successfully, particularly where water-power was available. With the balance of £14,143 brought in, the available profit was £45,512, which they proposed to apply in paying two years' dividend on the cumulative preference shares, thereby wiping out the arrears, and 3 per cent. on the non-cumulative preference shares, leaving £15,512 to be carried forward. He need not tell them that it was as great a satisfaction to the board as it must be to the shareholders, to have at last come within sight of an ordinary dividend; and he hoped they might accordingly feel justified in resuming the half-yearly payment of the cumulative preference dividend, and possibly also in making an interim distribution on the non cumulative preference shares. He made no definite promise, but the present outlook certainly warranted their entertaining such a hope. The balance sheet disclosed a most gratifying improvement in the company's financial position. They had now been able, not only to pay off all but £18,900 of the £75,000 note issue, but also to accumulate £100,000 liquid assets. There was a reduction of £150,000 in the item of investments and advances and the "amount written off" therefrom, which for some years had stood at £329,148, was this year reduced by £66,506 to £262,642. The speaker proceeded to explain how those changes had been brought about. Continuing, he said that, excluding the Lancashire Power Co., their connections and capital expenditure during the year were only half what they were during the previous year. With the paralysing influence of the Statutory Undertakings (Temporary Increase of Charges) Act overhanging so many of their undertakings there could obviously be no great inducement to sink further capital in pushing the development of the business, but the general industrial depression would, in any event, have resulted in less active development. Most of the undertakings showed substantially improved results, and the dividends and interest paid on their investments and advances exceeded the previous year's figure by £7,865, although the total amount of such investments and advances was reduced by £150,000, as he had already explained. Including their large holding in the Urban Co., they were still without any return on £305,000 of ordinary share holdings, but the anticipated removal of the statutory limitation of dividends under the Act should enable several of their sub-companies to make increased distributions. Falling costs should also help to produce improved results this year, for last year they derived only a trifling advantage from the fall in wages and the reduced price of coal, their wages and fuel costs still exceeding those for 1914 by nearly £230,000. The cancellation of the prior lien debenture stock would save them £2,500 this year and in future, since they would be relieved of the obligation to set aside the £1,000 prior lien redemp-

tion provision and to pay an extra ½ per cent. interest on the first mortgage debenture stock. The recent engineering lock-out had seriously inconvenienced them by postponing the delivery of urgently needed plant, but the prospects for the current year were distinctly encouraging. There was a rapidly-growing appreciation of the advantages of electricity, and they consequently looked forward to a steady expansion of the business, if only they were allowed a reasonable measure of freedom in its conduct. During the last few years they had had little inducement to sink further capital in the business, hampered as they had been by impossible conditions, but he was thankful to feel that they now had in the Electricity Commissioners a body of men with some knowledge of the needs of the industry, on whom he hoped they might rely to stand between them and Parliament, which had never understood those needs, and had therefore almost invariably sacrificed the welfare of the industry in its efforts to promote it. It would ill serve the real interests of their consumers if they were to involve themselves in fresh embarrassments by reducing their prices prematurely. Before long, however, with improving conditions, they looked forward to being in a position to make some reduction. During the past twelve years, by carefully nursing and strengthening the resources of their sub-companies, they had been able to more than double the business without increasing their own capital liabilities, whilst the prudent and conservative policy which they had pursued in dealing with the accounts had produced the present greatly improved financial position.

Mr. A. A. Campbell Swinton, F.R.S., seconded the motion, which was adopted unanimously.

Crompton and Co., Ltd.

The net profit for the year ended March, 1922, after providing for depreciation, interest on debentures, directors' fees, &c., was £35,828, plus £18,370 brought forward, making £54,198. Deducting the interim dividend on the preference shares paid in January, £4,886, the available balance is £49,313. It is proposed to pay a dividend of 3½ per cent. on the preference shares, making 7 per cent. for the year (requiring £4,890), to pay a dividend of 5 per cent. per annum on the ordinary shares, £16,338, to put to reserve for future taxation £10,000, and to carry forward £18,084.

For 1920 the net profit was £66,292, and the dividend paid on the ordinary shares was 10 per cent. per annum.

The annual meeting was held yesterday (Thursday).

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—

City & South London Railway.—£1,500,000 4½ per cent. redeemable second debenture stock, 1942-72, issued at 94 per cent., partly paid and fully paid.

London Electric Railway.—£1,000,000 4½ per cent. redeemable second debenture stock, 1942-72, issued at 94 per cent., partly paid and fully paid.

Application has been made to the Exchange Committee to allow the following to be officially quoted:—

Northern Mexico Power & Development Co.—100,000 common shares of $100 each; and 30,000 7 per cent. cumulative preference shares of $100 each.

Waygood-Otis, Ltd.

At the annual meeting on June 27th, Mr. H. C. Walker said that in view of the prevailing trade depression the results were satisfactory. The company had secured a number of important contracts, including orders for five lifts at the new County Hall, and sixteen for Messrs. Bourne & Hollingsworth. Design had been improved, and several orders had been placed for the latest type of patent micro self-levelling lifts. The accounts disclosed a strong financial position, but they also indicated a reduction in the amount of business. Relations between the company and its employés continued harmoniously.

Lisbon Electric Tramways, Ltd.

The annual meeting was held in London on June 28th. Mr. Ludwig Breitmeyer, who presided, said that the unsatisfactory conditions of the year 1920 had continued, but with less severity, during the year under review, the loss on working being only £440, as compared with £84,100 in 1920. The receipts showed a substantial increase, having shown the full benefit of the fare increases put into operation at the end of the previous year. On the other hand expenditure also increased. In the previous year the company arranged with the Government to run for a trial period of two months, at the end of which the books would be inspected by a Commission, which would adjudicate upon the question of fare increases. As a result the Commission strongly recommended that some means should be found to increase the receipts. Subsequently, in January of the current year, another strike was declared, and the Government granted a further increase of wages to the employés, and to meet this, imposed a tax of 30 reis per ticket on all tickets. The company protested against this arbitrary measure, but nevertheless carried it out in order to show its conciliatory spirit in smoothing over all difficulties. A further strike occurred in the following month, brought about by the dismissal of two employés who assaulted two of the principal officials. The Government saw that something must be done to put an end to the [illegible] created by these frequent disturbances, and [illegible] inaugurated a restricted service under military protection, [illegible] it was possible to resume normal operations in April, when the Camara had agreed to an increase and re-arrangement of the fares. A commission, consisting of [illegible] representatives and two members representing the company, had been formed; to this Commission all disputes as to future adjustments of tariffs were to be referred.

After providing for the interest and amortisation of the debentures of the Cia. Carris de Ferro de Lisboa, and the interest and redemption of the company's debentures, together with the London expenses, a loss for the year of £29,184 was shown. This, with the debit balance brought forward, left a total deficit of £48,455 to be carried forward.

The chairman hoped that by the next meeting Portugal would have "turned the corner" of its adversity, with beneficial results to the company.

Altrincham Electric Supply, Ltd.

After providing for debenture interest and redemption, the profit for 1921 was £7,77[illegible], plus £1,[illegible] brought forward. After meeting directors' fees for 1920, and preference dividend, putting £500 to depreciation, and paying 7½ per cent. for the year on the ordinary shares, £500 is written off expenses of ordinary share issue, and £726 is carried forward. Unsettled labour and industrial conditions adversely affected the company's profits. During the coal strike all the works to which the company supplied power restricted their consumption by at least 50 per cent., whilst many were partially closed down. At the same time, the company was forced to purchase inferior British coal and foreign coal, both at exceedingly high prices. These conditions largely reduced the amount of energy sold and at the same time increased working costs. Considerable and unavoidable delays took place in the erection of the additional water tube boiler and the new coal handling plant. The former of these, however, has been in operation for some little time, but the erection of the latter was not completed until after the period covered by the accounts; appreciable economies will be affected in coal handling from now onwards. The profits will not permit of any dividend upon the deferred shares. The consumers continue to increase, and, but for the abnormal conditions referred to, very satisfactory results from the year's working would have been reported. Loans have been obtained from the company's bankers to meet the increased capital expenditure referred to, and it is necessary that further capital should be provided for the purpose of repayment and for expenditure necessitated by the general expansion of the company's business, and in due course particulars of the directors' proposals will be laid before the shareholders.

South Wales Electrical Power Distribution Co.

The annual meeting was held at Cardiff on June 30th, Mr. W. Foster Brown presiding. The chairman, in moving the adoption of the report and accounts, expressed the regret of the directors that Mr. W. Gascoyne Dalziel, who had been chairman of the company for 15 years, had found it necessary to resign the chairmanship. They were glad, however, that Mr. Dalziel had found it possible to retain his seat on the board. During the year 7,440 preference shares had been issued to the Treforest Electrical Consumers' Co., Ltd., and further shares would be issued to it from time to time in consideration of the shareholders in that company providing a large amount of additional capital for the purpose of installing further generating and other plant, which was urgently required. The original arrangement, made in 1906 with the Treforest Co. was that for the capital provided by its shareholders (who were also the principal users of that company's electrical supply) it received an equal amount of 5 per cent. prior lien debenture stock. It was found impossible, however, under the financial conditions prevailing after the war, to raise the capital required on the 5 per cent. secured by that stock alone, and it was, therefore, decided, after prolonged negotiations, to issue to the Treforest Co. 5 per cent. preference shares in the nature of a bonus equal to the amount of capital already provided, and to be provided, by the shareholders of that company. These preference shares were simply interest-bearing shares, and did not carry any right to participate in the assets of the company, nor any voting power. The net result of the company's working during last year was to reduce the balance of £4,416 brought into the accounts from the previous year by £763. After payment of all expenses, there was a credit balance of £35,294, which, with the £4,416 brought forward, made £39,710. Deducting the payment of interest on the prior lien debenture stock and the ordinary debenture stock, including £4,468 on the further stock issued in satisfaction of deferred warrants, and placing £11,169 to depreciation of new plant account, there was a balance of £3,653 to be carried forward into 1922. The past year had been one of considerable difficulty. The coal stoppage very materially curtailed the demand for electrical energy from the company's power station at Treforest, but it was a matter for congratulation that it was able during the period of the strike to supply the power required by consumers for such essential work as pumping and ventilating

at the collieries. The plant at the company's works had been running continuously for many years, and often during the war period under conditions of stress which it was not possible to avoid. This culminated last year in trouble with the machinery, and the joint effect of this and the coal stoppage had been to reduce the output for 1921 by 10,510,549 units as compared with the previous year. It was satisfactory, however, that the demand upon the company's power station continued to extend. In 1906, when the company made its first agreement with the Treforest Co., the number of units sold per annum was between nine and ten millions. By 1920 the units sold had risen to 57 millions, and the gross annual revenue increased from £28,000 to about £300,000 during the same period. To meet the continued expansion of the company's business, it had been necessary to make provision for the largely increasing capacity of the generating plant at the Treforest power station, and orders had been placed for a 15,000-kW steam turbine set of the most modern design with necessary accessories, the need for which had been seriously and increasingly felt for some time past. During the year an additional 4,600 h.p. had been connected to the mains, bringing the total to 65,500 h.p. Under the provision of the agreement with the Treforest Consumers' Co., the latter undertook to find capital not exceeding £400,000 in exchange for an equivalent amount of 5 per cent. prior lien debenture stock, and also undertook that, after the new plant on order was running fully loaded, it would provide not less than £3,000 per annum for division among the ordinary shareholders of the South Wales Co. before it would have power to reduce the price charged to consumers. Continuing, the chairman stated that the company now had a Bill before Parliament, the first of the two principal provisions of which was a reduction in the ordinary share capital from £610,120 to £152,530. At the inception of the company a large capital outlay was incurred in obtaining statutory powers, establishing electric power stations at several centres in South Wales, and in laying many miles of mains in the district to be supplied. It was found, however, that the demand for electric power in those days was not commensurate with the outlay which had been incurred, and the company found itself in low water. Certain of the power stations were sold at considerable capital loss. Meanwhile the original capital had been upheld in the balance sheet, with the result that the figures were not fully represented by assets. After the Bill in the present session of Parliament had passed, it would be possible to present a balance sheet in which the figures were well represented by actual assets, and which would more clearly indicate the substantial progress which the company was making. It was now able to pay its prior lien debenture and ordinary debenture interest, and had a good prospect, when the expansion and economy to be derived from the new plant now on order was realised, of paying dividends upon the non-cumulative preference and revised ordinary share capital of the company. The second principal provision of the Bill in Parliament was to give powers to local authorities to invest capital in the company's undertaking. The directors looked forward with confidence to the future. With the much-improved earning capacity of the undertaking, the opportunity which existed for further considerable developments in the district for the future, and with a properly adjusted balance sheet, it ought to be possible to obtain the necessary capital for further development when required.

The report and accounts were adopted, and the retiring directors, Mr. W. Foster Brown, and Mr. Charles O'Callaghan, were re-elected.

Submersible Motors, Ltd.

The profit and loss account for the year 1921 shows that the loss was £26,501, from which has to be deducted £8,997, leaving a net debtor balance on profit and loss account of £17,504. Liability for excess profits duty has not yet been settled, but it is estimated that the amount reserved, *viz.*, £22,500, will be sufficient to cover excess profits duty to the end of the final accounting period, September 30th, 1920, and income tax to date. The directors regret that the company, in common with the whole of the engineering industry throughout the country, has been adversely affected by depression. The position was aggravated by the coal strike and the founders' strike. At the termination of the war the Admiralty was possessed of considerable quantities of their submersible pumps. These were handed over to the Disposal Board, which has been offering them at extremely low prices. Until these are all disposed of, the company's sales will continue to be affected. Submersible motor pumps have been installed in several coal mines, with satisfactory results, and the directors are looking forward to increased business in this direction.—*Financier.*

The French Thomson-Houston Co.

The report of the *Compagnie Française pour l'Exploitation des Procédés Thomson-Houston* states that the gross profits, which reached 33,850,000 fr. in 1920, rose to 35,435,000 fr. last year. After having deducted normal depreciation, general expenses, and interest service of the loans, there remains 23,592,000 fr., as against 229,000,000 fr. in 1920. It has been decided to devote a further sum of 3,512,000 fr. to depreciation, and pay a dividend at the rate of 45 fr. per share, as in the preceding year. These results are considered to be favourable, having regard to the continued existence of the crisis and the considerable fall in prices. The report states that the requirements of the distributing companies and the railways principally apply to large electrical machinery, and the chief efforts of the company are devoted to this work. During the year the works at Saint-Ouen, and the new installations at Colombes, were brought into operation. With the assistance of the information furnished by the United States General Electric Co. in the matter of the construction of high-voltage machines, it had been possible in the finishing and insulation of the machines to obtain results which had never previously been achieved in France. The report reviews the developments which took place at the other works belonging to the company, and foresees a great expansion in the telephone service, principally through the contemplated substitution of automatic for the manual exchange system. At the annual meeting on June 22nd, the chairman mentioned that the value of the orders on the books was 237,500,000 fr., as compared with 175,000,000 fr. at the beginning of June, 1921.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

In a circular letter, signed by the Secretary, and issued to shareholders, under date June 17th, the present position of the company is reviewed. The directors state that since the beginning of the financial year, which started badly owing to the adverse trade conditions at home and abroad, they have arranged a sliding scale of wages with the employés, dependent on the cost of living, and on a base mutually satisfactory to both parties, which they hope and believe will have the effect of reducing and possibly eliminating the labour disputes which have stood in the way of the recovery to a healthy condition of trade. The letter continues:—

"In addition to the decided improvement in our labour conditions, we are feeling the great advantages of an improved costing system which has been established at the works, and are now in a better position to deal with the many questions which arise in this connection. The engineers' dispute, which appears to be nearing a settlement, has affected us indirectly inasmuch as the shutting down of the various engineering works throughout the country means less consumption of our manufactured goods. The tire trade shows little signs of improvement, but the golf ball business continues to increase. We have also obtained an order for a considerable length of submarine cable, and our new gutta percha core, on account of its smaller cost, encourages the hope that we may regain our share in this particular branch of industry. Our Persan works have a good number of orders on hand, and should show an improvement on last year. The Burton factory is increasing its output; and, as a result of their reorganisation, our foreign branches are more favourably placed for business. As the year started badly, though there are now indications of improvement, it is impossible to foretell the result of the year's trading until the stocks are valued and the accounts are made up. For this reason your Board regret that they are unable to recommend the payment of an interim dividend on the ordinary shares. With regard to finance, the Revenue Authorities are now taking steps in the direction of assessing our Excess Profits Duty refund. The French revenue questions, alluded to in the chairman's speech at the last annual meeting, are still under discussion. We hope further to ease the cash position by the realisation of some of our floating assets. It is satisfactory to report that the company was awarded first prize in an international competition for a safety petrol tank for aeroplanes. The tank proved successful against incendiary bullets, and against the outbreak of fire caused by the concussion of a crash. It should not only prove indispensable for aeroplanes, but should be in demand for motor vehicles, in which collision makes the occupants liable to a most terrible death."

The half-yearly dividend on the preference shares was payable on July 1st.

French Companies.

All the companies working under concessions in Paris—lighting, tramways, and railways—have derived financial advantages from the modified or supplementary conventions concluded with the Municipal Council of Paris last year, which were brought into force as from the beginning of 1921. A summary of the results is given below:—

The accounts of the *Compagnie Parisienne de Distribution d'Electricité* for 1921, which have been prepared on the basis of the new convention with the City of Paris, show net profits of 20,646,000 fr., and it is proposed to pay a dividend at the rate of 35 fr. per share. In 1920 the company incurred a large loss, but contributions from the special account represented a credit balance of 4,210,000 fr., and a dividend at the rate of 12.50 fr. was paid.

The *Compagnie du Chemin de Fer Nord-Sud*, whose accounts for 1921 are based upon the new convention with the City of Paris, records net profits of 4,824,000 fr., permitting of the payment of a dividend at the rate of 13 fr. per share. This compares with 10 fr. or 4 per cent. in 1920.

The *Compagnie Metropolitain de Paris*, under the new convention with the City of Paris, reports net profits of 14,482,000 fr. for 1921, and a dividend at the rate of 28 fr. per ordinary share. During the year a further length of line was brought into service, thus increasing the mileage worked to 50, while 23 miles of line have yet to be brought into use under the concession.

The *Compagnie des Transports en Commun de la Region Parisienne*, which is the lessee company of the various surface transport undertakings which were expropriated by the City of Paris in conjunction with the General Council of the Seine Département, reports net profits of 5,275,000 fr. for 1921. It is proposed to pay a dividend at the rate of 6 per cent. (30 fr.) on the share capital, which rate is guaranteed under the agreement with the municipal council, and a supplementary rate of 9.75 fr. per share, the latter resulting from the premium earned for economy in working the combination.

The *Société Francaise Radio-Electrique* states that the results obtained in 1921 were very satisfactory. The machines and apparatus produced by the company were meeting with increasing appreciation not only in France but also in most other countries. After having applied 1,624,000 fr. to depreciation out of gross profits of 3,623,000 fr., the balance has permitted of the payment of a dividend at the rate of 25 fr. per share.

The *Compagnie de Locations Electriques* reports that the development of the hiring out of installations and of the branch forming the very base of the company continued satisfactory. The high and low pressure networks for the Agricultural Electrical Co-operative Society would soon be completed. The ordinary shares are to receive a rate of 4 per cent. out of the net profits of 181,000 fr. for 1921.

German Companies.

The *United Aluminium Works Co.*, of Lautawerk, in which are incorporated the aluminium works of Lauta and Horrem, belonging to the German State, report net profits of 8,980,000 marks for 1921.

The report of the *Robert Bosch Co.*, of Stuttgart, states that the turnover in lighting installations and lubricators increased in 1921, but the sales of ignition apparatus declined. Including the balance forward the accounts indicate net profits of 16,003,000 marks, as compared with 6,932,000 marks in 1920, and the dividend rises from 10 per cent. in the latter year, to 25 per cent for 1921.

The *Dr. Paul Meyer Co.*, of Berlin, reports that the turnover in 1921 again experienced a considerable increase. After having made provision for depreciation, the accounts show net profits of 6,535,000 marks, as compared with 1,739,000 marks in 1920, and the dividend is raised from 12 per cent. in the latter year to 15 per cent. for 1921.

The report of the *C. Lorenz Co.*, of Berlin, states that both the volume and value of the orders booked and the turnover in 1921 were considerably greater than in the preceding year. After setting aside 3,000,000 marks for works' maintenance and writing off 2,015,000 marks for depreciation, as against 2,709,000 marks in 1920, the accounts show net profits of 6,241,000 marks, as compared with 2,742,000 marks in 1920. It is proposed to pay a dividend at the rate of 35 per cent. (25 in 1920) on the old shares and 17½ per cent. on the new capital.

The report of the *Felten & Guilleaume Co.*, of Cologne-Mulheim, states that 1921 was quite a satisfactory year. At the end of the third quarter the market became very active, as after several months of great reserve, both inland and foreign customers proceeded to make new purchases, principally in the iron and steel departments, so that almost as many orders had to be declined as accepted—a state of affairs which continued until recently. The cable business was fairly uniform, and was mainly limited to the home market. With approximately the same number of workmen and staff, the output was increased, but the value of the turnover decreased owing to the lower cost price of raw materials and the small profits. The gross profits rose from 74,445,000 marks in 1920 to 154,546,000 marks last year, and the net profits and balance forward from 25,992,000 to 48,050,000 marks, permitting of the payment of a dividend of 25 per cent., as compared with 20 per cent. in 1920. The report further states that the undertaking of the North German Cable Works Co., of Nordenheim, is now entirely owned by the company, which has also regained control over the Felten & Guilleaume Co., of Vienna.

The *North German Marine Cable Works Co.* reports net profits of 2,070,000 marks for 1921, as compared with 970,000 marks in the previous year. It is proposed to pay a dividend at the rate of 5 per cent., this being the first distribution for some years past.

Bergmann's Elektricitätswerke, in Berlin.—With reference to this company's report for 1921, which was summarised in our issue of May 26th (p. 745), there was a net profit of 20,070,000 marks. The machine department, in particular, was replete with orders. Among others, the company had received orders for big generators for the Walchensee installation. Some commissions received from the State Railway Department for express locomotives for the Silesian mountain districts had been executed. The share capital is to be increased by a further issue of 65,000,000 marks to 165,000,000 marks.

The directors of *Brown, Boveri & Co.*, of Mannheim, recommend an increase in the rate of dividend from 10 per cent. in 1920 to 15 per cent. for last year.

The *Korting Electricity Works Co.*, of Berlin, reports net profits of 2,500,000 marks for 1921, as compared with 2,850,000 marks in the previous year, and the directors recommend a dividend and bonus at the rate of 50 per cent., as in 1920.

The *Continental Co. for Electrical Undertakings*, of Nuremberg, reports net profits of 2,858,000 marks for 1921, as contrasted with 1,759,000 marks in the preceding year. The dividend, which was at the rate of 5 per cent. for 1920, is increased to 8 per cent. for the past year.

The *Electra Co.*, of Dresden, after having written off 406,000 marks for depreciation, reports net profits of 2,195,000 marks for 1921, as against 726,000 marks in the previous year. It is proposed to pay a dividend at the rate of 10 per cent., as compared with 6 per cent in 1920.

The *German Transmarine Electricity Co.*, of Berlin, whose South American undertakings were sold some time ago to the Compania Hispano-Americana, of Madrid, reports a loss of 17,821,000 marks for 1921, which is entirely due to losses on exchange in connection with the redemption of the company's pound sterling debentures, which took place at the end of last December.

The accounts of the *Electricity Co.* (late *Lahmeyer*), of Frankfort-on-Main, record gross profits of 13,391,000 marks in 1921, as against 9,802,000 marks in the preceding year, the net profits being 6,525,000 and 4,388,000 marks in the two years respectively. It is intended to pay a dividend at the rate of 12 per cent., or 2 per cent. higher than in 1920.

The report states that the favourable results were due to the additional profits realised by most of the subsidiary companies, to larger receipts from interest, and to the profits arising from the constructional work carried out in connection with associated companies. Among the works now in course of execution are mentioned a new steam power station near Heilbronn for the Wurtemburg Power Co., and provisionally for 10,000 kW, and a 10,000-volt line for the Laufenburg power works, and a similar line for the Lech Electricity Works. The net profits in 1921 were 6,525,000 marks, as contrasted with 4,388,000 marks in the preceding year.

Lima Light, Power and Tramways Co.—The profit for 1921 was £P215,020; less bond service, £P17,057; bond amortisation during 1921, £P53,387; European expenses, £P2,232; interest and discounts, £P27,898; loss on exchange, £P39,742; provision for bad and doubtful debts, £P3,000; depreciation of investments, £P33,968; leaving £P7,733, plus balance brought forward, £P95,091, making £P102,825. This amount the board proposes to transfer to general amortisation and reserve fund.

Metropolitan-Vickers Electrical Co., Ltd.—According to the financial Press, the directors announce that it is their intention to increase the sinking fund for the redemption of the six per cent. prior lien debentures by setting aside this year the additional sum of £131,233, and that the whole of the above-mentioned debentures will be paid off at par on January 1st, 1923.

Fellows Magneto Co., Ltd.—Owing to the serious depression in the motor trade, no profit was earned during 1921. There has been a great fall in stock values, and the loss for the year is returned at £49,009. The debit balance to carry forward is £10,424. Since the beginning of 1922 sales have improved, and at the date of the report the monthly totals of magnetos sold exceeded any in 1921, and though export trade is practically non-existent they are now rapidly approaching the sales of the boom period of 1920. No dividends are recommended.

Vickers, Ltd.—The directors have declared a dividend for 1921 at the rate of 5 per cent. per annum, less tax at 6s in the pound, on the ordinary shares. No ordinary dividend was paid for 1920.

Notting Hill Electric Lighting Co., Ltd. According to a financial paper, the directors announce an interim dividend of 4s. per share, free of tax, on the deferred shares.

Spanish Telephone Co.—The *Financier* states that a dividend of 5 per cent., less tax, is recommended. The net revenue was £2,372. £1,000 has been put to reserve.

Bell Telephone Co. of Canada.—Quarterly dividend of 2 per cent., less income tax.

Anglo-American Telegraph Co., Ltd. Interim dividend for the quarter ended June 30th of 12s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less tax.

General Electric Co., Ltd.—As we go to press it is announced that the dividend on the ordinary shares for 1921 is to be at the rate of 5 per cent. per annum, less tax, as compared with 10 per cent., free of tax, for the previous year.

Chile Telephone Co., Ltd. Final dividend of 3s. per share, free of tax, for the half year ended March 1922.

STOCKS AND SHARES.

TUESDAY EVENING.

There is a good deal of business in a number of the Stock Exchange markets. Even brokers in industrials are inclined to complain that they are being neglected owing to the favour shown to gilt-edged investments. Nevertheless, the speculative and semi-speculative stocks are by no means out of the picture. Substantial rises in Metropolitan Railway ordinary and in Districts illustrate the willingness of the public to take a hand in speculative markets. Weakness overtook General Electrics, on the expectation that the dividends will be reduced. Readers of these weekly letters will certainly not be amongst those who are likely to experience surprise at a cut in the company's 10 per cent. dividend record.

Although the Bank Rate remained last Thursday at 3½ per cent., this was comfortably concluded as being due to the fact that the Bank Court might decline to lower the Rate during the last week of the half-year, but that they might be willing to put it down on the first Thursday in July. Consequently, there has been a good deal of pleasurable anticipation of a fall to 3 per cent. this week. Hence the strength displayed by gilt-edged stocks of all descriptions. The recent issue of 4½ per cent. second debenture stock by the City & South London Railway and the London Electric Railway appeared none too successful, as compared with the prompt over-subscription secured by a good many other newcomers earlier this year. As soon as the allotments came out, however, and the first lot of stags had been disposed of, the prices for both stocks advanced sharply to 1 premium. There is not much advantage to be obtained by the purchase of partly-paid scrip, and a good many people have bought the fully-paid scrip at about 94¼. With a plentiful supply of stock on offer to meet the demand, the market is quite a good one, and while money remains cheap, there can be little doubt as to the quotation steadily advancing—possibly to the neighbourhood of 100. Having regard to the prices of Victory Bonds, the Funding Loan and other Government issues, the prophecy is not so optimistic as, on its face, it may appear.

The Metropolitan Railway dividend is expected within the next week or so, and keen curiosity awaits its announcement. A year ago, the rate was 1¼ per cent. per annum, and for the three previous years 1 per cent. was paid. The full dividend for 1921 was made up to 2½ per cent. Some profess to look for a substantially better dividend this year. The District Company has paid no interim dividend for about forty years, so that, if anything is distributed in respect of the past six months, it will be something of an event. The Underground Railways are said to be doing well, and the decided dash of speculation about the stocks renders them attractive to a fairly wide circle of people who do not mind putting them away as more or less permanent investments in the hope of the future bringing handsome profits through capital appreciation. The interim dividend on Underground Income Bonds, it may be mentioned, was at the rate of 4 per cent. a year ago, this being also the dividend paid for the full twelve months. Districts have risen 5½ to 39, and Metropolitans a couple of points to 47.

The fall in Marconis was arrested by a little support, but the market remains nervous and timid. With the dividend declaration so close at hand, remembrance recalls the disappointment caused by the announcement of a year ago, and in view of possible disappointment this time, a good many people have been selling their shares. The price has dropped from its recent best level of 2 13/16 to 10s. lower, and Marconi Marines have given way to 1 7/16; in Radios there is nothing doing.

Electricity Supply shares are a good market. London Electric preference strengthened to 5. Hendon 6 per cent. preference are not offered under 5 1/16, and, even at this price, the supply is very limited. Metropolitan preference have recovered the dividend of 2s. 3d. less tax, deducted from the price last week. No market effect followed the consideration, by the Standing Committee of the House of Commons, of the Government's Electricity Supply Bill. As is well known, the Bill is intended to be a supplement to the Act of 1919. In the foreign group, Shanghai Electric Construction shares fell 10s. to 18½. The newly-issued Indian scrip stocks are better. Calcutta 7 per cent. second debentures rose to 3 premium. Madras 7 per cent. and Indian 5 per cent. (tax free)) debentures hardened to 10s. premium and 5s. premium respectively; both had been down to "par," *i.e.*, the issue prices of 94 and 95.

Cable stocks are steady. Eastern ordinary is down 1, but Globe ordinary recovered 5s. dividend; the preference at 11¼ are also xd. Anglo-American preferred is better at 104. Falls of 1/16 occurred in Oriental Telephone and United River Plate Telephone. Siemens 4½ per cent. debenture is now quoted 89 xd. The shares are easier at 26s. 3d.

General Electric ordinary dipped sharply to 17s. 6d., a fall of 2s. 9d., rallying to 18s. on a little support. The dividend is expected to be 5 per cent., but will be officially declared before this paper is published. It has been plainly hinted here that the company could not be expected to maintain its previous 10 per cent. tax-free dividend. Five per cent., less tax, is, however, a heavy reduction, and this is reflected in the drop in the price of the shares. Several factors combined to bring about a material shrinkage of profits. The coal strike and the necessity for writing down stocks have no doubt contributed largely to the result. Both classes of preference shares—the 6½ per cent. "A" and the 7½ per cent. "B"—are marked down to 22s. 3d. Edison 4 per cent. debenture at 64 xd. is rather firmer. Electric Constructions eased off to 25s. British Aluminiums are 6d. down at 18s. 3d.

Vickers created a surprise by declaring a 5 per cent. dividend, and the shares rose from 12s. 3d. to 14s. 3d. amid lively excitement in the Stock Exchange. Market gossip said that six or seven thousand shares had been bought, on the previous business day, from the provinces. If so, it may have been profit-taking which caused a setback to 13s. 9d.; the 5 per cent. tax-free preference rose from 14s. 3d. to 17s. 6d., relapsing to 16s. 9d. later. Metropolitan-Vickers are unchanged. Babcock & Wilcox remain at 3.

Mexicans are falling back for want of news concerning a settlement. The Utility issues, however, exhibit no particular movement. Brazilian Tractions shed a point. Anglo-Argentine Tramways 5 per cent. debenture stock rose 1½ to 81½. British Electric Traction ordinary declined to 51½ on the appearance of a small seller.

The rubber share market, galvanised into sudden life by the hope that the Dutch Government would introduce compulsory restriction of output in the Netherlands East Indies, sank back into dulness on the recognition of the fact that this may take a long time to carry into effect. Other industrials are somewhat dull, the public attention being more occupied with the best-class stocks. Victoria Falls ordinary rose to 13s. and the preference to 23s., in sympathy with a mild boomlet in South African mining shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price July 4 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	6½	—	6 11 0
do. do. do. 4½ Pref.	4½	4½	3¾	—	5 16 2
Chelsea	6	6	5⅝	—	5 6 8
City of London	14	14	38/9	—	7 4 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1⅛	—	6 2 0
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 13 0
Kensington Ordinary	9	10	7⅛	—	7 0 7
London Electric	2½	4	2⅛	—	5 17 8
do. do. 5 per cent. Pref.	6	6	5	+ ½	6 0 0
Metropolitan	7	7	6⅝	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	32½xd	+1/6	6 0 0
St. James' and Pall Mall	12	12	8½	—	7 1 2
South London	7	7	3½	—	8 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅜	—	6 15 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	104	+ ½	5 15 5
do. Def.	1½	34/6	23⅝	—	7 6 0
Chile Telephone	6	6	6⅛	—	4 15 1
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	18⅝	+ ⅛	5 7 5
Eastern Tel. Ord.	10	10	187/8	—1	5 6 8
Globe Tel. and T. Ord.	10	10	19xd	+ ½	5 5 3
do. do. Pref.	6	6	11xd	—	5 9 1
Great Northern Tel.	24	22	28½xd	—	7 14 4
Indo-European	10	10	37½	—	6 3 5
Marconi	25	15	2⅛	— 1/16	6 9 10
Oriental Telephone Ord.	12	12	2⅜	— 1/16	*5 1 4
United R. Plate Tel.	8	8	7⅞	—	*5 11 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18½	—	*5 8 0
HOME RAILS.					
Central London Ord. Assented	4	4	88	—	5 17 8
Metropolitan	1½	2½	47	+2	4 15 9
do. District	Nil	1	35	+8½	2 11 8
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	2	4	82½	+1	*4 17 0
FOREIGN TRAMS, &C.					
Anglo-Arg. Trams. First Pref.	5½	12½	8½xd	—	7 17 2
do. do. 2nd Pref.	Nil	5½	3½	+ ½	7 2 0
do. do. 5 per cent. Deb.	5	5	81½	+1½	6 4 3
Brazil Tractions	Nil	Nil	51	—1	7 16 10
British Columbia Elec. Rly. Pcc.	5	5	80½	—	6 4 3
do. do. Preferred	5	93/-	69½	—	*6 13 0
do. do. Deferred	3	124/-	73	—	*8 10 0
do. do. Deb.	4½	4½	80	+1	5 6 3
co Trams. 5 per cent. Bonds	Nil	Nil	71½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	37½	—	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	53		Nil
do. 1st Bonds	Nil	5	69½xd		7 3 3
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	3	—	5 6 8
British Aluminium Ord.	10	10	18/3	—6d.	—
British Insulated Ord.	15	15	2⅜	—	7 1 2
Callenders	15	15	2⅛	—	7 5 3
do. 6½ Pref.	6½	6½	1⅜	—	5 9 5
Crompton Ord.	10	10	18/9	—	10 13 4
Edison-Swan	10	—	4/6	—	—
do. do. 5 per cent. Deb.	5	5	64xd	+ ½	7 16 4
Electric Construction	10	10	1¼	—½	8 0 0
English Electric	8	8	15/-	—	6 13 4
do. do. Pref.	6	6	18/9	+6d.	6 8 0
Gen. Elec. Pref.	6½	6½	22/3	—1/-	5 19 0
do. Ord.	10	10	18/-	—2/3	—
Henley	15	15	2⅝	+ 1/16	6 13 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1½	—	—
Met.-Vickers Pref.	8	8	2⅛	—	6 11 2
Siemens Ord.	10	10	1⅝	—9d.	*7 12 4
Telegraph Con.	20	20	25½	—	*4 11 6

* Dividends paid free of Income Tax.

ELECTRIC WATER-HEATING FOR DOMESTIC PURPOSES.

By GEORGE H. WOOD, A.M.I.E.E.

The problem of heating water for domestic purposes is one which is becoming daily more important.

The large majority of supply authorities look on the problem as insoluble, that is, in competition with gas and other methods; but whilst it is perfectly true that the electrical method is not at present practicable for heating very large quantities of water such as are required in hotels, boarding-houses, &c., yet for the average middle-class household electric water heating is a sound and practicable proposition.

The idea that gas is necessarily more economical for water heating is largely a fallacy, for although one can buy more B.th.u. in gas than in electricity for a penny, the superior efficiency of the electrical method goes a long way to offset the difference in price of the heat energy.

In practice, electricity at three-halfpence a unit can favourably compete with gas at 4s. 6d. per 1,000 cu. ft. Gas is not such a serious competitor as is usually thought, for the various gas circulators are expensive in first cost and installation cost, and are, moreover, expensive and inefficient in operation.

Geysers, too, are expensive to install, and are unsatisfactory from the health point of view, as, unless attention is paid to proper ventilation and cleaning, fumes are emitted with sometimes fatal results.

The use of gas in a room devoted to personal cleanliness, such as a bathroom, is inexcusable where electricity is available at reasonable rates.

Consumers are easily interested in any electrical device which will give them the hot water they want at a reasonable cost. As a rule they have first-hand experience of the cost and unhealthiness of the gas method, and of the vagaries and extravagance of the average coal range.

When installing electric water-heating apparatus, it is of the first importance to bear in mind that electrically-produced heat is comparatively dear, and must not be wasted. The electric heating process being a non-combustion process, lends itself readily to efficient heat insulation, and efficiencies in the region of 96 per cent. are easily obtainable. To secure this result tanks and pipes must be properly lagged. We cannot afford to waste the heat by running unlagged pipes at random—such a procedure would kill an installation from the start.

There are two distinct methods of electric water heating, and a third system, which may be considered as a combination of the other two. The first is the "geyser" system, involving a high loading for a short period. The second is the "heat storage" system, involving a low loading continuously. The third system combines a high loading for short periods and a low loading continuously in one apparatus.

1. *The "Geyser" System.*

In this system the water to be heated flows over a coil of wire (which should be insulated from the water) and extracts heat from it. Thus a constant flow of hot water is obtained. Arrangements are easily made whereby the flow, and therefore the temperature, of the water may be regulated, and it is easy to arrange that the turning of the tap switches on the current and *vice versâ*, thus obviating any possibility of overheating the element.

These geysers are excellent for purposes where small quantities of water are required, as for lavatory basins, dental use, medical purposes, &c., but for providing a bath they are not practicable, owing to the high loading required. Even a 6.5-kW loading is not sufficient for baths, and it is hardly practicable (generally) to install anything larger when the cost of cables, the meter, and the loading of mains are taken into consideration.

2. *The Heat-storage System.*

This system consists essentially of a containing tank, to which is fitted an electrically-heated element (usually of the immersion heater type), the loading of the element being in the region of from 200 to 300 watts.

This element is in circuit continuously, giving 100 per cent. load factor. An element loaded to 200 watts will heat about 18 gallons of water to a temperature of 150° F. (assuming a cold-water temperature of 50° F.) for a consumption of six units. This system, with its low loading and 100 per cent. load factor, is ideal from the central-station, mains, and installation points of view. It has, however, the following practical disadvantages: The loading being low and the heater being in circuit for 24 hours a day, it is necessary to design the heater to provide the maximum amount of water likely to be required. Should this amount be exceeded, no hot water is available, and this annoys the consumer. If the amount of hot water provided is too great, then this system is wasteful. The latter disadvantage may be overcome by the use of thermostatic control, but such control introduces complications and adds to the first cost.

3. *The Combination System.*

The third system may be considered as a combination of the two already examined. It consists essentially of a water tank heated by two separate elements—one of high loading and one of low loading. These two elements can be in circuit together or separately as desired.

For bathroom purposes good results are obtained from a twelve-gallon tank, well lagged, and loaded up to 5 kW in all, the high loading being 4.8 kW and the low loading 0.2 kW. Such a tank will give a good bath in from 20 to 25 minutes, and, in addition, the low loading may be used to provide a constant supply of hot water day and night. If a series of baths should be required, so soon as the tank is emptied for one bath, it fills automatically *viâ* the ball valve, and, if the heater is switched on "full," then by the time one bath is finished another is ready, and so on.

If the low loading is left on at night, a bath is ready first thing in the morning.

A well-lagged pipe may be run from the tank to the scullery, and the water used for washing-up, &c.

The moderate loading of such a heater is practicable from the mains point of view, and the first cost and cost of installation are moderate. In places where an electric cooker is installed, the water heater may be supplied from a change-over switch in the cooker circuit, thus saving cable and improving the load factor.

The want of some electrical method of heating water for domestic purposes is a great handicap to the progress of electric cooking, and the provision of some such method not only helps electric cooking, but forms a valuable source of revenue in itself.

Test of Electric Water-heater.

Capacity	... ...	11.3 gallons.
Loading	... ...	high 2.7 kW.
		low .2 kW
	Total ...	2.9 kW.

The elements are of the immersion-heater type, there being six in all. Five elements are loaded to 540 watts each, and, working in parallel, form the "high" loading; one separate element loaded to 200 watts forms the "low" loading.

The result of a test was as follows: —

Temperature.	*Time.*	*Current.*
76° F.	0 mins.	29 amperes.
84 ..	5 ,,	28 ..
90 ..	10 ..	28 ..
96 ..	15 ..	28 ..
104 ..	20 ,,	28 ..
110 ..	25 ..	28 ..
116 ..	30 ..	28 ..
123 ..	35 ..	28 ..
127 ..	40 ,,	28 ..
136 ..	45 ..	28 ..

Efficiency = 94.3 per cent.

It will be seen from the above test that after 30 minutes 11 gallons of water were available at a temperature of 116° F. A normal bath temperature is 105° F.; allow 110° F. to be on the safe side. To get this temperature we must add 1.5 gallons of cold water (60° F.); this gives a total of 12½ gallons of water.

The loading is 28 amperes, period half-an-hour, voltage 100, equal to 2.8 kW for half-an-hour—equal to 1.4 kWh. At 1.5 pence per unit, this costs 2.1 pence.

Performance of Electric Water-heater, in daily use.

Period, November 29th, 1921, to February 19th, 1922.
Energy consumption = 482 units = 40.16 units per week.
Water-heater used as follows:—
Baths for two children every evening = 2 units per day.
Household washing on Mondays = 7 units.
Baths for adults (5 or 6 per week) = 12 units.
Average weekly consumption = 40 units.
(*Note.*—This applies to winter conditions.)

A SHIP'S LOG AND SPEED INDICATOR.

There are still many inventions that were developed to a high pitch during the war which have not become generally known, and especially is this the case with marine devices. We think a description of an electrically-operated ship's log and speed indicator, used extensively in our own and foreign navies, will be of interest. This system, devised by Messrs. Elliott Bros. (London), Ltd., records the distance travelled by a ship through the water, and affords an indication of the speed in knots at any moment. The apparatus fixed in the ship consists of a valve fitted in the bottom as near as possible to the ship's turning point. An extension at the top of the valve carries a gland containing suitable hydraulic packing. Through the valve and gland protrudes a bronze tube with an opening facing forward for the admission of water as the tube travels forward with the ship, and another opening aft for the exit of the water. Between these openings is a propeller, which operates transmitting mechanism, so designed as to make a definite number of revolutions while the ship travels one nautical mile. This log tube is illustrated in fig. 1; the left-hand view shows the top portion, and the right-hand view the bottom portion, containing the propeller. There is a clutch at the top of the tube which engages with the driving spindle of the transmitter. This transmitter is illustrated in fig. 2. The main features of the device are a magneto generator, the output pressure of which increases with the speed of the propeller in the log tube. In connection with this voltmeters are fitted in various positions in the ship, having scales marked in knots. Then there is a commutator for transmitting impulses to distance recorders. This is so arranged that 100 impulses are made while the ship travels one nautical mile. In order to adjust the readings of the speed indicators to correspond with the distance recorders a variable resistance is inserted in the indicator circuit. Adjustment of the speed recorders is made by changes in the driving gears.

The speed indicator is a moving-coil instrument filled with oil to get sufficient damping of the pointer movement to obtain steady readings. One magneto generator can actuate any number of these indicators up to ten. The distance recorder is contained in a watertight case. The mechanism is carried on a hinged frame, and can be swung out for inspection. The motion is obtained by the attraction of a soft-iron armature by an electro-magnet, which moves a pawl-and-ratchet gear. A central pointer indicates one nautical mile in one hundred steps, and a larger hand registers up to one hundred miles on a circumferential scale. The total distance travelled is shown in figures through a window in the dial.

The log tube used on submarines is of different design, having two propellers, in order to provide for both surface and submerged travelling.

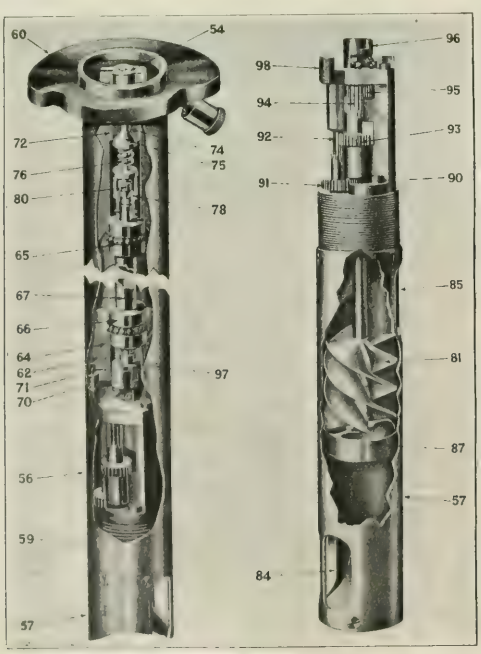


Fig. 1.—The "Forbes" Log Tube.

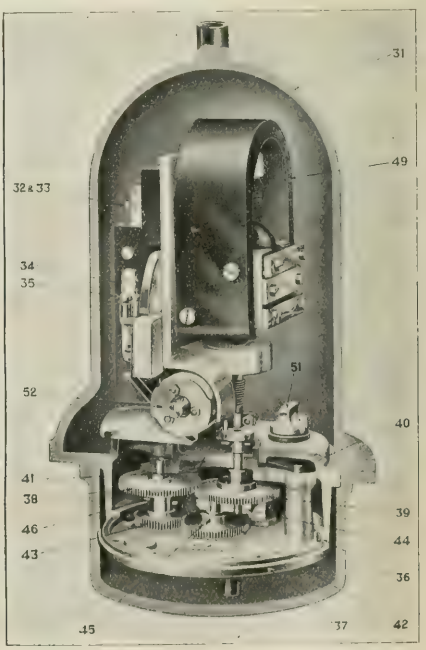


Fig. 2.—The "Forbes" Transmitter.

Index. 31, dome cover; 32/33, terminals; 36, fixing screw; 37, bottom cover plate; 38, 39, 42, and 43, gear wheels; 40, fixing screw; 41, worm on main shaft; 44, guide block; 45 and 46, split pins; 49, magnet; 51, oil plug; 52, commutator; 54, clutch; 56 and 57, top and bottom pointers; 59, securing screw; 60, plug; 62, outer collar; 64, inner collar; 65, upper ball bearing; 66, lower ball bearing; 67, tubular shaft; 70, locking ring; 71, pin in locking ring; 72, sleeve; 74, lignum vitæ bush; 75, watertight spindle; 76, coring; 78, collar fixed to shaft; 80 collar fixed to spindle; 81, propeller; 84, water entry; 85, water outlet; 87, ebonite bracket for propeller bearing; 90, 92, and 94 pinions; 91, 93, and 95, gear wheels; 96, clutch; 97, other half of clutch; 98, projection for locking ring.

BRITAIN'S INTERESTS IN CHILE.

Britain's stake in Chile is represented by investments, including Government and municipal loans, railways, mining, and other industries, banking and commerce, to a total which H.M. Commercial Secretary at Santiago (Mr. W. F. V. Scott) estimates at over £100,000,000.

United States investments in Chile are stated by the American Ambassador to amount to $200,000,000, or, say, £40,000,000, which sum is placed mainly in copper and iron mining. If trade follows finance there should be good opportunities for British merchandise and American goods in the Republic, but the former should have first chance.

Indeed, for the past decade, Britain, the United States and Germany have shared at least 70 per cent. of Chile's total import, and 80 per cent. of its total export trade. Before the war Germany came next, after the United Kingdom, but during the war America secured all Germany's trade, besides about 10 per cent. of British.

It is a hopeful sign that in 1920 the British Empire sold to Chile the same percentage of goods as in 1914, and regained its position as first importer to the Republic. Since then business has been severely depressed; to what extent is clearly shown in Mr. Scott's report, which has recently been issued by the Department of Overseas Trade. Yet there are signs of recovery, and these have become slightly more pronounced since Mr. Scott's report was closed. He says, moreover, that any material improvement in the depression from which the whole world is suffering will bring about a corresponding revival in Chilean business. Heavy stocks of nitrate have still to be cleared.

In contrast with the general halt in the iron and steel trade, the Chilean State railways are large purchasers of rails and railway material.

In Mr. Scott's opinion it is not superfluous to point out that Chile is one of the most energetic and progressive Republics of Latin America. It was not a manufacturing country in the past, but it is fast becoming one. Formerly, its trade was done exclusively by foreigners, but now the Chilean is taking a personal interest in business. For the latter reason especially the market must be carefully studied and the mentality of the Chilean understood.

Personal contact only, adds the Commercial Secretary, can give the knowledge required, and suitable representatives must be sent out before a sound and remunerative connection can be built up. One hundred pesos per day, excluding passages and rail expenses, must be calculated as a minimum for a representative while travelling in Chile.

Appointment of Agents.

The question of the appointment of agents must be given very careful study. The number of agents is legion, but representatives of good reputation and sound business or technical knowledge, who are still open to take on agencies, are very scarce indeed. It goes without saying that no agent should be appointed until exhaustive information, both as to his honesty and capacity, has been obtained from possibly more than one reliable source. Banks' references are frequently not sufficiently informative, their information is often second-hand, and their dealings are frequently of such a nature as not to enable them to form a proper estimation of the character of their clients. A large banking account is no guarantee of an agent's straight dealing or of his capacity.

The Commercial Secretary advises strongly against selling any goods in Chile except through a duly appointed agent. The representative or traveller should merely accompany the agent in order to gain a knowledge of clients and local requirements, and give any technical information required of the goods his firm sells. A traveller selling goods without a local agent is liable to the Commercial Travellers' Tax, chargeable at a certain rate for each province visited, and involving a total, for the whole of Chile, of $30,000.

As a general rule, it is not desirable to send out goods on consignment, but in the case of certain classes of goods, where competition is very keen, and particularly in the case of goods unknown to the markets, consignments are necessary.

On the subject of agency expenses, the report points out that several foreign manufacturers contribute substantial sums towards agents' office expenses, beyond paying ordinary disbursements, such as cost of cables and postages, advertising, &c. It quotes a specific case of a foreign machinery manufacturer, who, besides consigning to his agents in Chile machinery to the value of several hundred pounds, pays a retaining fee of 1,000 pesos per month to the agents, and accepts payment from the buyer at 120 days, to be remitted by the agents 60 days after receipt.

Hints and Criticisms.

There are many ways in which the manufacturer and merchant can increase his trade, amongst which Mr. Scott mentions:—

1.—Regular visits from representatives.
2.—Systematic circulation of catalogues printed in Spanish.
3.—Continuous study of the market and adaptation to it.
4.—Full co-operation with local agent, whose suggestions and advice should be followed where practicable.
5.—Adoption of metric system for all weights and measures.

There is a tendency throughout Chile, he says, to complain, in a general way, against the British manufacturer, and to criticise his methods. This is, no doubt, due to the disorganisation caused by the war and the abnormal conditions still prevailing. The forms which these complaints and criticisms usually take are as follows:—

The difficulty of obtaining reliable information concerning British manufacturers generally.

Whilst a large number of American catalogues are regularly circulated, British catalogues are rarely received.

British catalogues, more often than not, are in English, which is Greek to the Chilean, and when translated into Spanish are frequently full of mistakes; they contain English weights and measures; they are not illustrated or sufficiently self-explanatory.

British representatives are not sent out often enough, and those that do come—

1.—Can rarely speak Spanish.
2.—Have to make a hurried trip lasting about a quarter of the time necessary.
3.—Only visit Santiago and Valparaiso, whereas they should make a prolonged tour of all the principal towns.
4.—Are sometimes not of a sufficiently refined or educated type to be *personæ gratæ*.
5.—Rarely understand the mentality of the Latin races, among which the Chilean holds a high position.

Amongst industrialists and users of machinery, complaints are general that agencies for the sale of machinery are often given to firms who have no engineer qualified to advise them as to the types of machinery they should purchase.

Electrification Schemes.

In describing the depression which has overtaken the coal market, Mr. Scott mentions certain electrification schemes the realisation of which will affect fuel imports. These are:—

(1) The electrification of the First Zone of the State Railways—say 100,000 tons per annum. (2) The electrification of the Iquique Nitrate Railway, Ltd. (3) The electrification of the Chilean Transandine Railway. (4) The completion of the power plant of the Compañía Nacional de Fuerza Eléctrica (controlled by Messrs. Pearson, Ltd.), which will be able to supply power to all industries, railways, &c., in the centre of Chile. (5) The adoption of petroleum in the Nitrate Oficinas, instead of coal.

The first named scheme is being undertaken by United States enterprise. A contract has been signed in Santiago between the Westinghouse Electric International Co. and the Chilean State Railways, to electrify the First Zone of the State railway between Valparaiso and Santiago. The work has been commenced.

With regard to hydro-electric schemes, in general, the Chilean laws and regulations, in the matter of concessions, are very liberal. It is calculated that at present there is at least 4,000,000 h.p. of unused hydraulic power, which could be utilised for mining, electric light, traction, and other industries in the country.

Electric Power and Tramways.

The ex-German Chilean Electric Tramway & Light Co., Ltd., of Santiago, which was handed over to the Receiver of Enemy Firms during the war, and in which an English firm acquired the controlling interest, has been reformed into a Chilean company, the Compañía Chilena de Electricidad Limitada, with an increased capital of £12,000,000, and has also acquired the controlling interest in the recently formed Chilean Compañía Nacional de Fuerza Eléctrica, whose original capital was £800,000, now increased to £3,000,000. A large power plant is being erected to utilise waterfalls within 30 miles of Santiago, which is anticipated to be effective in July. Distributing stations will be erected for utilising the power over a large radius round Santiago, and beyond lighting the Capital and running its tram service, the contract has already been secured for running the First Zone of the State Railway between Santiago and Valparaiso, the electrification of which is now being commenced. Other contracts likely to be secured are the running of the Transandine Railway, shortly to be electrified, Valparaiso Port Works, and a large number of industries in the zone covered.

Rivalry in Communications.

The Chilean Government concluded a contract in October, 1921, with Messrs. Siemens, Schuckert, Ltd., in consideration of which, for the sum of $1,455,000 [illegible] contractors agreed to erect eleven radio telegraph stations at Santiago, Valparaiso and Punta Arenas, all capable of communicating with Buenos Aires, and at Iquique, Antofagasta, Taltal, Tocopilla, Caldera, Concepción, Valdivia, and Chiloé, with a maximum radius of 1,550 miles. The system to be installed is the Telefunken.

The editor of an Italian paper published in Buenos Aires,

visited Chile in November, 1921, with the object of interesting his compatriots in the proposed laying of a submarine cable connecting Italy with South America. The cable will start from Fiumicino, in Italy, and run to the Argentine. Lisbon and Brazil, and it is hoped will have branches to the Near East, the Balkan States, Spain and North Africa.

THE NATIONAL PHYSICAL LABORATORY.

Visit of Inspection and Report.

The annual visit of the National Physical Laboratory, Teddington, by the members and guests of the General Board took place on June 27th, the weather fortunately keeping fine, so that, in addition to the very interesting and instructive inspection of the various departments, the gardens at Bushy House were much enjoyed. The guests, to the number of about 800, were received in the early afternoon by Prof. Sir Charles S. Sherington, G.B.E., president of the Royal Society and chairman of the General Board of the Laboratory; Sir Arthur Schuster, F.R.S., chairman of the Executive Committee of the Laboratory; and Sir Joseph E. Petavel, K.B.E., D.Sc., F.R.S., its director; and were afforded the opportunity of seeing some of the work that is being done in all the various departments, the attention of the visitors being drawn to many exhibits possessing features of special interest.

The report of the Laboratory for 1921* gives details of the work that was accomplished last year, and outlines the programme for the present year. After mentioning that a somewhat serious diminution took place last year in some branches of the test work undertaken by the Laboratory, the executive committee points out that in a scientific institution fluctuations in paid work cannot be compensated for by corresponding fluctuations in the trained staff, and it expresses the hope that means will be found to maintain the full activities of the Laboratory and to avoid the loss of trained members of the staff whom it would be difficult to replace.

The work done by the Laboratory for the Research Boards of the Department of Scientific and Industrial Research, appointed to co-ordinate research of general interest to the fighting Services, has grown considerably in importance during the past year, and such work must grow rapidly. The tendency is thus to broaden the work of the Laboratory, and, since the majority of such problems are also of industrial interest, to increase its general utility, while meeting the special needs of the Services with a comparatively small increase of cost.

As an example may be quoted the work on the magnetic properties of iron and steel. In its general aspect this is a fundamental research of the kind which the Laboratory was founded to undertake. In connection with it numerous special questions arise, the solution of which is of immediate importance to the Services, especially to the Admiralty; the production of permanent magnets of high intensity; of non-magnetic steels; of iron of high permeability and low hysteresis loss; the study of the magnetic behaviour of various materials at different frequencies of the exciting field, each has a number of particular applications to Service problems.

One of the principal functions of the Laboratory is the maintenance of accurate standards of measurement. During the twenty years of its activity it has become responsible, directly or indirectly, for the care and maintenance of nearly all the primary standards of the country. On behalf of the Ministry of Transport it has undertaken the custody of the legal electrical standards, which are now preserved in Bushy House. Their values have been accurately determined in terms of the international electrical units, which are themselves known to a high degree of accuracy in terms of the "absolute" units. Dependent on these are a number of derived units—units of capacity, inductance, &c.—whose values are maintained by means of standards constructed in the Laboratory. The Laboratory has more recently, at the request of the Radio Research Board, undertaken the construction and preservation of the high-frequency standards required for wireless work. The Laboratory is responsible in this country for the maintenance of accurate standards of illumination, and is at present engaged, in co-operation with other national standardising laboratories, on the establishment of international standards, in accordance with a programme laid down by the International Illumination Commission.

Closely related to the maintenance of standards of measurement is the improvement of standards of quality and performance. The examination of heat-insulating materials, electrical insulators, X-ray protective materials, and the production and examination of optical glass, provide examples of work of this character. The Laboratory is also responsible for the preservation of the radium standard for this country, and the maintenance of standards of performance is exemplified by the testing of instruments of all kinds.

The work undertaken for research associations shows continued development. A large number of special investigations have been carried out for the British Electrical and Allied Industries Research Association. For the Non-Ferrous Metals Research Association research is in progress on the influence of foreign elements in copper. Following the investigation carried out at the Laboratory into the production of resistance materials, it has supplied "ohmal" resistance wire to the British Scientific Instrument Research Association for more extended trial by its members in instruments manufactured by them. It is also collaborating with the Association in a research on radium luminous material.

A somewhat serious diminution took place during the year in some branches of the test work undertaken by the Laboratory. Reference was made in the previous report to the reduction in the number of electrical and optical instruments sent for test, which became more marked during the year under review. The fall has been in some degree balanced by the rise in other classes, but a loss of income under this head is to be expected until trade conditions improve. Closely related to test work are the special investigations carried out, against payment, for individuals and firms. These often deal with problems of considerable interest, and it may be added, to the credit of British industrial undertakings, permission to publish results of general value is rarely withheld when the Laboratory considers publication desirable. Such work has increased appreciably since the war, and compensates in some measure for the reduction in test work. Tests and investigations for War departments were formerly carried out at the Laboratory as "free services." Under a recent Treasury decision payment is now made to the Laboratory by these departments for the work done for them. Work done for civilian departments, including the boards and committees of the Research Department, continues to be rendered as a "free service." Additional provision is made on the vote of the Research Department for any expansion found necessary during a current year. Provided there be no falling off in the work performed for the War Departments, two-thirds of the income of the Laboratory will in future be received in return for direct services rendered. The remainder is barely adequate for the carrying out of the multifarious duties for which the Laboratory was founded. While the committee desires to co-operate in the interests of true economy, it considers that a serious curtailment of expenditure at the present time would be wasteful in the long run.

Good progress has been made in practically all departments with research work and investigations directed to the maintenance of standards and improvement of the accuracy of measurement. The accounts given by the heads of departments in their contributions to the report of the methods developed and the results attained will be of great general interest and of considerable importance to industrial undertakings.

The Heat Department has continued its work in the international comparison of high temperature scales; a new standard pyrometer of the disappearing filament type has been constructed, and promises to give results of high accuracy. An interesting series of experiments has recently been carried out for the Building Research Board on heat transmission through building materials. Determinations of thermal conductivity have been made for materials employed in electrical work, for insulating oils and for metals at high temperatures.

In the Radiology Division a larger number of radium preparations has been sent for test than in any previous year, and experiments have been made to determine the amount of absorption by the platinum or silver tubes in which they are usually contained and by the salt itself. An investigation relating to radium luminous compound is in progress for the Chemistry Research Board of the Research Department. The methods of measurement of the intensity of X-rays have been improved and an investigation has been made into the absorptive qualities of protective materials. At the request of the X-ray and Radium Protection Committee, lately appointed, the Laboratory has undertaken the inspection of X-ray and radium installations for medical purposes and a number of such installations throughout the country have been examined. In many cases improvements have been suggested to secure greater protection for the operator and the nurses. Work on methods of "dosage" measurement has been completed.

In the Electrotechnics Department work in the alternating current section has been mainly directed to the improvement of methods and apparatus for tests on alternating-current instruments and machines. Good progress has been made with the construction of a high-voltage wattmeter for the measurement of power at potentials up to 100,000 volts. Advice was given with regard to the protection from lightning of the new London County Council Hall.

In the direct-current section considerable progress has been made with the work on buried cables, which is being carried out for the Electrical Research Association. Sufficient information is now available for the preparation of load tables, at both high and low pressures, for armoured cables laid direct in the ground. The deterioration of the various insulating materials, as the result of the heating of the cable, has been investigated and the problem of finding a dielectric which will withstand a higher temperature is receiving attention. For the determination of dielectric losses in high-pressure cables some special transformers have been constructed in the Laboratory.

*H.M. Stationery Office, Kingsway, W.C.2; price 6s. 6d. net.

The rating of cables when a large number are laid together has been investigated for the Admiralty. The current rating of cables loaded intermittently is also being examined. In conjunction with the Laboratoire Central d'Electricité and the Bureau of Standards, measurements are being made of the electrical conductivity of a number of French, American, and British samples of aluminium, with a view to specifying a figure for the conductivity of commercially pure aluminium.

In connection with the transfer to the Laboratory of the electrical standards formerly in the custody of the Board of Trade, an examination of the records has been made to determine the basis for the tests laid down for the approval of meter types and the requirements have been carefully re-considered and brought up to date. The action of fuses is being investigated, and tests have been made on fuse boxes of various types for private firms. An investigation is being made into the efficiency of bolted and clamped joints in bus-bars. Measurements of the insulation and surface leakage of various composite insulating materials have been made for the Electrical Research Association and the effect of heat and moisture and of soaking in various re-agents has been examined.

In the photometry section the work on ships' navigation lamps has been continued and a considerable programme of work has been carried out for the Home Office Factory Lighting Committee, which resumed its work, interrupted by the war, at the end of 1920. A committee has been formed by desire of the Office of Works and the Post Office to consider the lighting of public buildings, and much time has been spent on experimental work. An investigation relating to searchlight carbons is in progress for the Admiralty. The Laboratory is co-operating with the International Commission on Illumination with a view to the establishment of international standards, and inter-comparison of standards with other national standardising laboratories will be undertaken. Some important additions have been made during the year to the equipment for determining the distribution of light from large sources and for measurements of average candle-power.

In the Engineering Department experiments on the transmission of heat from a surface to air flowing over it have been continued throughout the year.

Among other special investigations which have been in progress during the year may be mentioned the tests on the lubricating properties of heavy oil, at high temperatures and pressures, and for high velocities of the bearing surfaces; comparative tests for electric power consumption, tractive resistance, &c., on tramway cars; and tests of the mechanical properties of insulating materials, and of overhead line wires and stranded cables for the Electrical Research Association.

A comparison of the tests made at the Laboratory shows that during the year ended September 30th, 1921, a total of 925,500 tests were completed, as compared with 1,656,872 in 1919-20, and with 1,303,312 in 1918-19. A decrease is recorded in the number of tests made in all departments except the Engineering Department, which showed an increase of 251 to a total of 1,071. In the Electrical Department the total number of tests carried out was 2,305, as compared with 3,882 in 1919-20, and 12,986 in 1918-19.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Armature and Commutator Testing Device.

The P. E. Chapman Electrical Works, N.E. Corner, 10th and Walnut Streets, St. Louis, Mo., U.S.A., has sent us particulars of the "Armeter," a device for testing armatures and commutators. It is said to be a great improvement upon the step-by-step test usually employed, as all coils are tested simultaneously. The device consists, as will be seen from the illustration (fig. 1), of a number of small lamps mounted with their circuits in a circular base. There is a circular opening in the centre with contacts corresponding to the number of lamps.

It is claimed that the "Armeter" will detect open circuits, bad joints and their position, short circuits between sections, short-circuited windings, wrong connections, irregular number of turns, earths, &c. An armature is tested by inserting its commutator into the circle of contact fingers, whereupon the indicating lamps will all light up to half their normal illumination if the windings are correct. A short circuit will be indicated by extra brightness in one of the lamps; an open circuit will cause the lamp concerned to remain unilluminated. Bad joints and excess turns are indicated by dimness of lamps. An "earth" detector operates simultaneously.



Fig. 1.—The "Armeter" Testing Device.

The device is strong and durable, there being an absence of moving parts, with the small exception of the contact fingers, which are on springs. The "Armeter" should prove very useful in works where large numbers of small armatures of the same pattern are produced. The Igranic Electric Co., Ltd., Bedford, is acting as British agent.

New "Heatrae" Developments.

Electric Fires, Ltd., King Street, Norwich, has recently introduced several new "Heatrae" appliances. One of these is the "Peter Pan" "double-purpose" heater, illustrated in fig. 2. This is strongly constructed of steel, with a nickel-plated finish. The loading is 600 W and the heater is 9 in. high, 8 in. wide, and 7 in. deep. When in the position shown in the illustration the appliance forms a radiator, but it can be turned over to rest on one of the legs and the handle, to act as a hot plate.

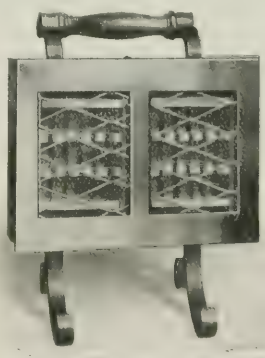


Fig. 2.—The "Peter Pan" Electric Heater.

The firm's other main departure is in the direction of small immersion heaters for photographic purposes. One of these is shown in fig. 3, being used in a developing bath.

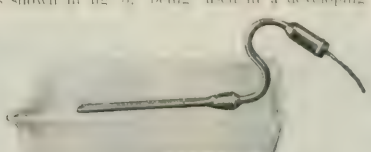


Fig. 3.—A "Heatrae" Immersion Heater.

This has a capacity of 600 W and an overall length of 12 in. Another form of immersion heater for use in deep tanks is also made. This can have a length of 34 in.

The "Bulle" Electric Clock.

A self-contained electric clock which, it is claimed, will run for ten years, has been put on the market by the Bulle Horo-Electric, Ltd., 109, Kingsway, W.C.2. The action of

this clock is provided by a solenoid, mounted on a pendulum swinging over a permanent bar-magnet, current being passed through the coil at suitable intervals to give a repulsion effect which keeps the pendulum in motion. The electrical impulses are given by a small dry cell enclosed in a brass container. The positive pole of this cell is connected to a plate fixed on the framework of the clock, but insulated from it, and the negative pole to the framework itself. A flexible lead connects the frame to one of the pendulum's two rods, and this in turn is connected to one end of the solenoid winding. The other pendulum rod is connected to the other end of the coil, and terminates in a conducting pin, which comes

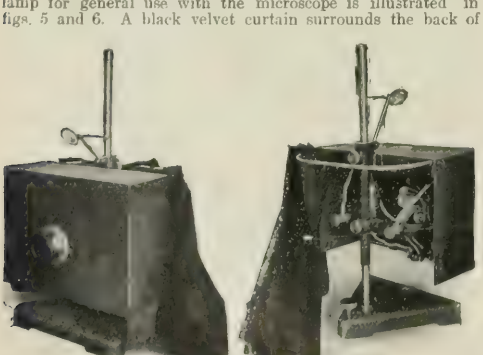


Fig. 4.—The "Bulle" Electric Clock.

into contact alternately with metal and insulated contacts, forming the top of a forked piece of metal connected to the positive pole. The forked portion is rocked by the motion of the pendulum, thus permitting an intermittent current to flow through the coil. The pivoted fork also operates the hands by means of a pawl and ratchet device acting through a worm-screw and central wheel. The mechanism is enclosed in a glass dome, and mounted on a substantial wooden base. It will be seen that the makers' claim should be borne out provided the battery will last for ten years, as the energy consumption is negligible—the current taken being 2.5 mA at second intervals.

The "K.B.B." Microscope Illuminant.

To provide a source of monochromatic illumination for microscopic investigation, Messrs. Kelvin, Bottomley and Baird, Ltd., Kelvingrove Works, 299, Hither Green Lane, S.E.13, have introduced a new form of quartz mercury vapour lamp. The two principal features of the design are that the quartz burner tube is not exhausted but works under atmospheric pressure, thus eliminating the defects associated with the vacuum type of mercury lamp, and that no mechanical devices are required for starting the arc, which also simplifies the lamp and lengthens its life. The form of lamp for general use with the microscope is illustrated in figs. 5 and 6. A black velvet curtain surrounds the back of



Figs. 5 and 6.—The "K.B.B." Microscope Illuminant.

the lamp. This cuts off all extraneous light and protects the observer from direct rays from the burner. Both horizontal and vertical beams of light are furnished, a small silvered mirror fitted above the vertical aperture reflecting the beam in any desired direction. The condenser tube in front of the housing is of a diameter suitable for a standard sub-stage condenser or other microscope fitting. Other types of housing can be supplied, and for ultra-violet ray work a quartz condensing lens can be fitted.

THE TRANSVERTER.

A New Current Converter.

In the course of a paper on the subject of "Recent Improvements in Equipment for Electric Railways, Making for Economy," which he read before the Institute of Transport recently, Mr. Roger T. Smith, M.I.E.E., electrical engineer to the Great Western Railway, made the following important and interesting announcement:—

A machine for producing direct current from alternating current has been designed by Mr. W. E. Highfield and Mr. J. E. Calverley, and has been built at the Dick-Kerr Works, Preston, by the English Electric Co., Ltd. It consists essentially of a static transformer member and of a fixed commutator with revolving brush gear driven by a small motor running in synchronism with the alternating current supply to the primary windings of the transformer. Secondary windings on the transformer connect to the commutator, which converts the alternating current to direct current. Several groups of secondary windings may be placed on the transformer, and by connecting them to commutators connected electrically in series, high pressure direct current is produced. Each commutator in the machine first made deals with a pressure of the order of 12,500 volts, so that the eight commutators provided give 100,000 volts. This machine is termed a "transverter," since it first transforms and then converts the alternating current to direct current.

The experimental transverter apparatus, which was designed and constructed to give something under 400 kW at 100,000 volts, when put to work acted most satisfactorily, and no changes of importance in the design will have to be made as the result of 15 months' working.

Engineers, both manufacturing and purchasing, are agreed that the generator attached to a turbine should be a 3-phase generator. A transverter in the generating station turns the 3-phase current, at the voltage most suitable for generation, into direct current at the pressure most suitable for transmission, which may be 200,000 volts. At the far end the process is reversed in a sub-station containing a transverter or transverters, the direct current received on the commutators being turned into 3-phase current in the transformer. If low-pressure direct current is wanted for distribution, say 1,500 volts or 3,000 volts for railway traction, the necessary commutator or commutators are added to the transverter commutator shaft, and tappings from the transformer windings provide the necessary current at the proper voltage for commutating into direct current for distribution to the electrified track.

The losses in the transverter are the losses in the transformer, which are about 3 per cent. for the most generally useful railway size of 2,000 kW, and the losses due to the work done in turning round the commutator (mostly windage), which for a 2,000 kW transverter will be of the order of 2 per cent. The efficiency of transversion will, therefore, be of the order of 95 per cent. for the 2,000-kW size.

Two transverters used with a d.c. transmission for interconnection between two generating stations completely get over the troubles from any differences in frequency of the stations. The frequencies of the two stations do not enter into the problem except in the design of the transformer part of the transverter, and other troubles due to 3-phase exchange of current between two stations equally disappear.

Consider the transmission of 25,000 kW for railway traction purposes by transverted direct current at 100,000 volts through duplicate underground cables, the earth not being used as a return, and by 3-phase underground cables in duplicate at 66,000 volts. The total transmission is to be a little under 50 miles from a generating station to four sub-stations, equipped in one case with transverters giving 1,500 volts d.c. for railway traction, and in the other case with rotary converters under the same conditions.

In the case of the 3-phase cables the line losses will not exceed 4 per cent. at the maximum peak load, and in the case of the direct-current cables the losses will not exceed 3 per cent. at the peak load. The cost of sub-station buildings, rotary converter equipment, and transmission cables for the 3-phase case is £730,000, and the cost of transverter sub-station buildings and equipment, including the necessary transverters in the generating station, together with the high-pressure d.c. cables, is £355,000, a saving of some 50 per cent.

The inventors have allowed the transverter to be publicly mentioned for the first time in this paper because, should the method of conversion and transmission be proved to be a commercial success, the apparatus becomes a matter of outstanding economic importance to railway electrification, as well as for the interconnection of generating stations and

for transmission generally. Transmission of large powers of the order of 50,000 kW for a hundred miles, if 200,000 volts can be successfully used, will become quite economical. But it is to be clearly understood that the transverter is not yet a commercial success, only an experimental success in a workshop. The present industrial conditions have delayed its development, but it is understood that before many months are over two machines of about 1,000-kW output will be at work.

[We are indebted to the *Electric Railway & Tramway Journal* for the above particulars, as Mr. Smith's paper will not be available until the publication of the next issue of the Institute's *Journal*.—Eds. Elec. Rev.]

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Mangnall-Irving Thrust Borer.

Mr. Trotman raises a number of points, one of which I would like to discuss—namely, is thrust boring only to be used for short runs? As thrust boring is a new thing to me, I must admit that my experience has so far been confined to a "special case"—namely, laying fibre conduit under road crossings. The trials, however, that have just been carried through have proved so satisfactory that I have now no doubt that long runs can be tackled by this method without any difficulty.

In place of having draw-in pits, say, 80 yards apart and connected by expensive trenchwork, the following procedure is proposed: Pits will be sunk to serve as drawing-in pits for the cables and from these the thrust-boring machine will operate, boring in both directions, viz., forward and backward. Halfway between each of these other pits will be sunk, from which the conduit will be inserted for pulling through the bore holes. After the two conduit lines have been drawn through, the line will be made continuous, between the two "machine" or "draw-in" pits, by jointing a conduit to the two projecting ends in the pit, and these alternate pits will then be filled in, leaving the "machine" pits only as draw-in pits for the cables.

Obviously, the extra work entailed in sinking, say, twice the number of pits required in a trenched draw-in system, is a very small matter compared with the cost of trenching and reinstatement.

A. R. Porter,
Director, Key Engineering Co., Ltd.

Trafford Park, Manchester.
June 27th, 1922.

Bad Service of London Firms.

Will you allow me through the medium of your columns to give expression to some of my feelings with regard to the state of things now existing in respect of the delivery of goods on order from London firms in the electrical trade?

I happen to have studied the question of service between the wholesaler and retailer in many parts of the world, particularly in the United States, and, although an Englishman, I am bound to admit that our service methods are the worst in the world.

There will probably be a chorus of people who are ready to say that the complexities of our railway system are to blame for the delay in arrival of goods, but in three instances lately where I had cause to complain, I carefully made inquiries and inspected the consignment notes of the railway companies concerned, and I am of opinion that the railway companies are saddled with a lot of blame that is not theirs, but the senders'.

The position is a deplorable one for the electrical contractor because, in the first place, if he is honourable, he will not order from the wholesaler a pile of goods that he cannot pay for, and, again, the fluctuations of the market to-day are against laying in big stocks. In the second place, he orders usually the goods he requires for the jobs on hand, and any undue delay in the receiving of them is quite sufficient in these days of almost unprincipled cutting of prices to rob him of any profit (if such there should be) on the work.

There is to-day an army of incompetent, amateur young men posing to the public as electrical contractors, and these individuals, by the absurdly impossible figures quoted, make the genuine contractor sink or swim by means of a cut price. It is plain to see, then, that the contractor hopes beyond hope for a good delivery of the goods, but alas!

Using the information I have from three railway companies, I venture to suggest that there is no possible reason why we cannot get a 48 hours' service in the matter of delivery from London within a radius of 30 miles, which covers my area, and I am so disgusted with my treatment of late that I have closed the accounts of two well-known firms for this reason. One gets very sick of the usual letter of apology and a repetition by the next order. There is always the "out of stock" gag to fall back on in London, but in America I never heard the expression used, and I will wager that if our London dispatch firms were staffed by Yanks, the whole situation would be vastly improved.

In the three instances mentioned above, I gave an order to the field man, emphasising the urgency of the matter of delivery, and I have every reason to believe that he passed on my request; but in each case I waited over a week, and then had to expend 1s. on a trunk telephone call to get attention. "Let me see, what was it you ordered, sir?" is the weekly answer over the 'phone, and if you are lucky, someone really does put the order in hand. In these cases I waited from two to three weeks for goods that I had ordered with extreme-urgency messages.

When firms are unable to deliver at once, why not a letter to the buyer to say so? The London houses are very good at this if the account should be overdue a few days.

E. H. T.

June 24th, 1922.

Gas v. Electricity.

My attention has been drawn to an article appearing in your issue of the 16th ultimo, wherein you attribute to me certain statements made at the meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers, recently held in Cardiff.

I shall be obliged if you will please give equal publicity to the fact that the statements referred to were not made by me, neither did the *Western Mail* say so.

Octavius Thomas.

Pentre, Rhondda,
July 1st, 1922.

[We sincerely regret that through a misunderstanding we attributed to Mr. Thomas remarks for which he was not responsible. The report in the *Western Mail* placed his election as the new president immediately before the presidential address, which, it appears, was delivered by the retiring president, Mr. James Robb, of Chepstow. We tender our apologies to Mr. Thomas.—Eds. Elec. Rev.]

The Sale of Wireless Apparatus.

I think the electrical contractor would be well advised to show more interest in the growing demand for wireless apparatus, as this lucrative branch of our business is in danger of falling into the hands of toy dealers, opticians, cycle dealers, &c. Our Associations ought to insist on manufacturers and wholesalers giving our trade the same protection which the motor and tire companies give their traders. I note that the large wholesale electrical firms have gone in for direct advertising in amateur papers. I call on the trade as a body to insist on our rights, namely, trade left in legitimate electrical contractors' hands and complete stoppage of direct advertising by wholesalers and manufacturers. If our request remains unanswered, why not form a wholesale contractors' federation?

R. J. Clarke.

Dublin, *June 26th*, 1922.

Civil Service Examinations.

I should like to correct a statement made by the Electrical Review in its issue of June 23rd, 1922, on page 883, where it is stated that "personal qualities" was a subject never seen hitherto at a Civil Service examination. It was a subject at a previous examination, viz., that for assistant traffic superintendent (telephones), of December, 1921. I sat for that examination, and was a successful candidate. The personal qualities subject helped me considerably. Perhaps you can insert the relevant portions of this note for the information of the readers of the Electrical Review.

F. E. Price.

Brighton, *July 1st*, 1922.

Flood Lighting.

The article published in your issue of the 23rd ult. on the "Possibilities of Flood and Projector Lighting" opens up a very interesting subject. I was rather sorry your contributor confined himself largely to the subject as applied to spectacular lighting, and also to the use of gasfilled lamps. The flood lighting principle has great possibilities when applied to the illumination of large areas—particularly in the open.

Some time ago the writer was interested in the illumination of shipbuilding yards by means of search light projectors, and on investigating the matter found it to be quite a practical proposition. One does not need to be an illuminating engineer to see how wasteful is the present system, with its large number of light units throwing a great share into the sky and leaving the ground level in comparative darkness. The proposal was to have, say, three or more search light projectors of the military type fitted with an arc lamp and mounted at the ground level. The projectors would throw a parallel beam at an angle of about 30 deg.

above the horizontal on to large convex reflectors mounted on crane gantries as high above ground-level as possible. The difficulty in making a reflector of suitable size would be overcome by having a large number of small flat surfaces mounted on a frame approximately of convex shape. The light thrown on to the reflector would be returned to the ground widely dispersed. Two or more projectors may be superimposed on one reflector, thereby increasing the illumination. Also the projectors may be run in opposition to each other, and thus avoid deep shadows. Lighting conditions under such a method would largely approach those of daylight, and would be much more economical than the present system, as the whole of the light produced (allowing for losses in transmission) would be available at the working plane. From calculations made when the system was under consideration it was found that an intensity of about 0.04 candle-power would be available over an area of 250,000 sq. ft. with a consumption of 21.6 kW. This allows for a 20 per cent. loss in the reflector.

Leslie E. Toplis.

Bothwell, N.B., *July 2nd*, 1922.

Where are the Young Men of the I.E.E.?

My attention was attracted by a letter, signed G. E. Moore, which appeared in the "Correspondence" columns of your issue of the 23rd instant, and I am tempted to make a few remarks concerning the possible reason for smallness of numbers of the young members of the Institution of Electrical Engineers at the summer meeting held recently.

Passing by the fact that many of us are unable, on account of our business affairs, to obtain a holiday exactly at any given time, and also leaving out of the question the case of the married younger members, I wonder if your correspondent, Mr. G. E. Moore, has any idea of how many of the single young members are utterly unable to afford to pay for such an outing as this out of the mingy remuneration which a so-called first-class profession—electrical engineering—affords them? Probably not.

I know.

There are hundreds, and perhaps thousands, of such members, who, being in possession of first-class engineering college certificates, and having served apprenticeships, and seen war service, are now in receipt of about 50s. per week, and this when living away from home. I am one.

Surely it is not supposed that such as these can afford this outing?

I might take this opportunity of mentioning that some of us—for I am not alone in this matter—are thinking of not being able to afford our I.E.E. subscriptions next January, because it cannot be denied that our £1 11s. 6d. per annum, or whatever it may be, given to a profession which in return pays us on a level with labourers and railwaymen, is not value for money; even though, as we are given to understand, we join the Institution for its good, and not that the Institution shall do us any good.

H. E. Taylor,
Stud. I.E.E.

London, *June 29th*, 1922.

I have been particularly interested in this correspondence in view of my own experience some years ago.

I was at one time an I.E.E. Student and reached the age limit shortly after the new regulations came into force.

I endeavoured to go further, but found that I was not sufficiently well-known to obtain the requisite signatures in support of my application. After being turned down several times on making application to Institution members for their support, I had of necessity to let the matter lapse.

The trouble was due to the fact that I was then serving with a firm which possessed no shining lights in the Institution, while my duties in those days gave me no opportunity of establishing any personal contact with I.E.E. members.

As time has passed I have specialised in a particular branch of the industry, having brought out and developed some 45 patents, being to-day the head of a well-known firm which advertises in your pages.

I have still no connection whatever with the I.E.E., but would take this opportunity of making a plea for the younger members, and particularly those who labour in the by-ways of the industry, and who do not receive the personal pull which comes to those serving with the large concerns.

A One-Time Student.

July 3rd, 1922.

I agree with "Younger Member," and sympathise with him in deploring the jealous spirit which seems rampant amongst the elder members of this Institution, and practically all others. But is it not typically British? Yes, I am English! but I abhor this mean disposition that exists in bodies of scientific men. If there is no co-operation amongst the old and young how can they keep the flag flying? how can they imbue in others what they are lacking themselves? In America and Germany, men give way to young brains. The result is obvious by their growing trade.

The only time the younger men have been in the foreground, in my opinion, was during 1914-1918, in France, under rather sterner conditions. My advice to all young members is this: Consider whether there is accruing from your membership, or likely to accrue, any special advantage under the present circumstances. Consider your chances abroad, there are already large numbers of young engineers making good in foreign parts.

Youngster.

June 30th, 1922.

I feel sure that I am expressing the view of many younger members when I say that I entirely disagree with your correspondent, "Younger Member" on the above subject.

To write about the "lack of recognition" and the "superior demeanour towards Students, &c.," by the senior members of the I.E.E. appeals to me as being very unfair.

I have always found, and others have only too readily agreed, that the most senior members of the Institution are always sympathetic, and easily approachable, at meetings of a business or social character.

"Younger Member" asks: "What encouragement does the I.E.E. give?" Membership is an honour in itself. Members receive full value for their subscriptions in the *Journals* issued from time to time, and have access to hundreds of pounds' worth of volumes in the library.

There are a number of Students' Sections now in being, from the meetings of which valuable information can be gained; and it is there that such points as "Younger Member" brings forward can best be discussed.

I have formed the opinion that being associated with the I.E.E. *is* a very valuable asset in securing a better position.

If some chiefs do rarely recognise the younger members, although much depends on what is meant by "recognise," then that is the business of the individual chief, and not the Institution, and therefore the attack upon the I.E.E. as a whole is quite unjustified.

"Younger Member" cannot possibly further the interests of the Institution whilst he exhibits such feeling.

I am afraid that the real reason why younger members abstain from the larger meetings is that "they stick to their bush," namely, younger members' functions—and salaries.

K. Pittaway,
Also a Younger Member.

London, *July 4th*, 1922.

In support of "Younger Member's" letter, I may say that I am also a Student member of the Institution, and have experienced the "lack of recognition and superior demeanour" which "Younger Member" writes about.

I have the pleasure (?) of being one of the youngest members of the Students' Section of one of the Territorial Centres, and find that this "superior demeanour" exists even amongst the Students themselves, and is reflected in the conduct of the "old hands" (the office-holders, as a rule) towards their younger fellow members.

It will, perhaps, be argued that dances are held as social events. Quite so, but are *all* the Student members in a position to present themselves (in immaculate evening dress) at a dance, with an expert knowledge of the latest fox-trots, waltzes, &c.?

Why not a reception committee, from which incoming and timid members could obtain information, *without* being given the impression that they are transgressing?

For goodness sake let us have more of the "each for all, all for each" spirit amongst all ranks of the Institution, more *varied* social events, more works visits (say every month), and more warmth in the "chairman's best wishes to the meeting," &c.

This cannot be obtained by any suggestions, &c., from "Savoy Place," or anywhere else for that matter, but it *can* be obtained by intensive, individual, co-operation.

Members, Associate Members, Graduates, and Students, remember, we are all members of a great club, with a common bond (electricity), and unless we "pull together" our "club" will be a "wash out" as far as most of us are concerned.

Another Younger Member.

July 3rd, 1922.

More Opportunities for Business.

It is very interesting to note Mr. F. R. Cripps's remarks in the issue of your journal of June 23rd, upon the possibilities of development in the electric truck industry in this country.

There is no doubt that there is ample room for big developments in this direction, both from the truck builders' point of view and from that of supply companies.

Truck builders' prices and designs may be worthy of contempt and condemnation, but I am inclined to think that the lack of enterprise on the part of supply companies plays a very large part in the apparent slow progress of the electric truck as applied to road service.

I do not know whether your correspondent is connected with the electricity supply industry, but if so he may be

able to help forward the good work of electrifying the 50 hand-propelled milk trucks of Worthing, as well as the thousands of hand trucks used in other ways in that and other towns, if I make a few suggestions with regard to electricity supply facilities.

As one very greatly interested in the development of electrically-propelled vehicles, I am strongly of opinion that unless truck builders and electricity suppliers co-operate more closely together, the use of electricity on the road will not increase at the rate that it should do.

There are quite serious objections to the use of electricity for truck propulsion, which could be to some extent removed by the aforesaid co-operation and enterprise. The first and greatest objection is the excessive weight of the battery required to operate even a small vehicle over a reasonable distance. This causes high first cost and comparatively high running costs for the weight carried. The second objection is the time required for boosting and charging, which seriously reduces the effectiveness of the machine. The third objection is that the battery is usually very unskilfully attended to, resulting in high cost of repairs.

Supply companies could remove these difficulties if they could arrange service stations at suitable points in a town's area, where batteries could be quickly charged when needed.

This would involve the supply company in considerable expenditure for battery purchase and maintenance, which would be recovered from the user by way of hire charges under agreement. There is not a doubt that truck users would welcome such an arrangement, and a big expansion of business would result, owing to lower first cost and ease of operation.

Gavin Ralston.

Weybridge, *June 27th*, 1922.

Correct Recognition of Pioneer Work.

I have been deeply interested in reading, in your issue of April 28th, 1922, on page 587, the contribution of Mr. E. Kilburn Scott, on "Correct Recognition of Pioneer Work."

I am fully in accord with what Mr. Scott has had to say, and greatly regret that he seems to think that there was an attempt in my booklet to belittle Michael Faraday and his great work. There is, perhaps, no one scientist whom I hold in greater reverence than Michael Faraday. It is a matter of record, however, that Mr. Joseph Henry discovered the law alluded to, but did not publish it. Faraday did, however, a year or so later, and be it said to his credit that he never, so far as I am aware, laid claim to the originality of the law.

Michael Faraday, however, with his wonderful painstaking work, laid the foundation stone in countless other things electrical that this day we, your American cousins across the sea, regard as classics in the development of electrical science.

Robert Sibley,
Editor, *Journal of Electricity and Western Industry.*

San Francisco,
June 14th, 1922.

Electric Furnaces.

Reverting to your issue of the 9th instant and the letter therein contained from "Adena," the electric smelting of zinc is being carried on commercially to-day both in Europe and America, and we shall be glad to put your correspondent *au fait* with what can be done if he will communicate with us.

The Stobie Metallurgical Construction Co.
Victor Stobie.

Dunston-on-Tyne, *June 29th*, 1922.

THE SOUTH-WEST MIDLANDS ELECTRICITY DISTRICT.

Electricity Commissioners' Second Inquiry.

The Electricity Commissioners, under the Electricity (Supply) Act, 1919, held a second inquiry at the Council House, Birmingham, on June 29th, for the purpose of finally determining the area of the South-West Midlands Electricity District. It will be recalled that in September, 1920, the area was provisionally determined,* and a scheme was submitted to the Commissioners by the Corporation of Birmingham and the Shropshire, Worcestershire & Staffordshire Electric Power Co.† In November of last year the Commissioners held their first inquiry in Birmingham,‡ as a result of which they approved a scheme for improving the existing organisation for the supply of electricity in the provisionally-determined district.§

The sitting Commissioners were Sir Harry Haward (chairman) and Mr. A. Page (who were accompanied by Mr. J. C. Dalton and Mr. D. S. Cumberlege). Mr. H. H. Joy represented the Corporation of Birmingham and the Shropshire, Worcestershire & Staffordshire Electric Power Co.; and Mr. A. Tylor the railway companies in the area, and a number of local authorities were also represented. The inquiry was only of a few hours' duration.

In opening the second enquiry, the Chairman alluded to the suggestion of the promoters that the Urban District of Perry Barr should be included in the area. On June 16th the matter was brought to the notice of the Commissioners by a letter from the Birmingham Corporation, and the Commissioners immediately wrote to the Perry Barr Urban District Council and the adjacent authorities inviting observations on the proposal. The Corporation of Walsall had indicated no objection to the inclusion, though its letter was not quite clear; while the Perry Barr Council expressed the opinion that its area should be included because of its geographical position; and no objection was raised by the Sutton Corporation. The West Bromwich Corporation pointed out, however, that it had an order under which it supplied the Hamstead Colliery Co., which was in the district of Perry Barr; but, subject to that, it had no objection. As the matter stood at present, added the chairman, the district of Perry Barr was in the provisionally-determined North-West Midlands District, and the North-West Midlands Joint Conference had stated that it would inform the Commissioners later as to its findings in relation to such a detachment.

A representative of West Bromwich asked for the inclusion in the scheme of a clause to protect them with regard to the Hamstead Colliery supply, and it was further stated that, subject to this point, there was no objection to the inclusion of Perry Barr.

An objection from Worcester was next heard. Ald. Hill, on behalf of that city and borough, took exception to the proposal that his district should be under the jurisdiction of the Advisory Committee, on which it had no representatives. He contended that the Worcester district was distinct and separate in every respect from that which was formed by the Birmingham Corporation and the Shropshire Co., and it must be obvious that it was undesirable from the point of view of Worcester that the authorities of that city should have to be controlled, or submit schemes of extensions, or new erections, to a committee with which they had nothing to do.

The Chairman pointed out that this was an entirely new point raised by Worcester; it was not raised at the previous inquiry; but he did not see how they would be subject to such control from the Advisory Committee, which he hoped would be of assistance to Worcester.

The scheme was then examined clause by clause, and there was some discussion as to the advisability of including in the agreement clauses safeguarding certain rights, powers and privileges of several districts, including West Bromwich, Smethwick, Oldbury, and Dudley.

The Chairman: Is such a clause necessary? We do not want to encumber the scheme with unnecessary protective clauses. My own view is that such rights are not in any way interfered with by the scheme.

Representatives from West Bromwich, Smethwick, Oldbury and Dudley expressed the view that the insertion of such a clause was desirable.

As to supplies to railway companies, the chairman mentioned that at the first inquiry the companies, through Mr. Tylor, expressed their general satisfaction with the scheme, but since then they had submitted representations that they should be placed in the same position as authorised undertakings.

Mr. Tylor stated that in the area under consideration there was a district not under a joint authority; it was managed by existing companies and by the Birmingham Corporation; and the railway companies did not wish to be put in any worse position from the point of view of obtaining the supply they might need than they would have been in if there had been a joint electricity authority in the area. It might be convenient, he added, for the railway companies to take a supply in one area, and they might wish to use it outside that area.

After some discussion the chairman suggested a new clause in the following terms: "Any railway company desiring to take a supply of electricity from either the Corporation or the Shropshire Co. for the purposes mentioned in Section 5 of the Electric Lighting Act of 1909, on making application accordingly to the Corporation or the Shropshire Co., as the case may be, may, in the event of a refusal by the Corporation or the Shropshire Co. to apply for the necessary consent or order enabling such a supply to be given, make representations to the Commissioners thereon; and the Corporation or the Shropshire Co., as the case may be, shall comply with any directions of the Commissioners in the matter."

Mr. Joy observed that it would be a serious matter if the Birmingham Corporation were put under any obligation to supply railway companies practically without limit, and the matter would require very careful consideration.

Mr. Tylor, for the railway companies, said it was, of course, not suggested that there would be any collusion between the Birmingham Corporation and the Shropshire Co. to put obstacles in the way of the railway companies' supplies, but the railway companies wanted the machinery if the occasion should arise.

*Electrical Review, October 1st, 1920; p. 434.
†Electrical Review, August 5th, 1921; p. 175.
‡Electrical Review, November 25th, 1921; p. 906.
§Electrical Review, March 31st, 1922; p. 439.

Eventually the clause was accepted, subject to a lengthy addendum defining the terms as to supply and period of contracts, and certain limitations of the obligations of the promoters.

Mr. H. K. Beale, chairman of the Birmingham Electricity Supply Committee, thanked the Commissioners for the sympathetic way in which they had listened to the scheme, and mentioned that it was the first of its kind to be put before them.

In reply, the Chairman said the Commissioners had had regard to the very peculiar and exceptional circumstances of the district in agreeing to the scheme put forward.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

16,614. "Portable electric boring machines." W. J. Evans and E. F. Joyce. June 15th.
16,626. "Electrically-operated valves." J. P. Campbell, F. B. Holt, and Metropolitan-Vickers Electrical Co., Ltd., and L. Miller. June 15th.
16,642. "Electric heat radiator for therapeutic purposes." Quarzlampen Ges. June 15th. (Germany, June 15th, 1921.)
16,649. "Ignition systems for internal-combustion engines." Skywing Aircraft Corporation. June 15th. (United States, December 1st, 1920.)
16,663. "Apparatus for carrying electric torch, &c., upon velocipedes, &c." E. Clarke. June 16th.
16,664. "Two-piece electric glow lamp bulb and combination or separation of its parts." F. Lebner and I. Rosenstok. June 16th.
16,665. "Telephone transmitters, &c." G. Freeman and A. H. Kirby. June 16th.
16,668. "Apparatus for automatically cutting off gas or electric supplies at a given time." H. S. Jones. June 16th.
16,671. "High-tension magneto-electric machines." W. T. Turner. June 16th.
16,677. "Anti-vibration fittings for electric lamps, &c." F. W. Thorpe and Veritys, Ltd. June 16th.
16,682. "Electric transforming machinery." Electric Control, Ltd., and O. Ellefsen. June 16th.
16,701. "Electrically-operated illuminated signs." S. T. Hosken. June 16th.
16,702. "Safety devices for electrical apparatus." Norwest Electrical Manufacturing Co., Ltd., and A. N. Penman. June 16th.
16,709. "Insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). June 16th.
16,713. "Electric generating sets." A. A. Price. June 16th.
16,716. "Attachment to valve detectors for wireless telegraphy, &c." P. G A. H. Voigt. June 16th.
16,717. "Rotating electric machines." O. Morduch. June 16th.
16,718. "Wireless direction-finding apparatus." C. Davis. June 16th.
16,733. "Trucks for tramway or railway vehicles." Peckham Truck and Engineering Co., Ltd., S. Thomas. June 16th.
16,747. "Electric welding." Soc. Anon. Electricité et Electromécanique. June 16th. (Belgium, May 11th.)
16,750. "Xylophone." D. Vigano. June 16th.
16,757. "Electrodes for welding, &c." W. W. Wilson. June 17th.
16,758. "Telegraphic and telephonic devices." A. R. Angus. June 17th.
16,776. "Electro motors." J. H. Parr. June 17th.
16,782. "Glass front for motor-car searchlights." C. Zeiss (firm of). June 12th. (Germany, June 17th, 1921.)
16,791. "Electric fuse and switch contact clips and cable blocks." C. A. Wootton. June 17th.
16,794. "Oscillatory electric circuits." T. G. Hodgkinson. June 17th.
16,796. "Electric incandescent arc devices." British Thomson-Houston Co., Ltd. (General Electric Co.). June 17th.
16,797. "Overhead switches for electric trolley conductors." L. Vallino. June 17th. (Italy, June 18th, 1921.)
16,804. "Devices for protecting and locating masses of dissimilar electric conductivity in the earth." R. Ambronn and Erda Ges. Fur Wissenschaftliche Erderforschung. June 17th. (Germany, June 17th, 1921.)
16,821. "Dynamo-electric machines." Sir C. A. Parsons and J. Rosen. June 17th.
16,826. "Electrical metal vapour apparatus." Siemens Schuckertwerke. June 17th. (Germany, June 18th, 1921.)
16,827. "Receiving arrangements for wireless telegraphy and telephony." J. C. W. Drabble and L. G. Preston. June 17th.
16,833. "Anti-vibration devices for electric flex and flexible gas tubes." H. Willis. June 19th.
16,838. "Safety spragging appliance for colliery trams, &c." I. D. Evans. June 19th.
16,839. "Electric lead terminals and manufacture of same." W. Horton and W. Preston. June 19th.
16,854. "Inductance motors." T. F. Wall. June 19th.
16,882. "Exhibiting advertisements, &c." H. Junghans. June 19th.
16,888. "Movable measuring system for electric instruments." Naamlooze Vennootschap Instrumentfabriek enhandel voorheen, P. J. Kipp and Zonen. June 19th (Holland, July 28th, 1921.)
16,891. "Protection of electric supply cables." W. A. Gilbert. June 19th.
16,893. "Systems of electric motor control." British Thomson-Houston Co., Ltd. H. C. Hastings and G. O. Watson. June 19th.
16,901. "Electric multiple safety devices." P. Meyrowitz. June 19th.
16,921. "Means for recording and reproducing sound vibrations." A. J. Garrod. June 19th (Australia, June 17th, 1921.)
16,930. "Installations of incandescent cathode rectifiers." Naamlooze Vennootschap Philips' Gloeilampen fabrieken. June 19th. (Holland, June 22nd, 1921.)
16,934. "Motor controlling apparatus." Waygood-Otis, Ltd. (Otis Elevator Co.). June 19th.
16,935. "Multi-voltage system of control for elevators." Waygood-Otis, Ltd. (Otis Elevator Co.). June 19th.
16,941. "Visual indication devices." J. F. Bruce. June 19th.
16,947. "Automatic current regulators." W. Langdon Davies and A. Soames. June 19th.
16,974. "Indicators for theatre, &c., seats." S. Lees. June 20th.
16,992. "Electricity generator." R. V. Farnham. June 20th.
17,009. "Electrical apparatus for high-frequency circuits." A. H. S. MacCallum. June 20th.
17,014. "Methods of obtaining visible temperature records." British Thomson-Houston Co., Ltd. (General Electric Co.). June 20th.
17,015. "Plastic compositions." British Thomson-Houston Co., Ltd. (General Electric Co.) June 20th.
17,016. "Electric butt welding machine." J. A. Bancroft. June 20th.
17,026. "Electric transformers." A. G. Ellis and Metropolitan-Vickers Electrical Co., Ltd. June 20th.
17,035. "Portable electric lamps." R. C. Kay. June 20th.
17,042. "Electrically-propelled mining machines." Sullivan Machinery Co June 20th. (United States, June 20th, 1921.)
17,053. "Telephone systems." Siemens and Halske Akt. Ges. June 20th. (Germany, January 21st, 1921.)
17,069. "Automatic telephone switching systems." W. Aitken. June 21st.
17,078. "Flexible current collector for metallic netting type of overhead electric conductor." L. A. Hackett. June 21st.
17,093. "Means for controlling electric circuits of automobiles." H. J. Lee. June 21st.
17,095. "Apparatus for wireless signalling, &c." A. Onwood. June 21st.
17,096. "Support for electric conductors." G. B. R. Pimm. June 21st.
17,101. "Ozone and electric therapeutic apparatus." J. R. Quain. June 21st.
17,105. "Advertising device for road vehicles." J. Robertson. June 21st.
17,113. "Electric resistances." H. R. B. Hickman. June 21st.
17,121. "Dynamo-electric generators." G. McAlpine and A. K. Toulmin Smith. June 21st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

33,509. "High-tension electric ignition devices for internal combustion engines." R. Bosch Akt. Ges. February 19th, 1920. (159,165.)

1921.

123. "Resistance grids." W. H. Keller. January 3rd, 1920. (156,193.)
1,478. "Fire alarm signalling apparatus." W. H. Garrison. May 10th, 1915. (157,772.)
2,576. "Electro-magnetic wave transmitting systems." O. C. Roos. January 19th, 1921. (181,047.)
3,928. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). February 2nd, 1921. (181,051.)
4,218. "Discharging devices for electric furnaces." C. T. Thorssell and E. C. Beck Friis. February 4th, 1921. (181,055.)
5,223. "Thermo-electric heat accumulating cooking stoves." S. Sacerdote and S. Christiani. February 15th, 1921. (181,063.)
6,445. "Rectification of alternating currents of electricity." S. A. Pollock. February 25th, 1921. (181,070.)
6,513. "Electric welding." Metropolitan-Vickers Electrical Co., Ltd. March 23rd, 1920. (160,768.)
6,901. "Sensitive plates and films for X-ray photography." N. E. Luboshey. March 2nd, 1921. (181,087.)
7,029. "Wireless telegraphy." G. M. Wright. March 3rd, 1921. (181,095.)
7,037. "Cable for conveyance of electrical energy with graduated insulation." L. N. Reddie (Soc. Pirelli & Co.). March 3rd, 1921. (181,097.)
7,303. "Earthing and bonding clip for electric circuits." C. J. H. Stevens. March 7th, 1921. (181,112.)
7,325. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., and F. W. Davis. March 7th, 1921. (181,115.)
7,326. "Automatic or semi-automatic telephone exchanges." Relay Automatic Telephone Co., Ltd., G. H. Bryant and B. B. Johnson. March 7th, 1921. (181,116.)
7,327. "Telephone systems." Relay Automatic Telephone Co., Ltd., and F. M. Ward. March 7th, 1921. (181,117.)
7,328. "Telephone exchanges." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. March 7th, 1921. (181,118.)
7,329. "Automatic and semi-automatic telephone exchanges." Relay Automatic Telephone Co., Ltd., F. M. Ward, and B. B. Johnson. March 7th, 1921. (181,119.)
7,330. "Automatic and semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. March 7th, 1921. (181,120.)
7,358. "Systems of and apparatus for ignition for internal combustion engines." British Thomson-Houston Co., Ltd., and A. P. Young. March 9th, 1921. (181,127.)
7,678. "Electrical measuring, indicating, or relay apparatus for polyphase circuits." Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1920. (161,167.)
7,699. "Telephone systems." Siemens and Halske Akt. Ges. April 15th, 1920. (161,933.)
7,954. "Automatic and semi-automatic telephone systems." W. Aitken. March 14th, 1921. (181,134.)
9,471. "High- and low-frequency telephone systems." Ges. für Drahtlose Telegraphie. April 1st, 1920. (Addition to 156,555.) (160,820.)
9,524. "Electrical switches." E. Dobson and Foster Engineering Co., Ltd. March 30th, 1921. (Addition to 166,592.) (181,166.)
9,877. "Electric burglar alarms." O. Kirk. April 4th, 1921. (181,171.)
9,919. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. October 22nd, 1920. (170,586.)
9,958. "Electro mechanical lamps." P. Blot Garnier and G. Chevalier. April 4th, 1921. (181,173.)
10,597. "Amplifiers for telephone circuits." Soc. Industrielle des Téléphones (Constructions Electriques Caoutchouc Cables). November 18th, 1920. (171,664.)
10,958. "Dynamo-electric lighting generators for motor cycles and the like." S. L. Price. April 14th, 1921. (181,187.)
11,666. "Electric heaters for liquids." W. Hayhurst. April 22nd, 1921. (181,196.)
11,934. "Rotary electric current distributors for ignition purposes in internal-combustion engines or the like." H. L. Pitt. April 26th, 1921. (181,200.)
12,105. "Telegraph systems." Western Electric Co., Ltd. April 27th, 1920, (162,616.)
12,154. "Method and apparatus for laying electric wires in conduits or the like." L. Gregger and F. Zachhuber. November 19th, 1920. (171,665.)
12,460. "Means for obtaining high-voltage electrical impulses." N. W. McLachlan. April 30th, 1921. (181,208.)
13,804. "Electrically-controlled locks." E. G. Mitchell and H. France. May 17th, 1921. (181,221.)
14,795. "Electric switches." H. A. Gill (J. W. Zander & Co.). May 27th, 1921. (181,231.)
15,846. "Combined plug receptacles and switches." British Thomson-Houston Co., Ltd. (General Electric Co.). June 8th, 1921. (181,237.)
19,348. "Gas voltameter." Siemens Schuckertwerke Ges. September 4th 1920. (Addition to 146,902.) (168,864.)
20,435. "Apparatus for producing imitation lightning for theatrical and like purposes." Schwabe & Co. March 1st, 1921. (176,310.)
21,347. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). August 11th, 1921. (181,265.)
21,466. "Thermionic valve modulating systems for signalling purposes." Western Electric Co., Ltd. August 17th, 1920. (Addition to 133,366.) (168,058.)
21,785. "Method and apparatus for signalling by means of electric lamps." L. McMillan. September 28th, 1920. (169,689.)
24,641. "Electric pocket lamps." B. Rogge. September 22nd, 1920 (169,439.)
25,247. "Insulators for electrodes of electrical gas purifiers." Lodge Fume Co., Ltd. (Metallbank and Metallurgische Ges. Akt. Ges.) September 23rd 1921. (181,284.)
34,454. "Electric switches." J. B. Tucker. February 28th, 1921. (Divided application on 179,722.) (181,299.)

1922.

7,852. "Telephone systems." Automatic Telephone Manufacturing Co. Ltd. April 26th, 1920. (Divided application on 162,297.) (177,178.)

THE

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THE ELECTRICITY SUPPLY BILL.

THE Electricity (Supply) Bill is now within sight of its goal. It has passed through the House of Commons practically to the last stage, and we can, therefore, now regard the Bill as being in its final form. The natural questions at such a juncture are: "How do we stand now? What is the gain or loss to the industry? Will the industry be better or worse off?"

Fortunately we can reply to these questions with confidence; the passing into law of the Electricity (Supply) Bill will be thoroughly to the good of the industry.

In the first place, there is the negative side. It means the end of electricity supply legislation of a general kind—at least, that is what the Government practically guarantees. Mr. Neal, when introducing the Bill into the House of Commons, said that after this Bill—quiescence. We shall have legislative rest—"for an aeon or two," as Kipling phrases it. This in itself is a gain; the uncertainty of the last two years or so as to what the second Bill was to contain has had almost a paralysing effect on the industry. Now that uncertainty is laid to rest for good.

In the second place, the contents of the Bill are good. Everyone must admit that the Electricity Commissioners have done their best to be fair to everybody and to give every poor dog, not only a bone, but the particular bone he asked for. The power supply companies, in fact, have got more than a bone, they have got nearly a whole joint to themselves. Further, it must be remembered that the Electricity Commissioners had an awkward task. They were given a most rudely dismembered torso to work up into something of a complete and animated figure. That they have done it with success everyone must agree. Note what they have done:—

They have provided the purseless Joint Electricity Authorities with financial powers. These powers are now so hedged round with safeguards that the bogey of "municipal extravagance" can no longer haunt even the most sensitive of minds. Even Mr. George Balfour must feel that he can now sleep in peace, secure that no "City Fathers" can surreptitiously pile up "colossal expenditures." This means the momentous fact that the work of forming Joint Electricity Authorities can straightway pass to fruition.

Then as to the many bones to poor dogs. Let us consider them seriatim: Someone said that to base the apportionment of the expenses of the Commissioners on the kWh generated (as in the 1919 Act) was not fair: it should be based on kWh sold. "Certainly," said the Commissioners, and made the alteration. The electricity supply companies wailed: "How can we develop when we are to be cut off in the flower of our youth at 12?" The compassionate Commissioners met their troubles by a provision for an extension of tenure to be granted, where, of course, such continuance is merited. "How about maximum prices?" queried other supply companies. "we can only get revision every five years." To which complaint the municipalities added "And we cannot get revision at all." So the Commissioners added a clause giving equal privileges to the municipal undertakings and reduced the revision period for everybody to three years. The power companies, too, were alarmed at some possible incursions into their rights and privileges—so a fully protective clause was included so that no Joint Electricity Authority should trespass in the area of a power company. For small out of the-way undertakings, too, provision is made for railway companies to give a supply, but here, too, the Commissioners have given full weight to the suscepti-

bilities of all other suppliers, so that the railway companies shall not infringe on any existing rights of supply. Lastly, even the staffs are not left out in the cold, and provision is made which considerably extends the scope of the section of the 1919 Act, which, it will be remembered, gives compensation to officials or workmen for deprivation of employment through any reorganising schemes coming into being.

Altogether it must be confessed that the Commissioners have given everybody at least something.

Finally, when we take into consideration the conflicting interests that the Bill has to deal with, and the political atmosphere in which it was finally moulded into shape, the industry must be congratulated on getting a very passable measure, and the sincerest thanks of the industry are due to the Electricity Commissioners for the obvious endeavours which they have made to help the industry as a whole and to meet the individual necessities of the various separate sections. And we are sure that the industry cannot express its appreciation more to the satisfaction of the Commissioners than by taking full advantage of the provisions of the two Acts (when this Bill is finally passed) to reorganise and develop by way of mutual co-operation.

Increasing Trade Inquiries.

Mr. A. A. Campbell Swinton, F.R.S., as chairman of Messrs. Crompton & Co., Ltd., told shareholders of that company last week that it was very difficult to forecast the results of the present year's operations. Most industrial authorities find it so, but that there is a revival of trade activity is proved by the fact that the inquiries received since the commencement of the financial year have been larger in number than during any similar period of the company's history. Unfortunately there is still a tendency to hold up the placing of actual orders, probably owing to the nervousness which is inevitable while unsettlement in Ireland and on the Continent cast their depressing influence over affairs generally. Mr. Campbell Swinton, however, regards the increased inquiry for quotations as pointing to the coming improvement in trade, while railway electrification and hydro-electric prospects, and the extending demand for electricity for lighting, power, and domestic purposes as reflected in the returns of electric supply undertakings, are features which are cheering to all our hearts.

Though the electrical industry has suffered less than others in the trade depression, it stands to gain much by, and also can assist to bring about, trade revival. Every sign of the approach of that revival is eagerly watched for and warmly welcomed, but the study of world conditions indicates that the return of general world trade to anything like normal conditions will be, as Mr. Swinton remarked, a slow process. There are, however, large electrical schemes which will proceed independently of extensive trade revival, yet will themselves directly promote increased activity in other trades, thereby hastening the general trade revival within the United Kingdom. The electrical engineering industry has an enormously increased productive capacity, and sorely needs that revival of Empire and foreign trade, for the want of which most of our industries are languishing to-day. Only by full activity of the works and economic production can the large capital invested in the extended electrical works be made to yield a reasonable return.

It will be noticed in the report of the General Electric Co., Ltd., which appears elsewhere in this issue, that while the year has been a very trying one in many particulars—one of "difficulties and disappointments"—the company records as a satisfactory feature of the year's trading that the actual number of transactions has not been reduced; they have, however, been of smaller amounts. There has thus been great activity, but it has been activity under the influence of restraint or enforced limitation. The demand is there waiting to mature. There is evidence of a desire on the part of the purchaser to go forward—but not too far until things are better.

Proposed Visit to Gennevilliers.

In our last issue (p. 2) we announced our intention to organise a visit of British engineers to the new 200,000-kW power station at Gennevilliers, near Paris, towards the end of September next, and invited communications from readers interested in the proposition. Replies are flowing in steadily, and we hope soon to be in a position to place more precise particulars of the arrangements before our readers; at the moment the main thing is to ascertain approximately the size of the party, in order to enable us to proceed with the preliminary negotiations, and we again invite those who are favourably disposed towards the scheme to write to us without delay. For the convenience of those who overlooked the announcement in our last issue, we repeat that the present basis of the scheme is to leave London on Friday, September 22nd, and return on the following Monday night, with the option of extending the visit to Grenoble and other places of interest. In our "Book Notices" we give particulars of a brochure issued by our contemporary, *La Revue Industrielle*, describing the Gennevilliers power station very fully.

Lead.

Lead is slowly getting into an easier position. There has been far too much manipulation of one kind or another witnessed in this market, and the result is that consumers have lost confidence and have been unwilling to buy further ahead than absolutely necessary. Even those dealing well forward frequently found themselves, when the time for delivery arrived, without the lead they had purchased, and forced to pay exorbitant premiums for spot metal to keep their works going. The market is now so closely controlled, however, that consumers are powerless, and not a few of them turn longing eyes back to the days when they had some sort of a run for their money. Assisted by the long-continued strike in Australia, and by the reduced output in Spain, partly due to labour troubles there, it has not been difficult to control supplies and maintain prices. Nevertheless, there is a strong impression that in Spain, at all events, the resumption of work was delayed for market purposes. Certainly, the lead market is to-day less free from manipulation than within living memory. Whilst supplies have been cut down greatly by causes mentioned above, consumption has also been greatly reduced, for nobody would pay the prices demanded for lead products except upon the most urgent spurring of necessity. The growing practice of shipping lead to outports instead of to London, apparently merely in order to keep the London market short of metal deliverable against Metal Exchange contracts, has indeed been very unfortunate. The broad tendency of prices from now onwards should be downward if the market is allowed to find its natural level.

Copper.

Copper, after a long period of post-war disorganisation, has by painful degrees worked itself into an economic position again, and while minor fluctuations are to be expected, the metal stands to-day at a very reasonable price. The huge stocks of scrap which for a couple of years or more weighed heavily upon a market already encumbered with an enormous surplus of virgin metal, have been dispersed to a great extent, and from now onwards consumers will have to rely mainly upon new production. The stocks in America of refined metal have been much reduced, and after a prolonged period, during which production virtually ceased, we find mines in all parts of the world resuming output. It is expected that by the time this new metal gets on to the market in the shape of refined copper, further inroads will have been made upon the remaining stocks, which are already down to strictly manageable proportions. Trade buying has been gradually pointing higher for

some little time, particularly in America, but even Europe is beginning to show more vitality, the only doubtful spot being Germany. That country has absorbed large quantities of copper since the war—far more, indeed, than appeared possible with her ruinous exchange; and if steps are to be taken to arrest the decline in German currency and the mark appreciates, the effect may be to cut off German buying of imported commodities. In the United Kingdom, conditions are certainly brighter. Whereas the mainstay of the market has been the cable and general electrical trades, there are now definite signs of returning activity amongst the brass founders and engineers and other big consumers, and there is no doubt copper can only be considered as reasonable in price to-day. It looks as if for a long time to come fluctuations will be moderate.

Form Letters for Jobs.

We have the utmost sympathy with the unlucky ones who find themselves out of employment, and especially with those who put forth every effort to "get into collar" again; the following remarks are made both in their interest and in that of employers whom they approach. It has been brought to our notice that large numbers of applications for appointments are being received by a firm which at present has no vacancies to fill, but which makes a point of courteously acknowledging such communications, and doubtless other firms are having a similar experience. These applications are all couched in the same literary form, and indeed, in many cases have been written with the same typewriter, whence it is inferred that someone is acting as scribe for clients who are seeking employment, doubtless for a fee.

We have no fault to find with this practice, which seems to us as legitimate as engaging a solicitor to conduct one's legal affairs, but obviously no useful purpose is served by directing a stream of applications to a firm which is accustomed either to promote junior members of its staff to fill vacancies, or to advertise a post in the trade journals; the firm is put to some trouble in replying to such letters, and, what is still more regrettable, the purse of the applicant is lightened to no purpose.

Our suggestion, therefore, to unemployed engineers is that they should not distribute their applications *en masse* without discrimination, but should see to it that the firms approached are only those which are thought to be in need of additional staff. In any case, it is useless to dispatch form-letters in quantity to the same address—they are detected at once and discredited by their common origin.

German Reparations in Kind.

It is only a few months since loud protests were made in Italy concerning a German proposal to deliver electrical machinery and plant to Italy on reparation account. In the end suggestions were put before the Reparations Commission that the deliveries should not take the form proposed, but should consist of raw and semi-finished materials for conversion into manufactures by Italian works. A similar problem of reparations has now arisen in France, where the Council of Ministers has decided to forward to the Reparations Commission a programme of a first section of public works to be executed by Germany under the Treaty of Versailles. The works comprise, in addition to the French portion of the Channel Tunnel and two parts of the North-Eastern canal, those relating to the bringing into use for hydro-electric purposes of the Rhone, the Truyère and the Dordogne at a total expenditure of 4,824,000,000 fr. It is proposed that the works should be executed as ordinary public works under the direction of French engineers. But the contractors would be Germans, and they would provide their own personnel and plant, and have to pay the workmen. It is further provided that about one-third of the deliveries (supplies) required shall be reserved to French industry, the third applying to the total deliveries, and not to each particular undertaking. Thus, for instance, the supplies for the Truyère and the Dordogne will be called for wholly from French industry. It is perhaps too early for French industries to have yet realised the full significance of the scheme, which a Paris contemporary publishes without comment. It is not quite clear whether the works in connection with the three rivers in question also include the provision of the hydro-electric plant, but apparently this is the case. If so, a strong agitation against this part of the scheme may be expected on the part of the French electrical industry, and for that matter influential interests in the industrial railway branch have already made a protest against the projected allocation of works to German industry.

Tube Railway Risks.

In the early days of underground electric railways some disastrous fires took place, including two in this country, which directed public attention to the special risks inherent to the operation of a tube railway; but for many years, thanks to the precautions that were taken in consequence thereof, there has happily been almost complete freedom from fires in tube railways. The fatal accident which occurred on the New York underground railway on July 6th reminds us that the risk cannot be entirely eliminated, but if we are to believe the reports in the daily Press, the consequences of this mishap might have been trivial but for a most unfortunate choice of fire-extinguishing apparatus.

According to the correspondent of the *Morning Post*, a short circuit gave rise to a small fire, to which the driver applied a chemical fire extinguisher; an explosion took place, followed by an outburst of noxious gases, which led to a panic, and 170 passengers were overcome by the fumes, three being killed and many injured. It is stated that the chemical fire extinguishers gave off phosgene gas, one of the deadly gases employed in the war.

It is easy to be wise after the event; but it is impossible entirely to acquit the responsible authorities of blame for permitting the use of such an objectionable and dangerous "safeguard." Absolutely innocuous substances are readily available, and we trust that tube railway managers everywhere will see to it at once that they are employed in the place of this compound.

Railway Electrification.

The inauguration of the new L. and N.W. electric train service between Euston and Watford marks the completion of a project which has been in hand for many years, but which has been delayed by the war; particulars of the very difficult operations involved are given elsewhere in this issue. Congratulations are due to the company on the progressive spirit in which it has planned and carried out this important work.

Sharply contrasted with the policy of the L. and N.W. Co. is that of the Great Eastern Railway Co., which has had in contemplation a great scheme of electrification for some years, but has apparently shelved the matter on the excuse that the existing steam service has been very greatly improved, and is now more efficient than any other of its kind in the world. But it is only a postponement of the inevitable, for electrification of the suburban services must surely come.

It is to be regretted that whilst almost all the other railway companies with London termini are pushing on with the electrification of their suburban lines, the Great Eastern, which handles such an enormous traffic at Liverpool Street, should be content with a makeshift policy. In every case without exception, we believe, where electricity has been substituted for steam, the immediate result has been an increased traffic which has amply justified the outlay from the commercial point of view the technical advantages of the change are not in question—the passengers have benefited by a more expeditious and comfortable service, and the pollution of the atmosphere has been appreciably reduced. We trust that no long time will elapse before the G.E.R. makes up its mind to fall into line with modern practice.

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NEW PLANT AT WEST HAM.

After a long period of vicissitudes, the West Ham Electricity Department has been able to put some badly-needed new plant into operation, the formal inauguration having taken place yesterday (Thursday). The undertaking is an important one, West Ham being within the Port of London; in fact, its proximity to the Metropolis tends to obscure its importance and the fact that it is the largest county borough in the kingdom. The electrical history of West Ham properly dates back to the early 'nineties, when a small plant consisting of two horizontal Crossley gas engines, each driving a 15-kW Brush-Vienna two-pole dynamo, supplied lighting energy to the public hall and library and a few adjacent buildings. An Electric Lighting Order was obtained in 1892, and five or six years later a single-phase, 50-cycle system was instituted. Generation was at 2,000 V, and the distribution voltage was 100, the plant having a capacity of 675 kW. Extensions soon became necessary, and in 1899, under the direction of Mr. J. J. Steinitz, and his assistant, Mr. J. Kerr Bock, two 1,200-kW Ferranti engines and alternators were installed, the alternators being of the copper-disk armature type. About this time it was discovered that an unlimited supply of electricity for 6d. per week was not remunerative to the undertaking! During 1902 and 1903 a useful load in the form of municipal tramways was added to the system, and in 1904 the Canning Town station with 5,900 kW of plant was opened. The low charges of West Ham are almost proverbial, and the first move in this direction (apart from the 6d. per week system already referred to) was the reduction of rates to 3d. per unit for lighting and 1d. for power, in 1906. The demand continued to grow, and additions were made to the plant from time to time, until in 1909 a contract for a bulk supply to the Port of London Authority was entered into. This necessitated further extensions soon afterwards; the P.L.A. is now one of the largest of the undertaking's customers. West Ham was fortunate enough to install some new plant immediately prior to the war, otherwise the ban placed on extensions during that period would have been felt more severely by the undertaking. As it was, although the lighting load fell off, the amount of electricity required for power purposes increased, and although the engineer (Mr. J. W. Beauchamp) managed to maintain the machinery in commission, the plant was sorely overtaxed. Upon succeeding Mr. Beauchamp in 1919, the present engineer, Mr. F. W. Purse, interviewed the Electricity Commissioners, and obtained their approval of the installation of a 10,000-kW turbo-alternator, together with the necessary condensing plant, boilers, and auxiliary apparatus. Tenders for this plant were obtained, and contracts placed in October, 1919. It was anticipated that the plant would be in service before the end of the following year, but owing to numerous labour troubles, nearly two years were lost, and had it not been that the prevailing industrial depression caused a lessening of demand, the undertaking would have been faced with serious consequences.



Fig. 1.—General View of Station, Showing Cooling Towers and Ponds.

The existing engine room and boiler house had ample space for accommodating the generating plant and boilers, but a new pump house, switch-room, filter house, and sub-station were required, and these, together with the foundations for the new plant and cooling towers, were all carried out by direct labour under the direction of the borough engineer, Mr. J. G. Morley.

Considerable modifications of the circulating water system were required to ensure that the necessary amount of water was continuously available. The water is taken from the River Lea, and the supply was somewhat restricted at low tide. To overcome this difficulty, cooling towers, made by the Davenport Engineering Co., Ltd., have been erected on the existing ponds, which have a capacity of 1½ million gallons. Three towers have been installed: these are seen in the general view of the works (fig. 1). There is ample accommodation for five more when they become necessary. By combining the use of the cooling towers at low tide with the river during the remainder of the time, a full supply of cooling water will be ensured at a minimum temperature throughout the year. The towers are 85 ft. long by 40 ft. wide post centres, the chimneys are 69 ft. high,

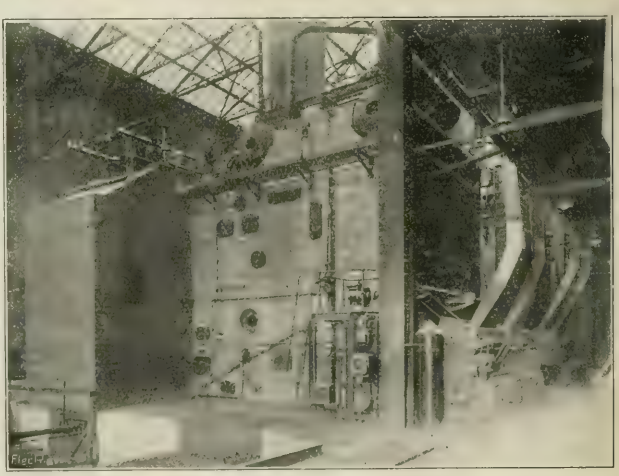


Fig. 2.—Boiler House.

and the height of the water inlet 18 ft. 6 in. above the foundations. Each tower can deal with 350,000 gal. of water per hour, reducing it from 93 deg. F. to 80 deg. F. The surface condensing plant was made by Messrs. Hick, Hargreaves & Co., Ltd., and is capable of condensing 116,000 lb. of steam per hour and maintaining a vacuum of 28½ in. when supplied with cooling water at 70 deg. F. The cooling surface amounts to 17,000 sq. ft., the amount of cooling water required being 875,000 gal. per hour. The 21-in. circulating pumps are electrically driven, and operate against a head of 50 ft., running at 720 r.p.m. The condensate extraction pump has a capacity of 16,600 gal. per hour, and extracts and discharges the condensate against a head of 20 ft. A Hick-Breguet "Ejectair" is fitted; this has a capacity of about 90 lb. of dry air per hour, and is operated by two steam jets in series, with an intermediate condenser, this arrangement providing a high degree of air extraction combined with low steam consumption. The plant is put into operation by the opening of the steam valve to the two jets and the closing of the switches controlling the circulating and extraction pump motors. The amount of steam used by the jets is only about 1 per cent. of that used by the main set.

The steam-raising plant, part of which is seen in fig. 2, consists of two Stirling boilers and Green economisers, complete with chain-grate stokers, and both forced and induced draught plant. The boilers are of the "Tri-drum" type, fitted with integral superheaters; each boiler has 35 tubes in the width and 15 from front to rear, giving a total of 525 main tubes. The heating surface totals 7,350 sq. ft. in each boiler, and each superheater has a heating surface of 1,580 sq. ft. Each boiler is fitted with two Babcock & Wilcox chain-grate stokers 14 ft. long by 8 ft. wide, giving a total grate area per boiler of 224 sq. ft. The economisers each have 320 tubes 11 ft. 6 in. long and 4½ in. in diameter. The working pressure is 210 lb. per sq. in. The superheater brings the steam temperature up to 642 deg. F. The normal evaporation is 52,000 lb. of steam per hour, but the boilers are capable of producing 65,000 lb. on peak loads. The forced and induced draught fans are of Messrs. Davidson's "Sirocco" design; the former are 30-in. fans, each driven by a 26-h.p. motor, and the latter are 70 in. in diameter, driven by 65-h.p. motors. The chimney is 8 ft. 6 in. in internal diameter, and has an effective height of 110 ft. The ashes, &c., are discharged into wagons below the boilers. The boilers can be fed with cold water or with hot water from the economisers. Crosby feed regulators ensuring a constant water level within the drums.

The generating plant (figs. 3 and 4) consists of a turbine by Messrs. Belliss & Morcom, direct-coupled to a 10,000-kW Vickers alternator. The turbine is of the eight stage impulse type, running at 3,000 r.p.m., and is one of the first machines of its size made to run at this high speed. The design of this turbine is similar to that of the smaller sizes, but the governing gear is of special design. When the speed rises above the predetermined limit, the valve of an oil relay is opened, permitting oil to flow in and operate a piston which partially closes the steam inlet. By means of links attached to the lever operating the steam valve, the turbine is maintained at its correct speed, and the relay valve at neutral, although the steam valve is in a different position. The emergency governor consists of an eccentric steel ring normally kept in central position on the tail shaft by a spring. At a fixed overspeed the centrifugal effect of the unbalanced ring overcomes the compression of the spring, and the ring moves outwards striking a lever which operates the oil relay above described. This operation can be effected by hand at any time by pulling out a rod. The whole of the gear is enclosed in a circular box at the front end of the turbine, and is open to inspection by the removal of the front cover. The steam pipe is 16 in. in diameter, and is suitable for passing some 150,000 lb. of steam per hour. In this pipe is a steam-metering apparatus supplied by Messrs. George Kent, Ltd. Forced lubrication is provided by a pump supplying oil to the governor relays and bearings, at 10 lb. per sq. in., through a large duplex cooler fitted in the basement. The oil drains back to the front end bedplate, which acts as a reservoir. The turbine is connected to the generator by a flexible coupling. The alternator shaft carries a flange, to which is bolted a sleeve. This sleeve fits over, with a slight clearance, a muff mounted on the tapered end of the turbine shaft. The drive is effected by means of steel pins lying in grooves in the opposing surfaces; these pins are retained in position by a ring at the end of the sleeve.

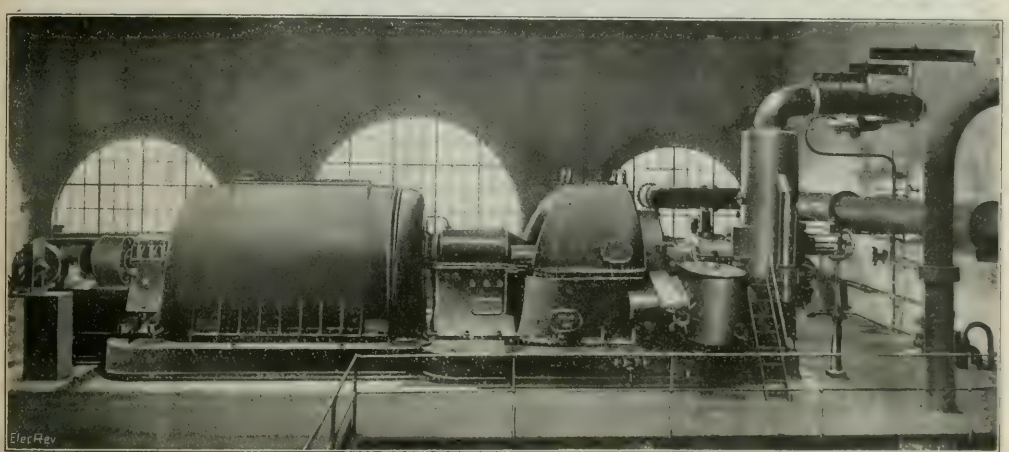


Fig. 3.—10,000-kW, 3,000-r.p.m. Belliss & Morcom-Vickers Turbo-Alternator Set

The generator is a two-phase machine designed to give its rated output at a power factor of .75. The generated pressure is 6,600 V per phase. The two phases have a common earthed lead; the pressure between terminals is therefore 9,300 V. The stator winding was tested at various stages of its manufacture, and withstood a final test of 20,000 V to earth. The generator is of the totally-enclosed type, with cooling air delivered from below at each end of the stator, and discharged both upwards and downwards from the centre of the machine. The cooling air required amounts to 40,000 cu. ft. per minute; this is supplied by a motor-driven blower. The air is drawn from an exterior filter house, in which are installed duplicate air washers supplied by the Servant Engineering Co., Ltd. The blowers are also duplicated, and there is still sufficient space for another air-washer and blower. Emergency dampers are provided to automatically cut off the air supply in the event of a

breakdown, which would restrict damage, and warning devices at the switchboard indicate whether the dampers are closed or open.

The stator of the alternator consists of a one-piece cast-iron housing carrying the laminated core, which is built up of high-grade steel laminations carried on heavy dovetails forming part of the frame. The core is clamped tightly between heavily-ribbed cast-iron end plates brought into position by hydraulic pressure. It is ventilated by means of numerous axial passages, which allow the air to play upon every individual lamination. The air flows from each end of the machine along these passages, and finally escapes into the stator frame by means of radial ventilating ducts built into the core structure. The stator coils are carried in open slots, and the embedded portion of the stator is insulated with mica applied under heat and pressure. The resulting mica sheath is so dense and solid as to give the impression of a metallic sheath when struck. The part of the stator windings external to the core is also insulated with mica, and here a certain proportion of treated silk fabric is used to facilitate the application of the mica to the curved parts of the conductor. The end windings are retained in position by a series of clamp plates and heavy bolts, securely stayed to the frame. The stator complete, with the exception of the end bells, weighs 45½ tons, but in spite of this it was built at Messrs. Vickers's River Don Works and transported as a finished article to the site.

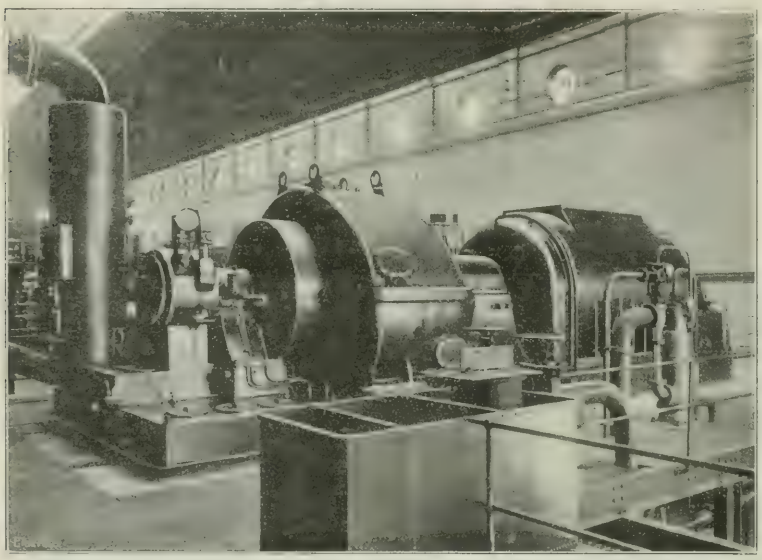


Fig. 4.—Steam End of Turbo-Alternator Set.

The rotor body is a special forging which received special heat treatment, the works having facilities beyond the ordinary for this purpose, owing to its production of large gun forgings. Tests showed an unusual uniformity of structure. The rotor windings are insulated throughout with solid mica, the insulation between the copper and the body of the rotor consisting of hard-pressed mica cells solidly embedded in the slots without the interruption of any ventilating ducts. The turns are insulated from one another by solid mica, and similar insulation is provided at the top of the slot and in the end bells. Leads are brought from the windings to steel slip rings, one at each end of the shaft, and are embedded in slots in the shaft and held by metal wedges. The total weight of the rotor is 12½ tons. The set is completed by a direct-coupled exciter controlled by a Brown-Boveri automatic voltage regulator.

In spite of the size of the set, it was completely assembled at the factory and tested under full-speed and over-speed conditions. When running at the rated kW load, at unity power factor, an efficiency of 95.8 per cent. was obtained.

Between the generator and the switchboard a reactance is included in the high-pressure leads to reduce the severity of shock to the machine in case of short circuits arising on the bus-bars or beyond them. These reactances are of the oil-immersed, self-cooled type, constructed by the Metropolitan-Vickers Electrical Co., Ltd.

The switchgear at the station has been reconstructed to render it capable of dealing with an ultimate plant capacity of 70,000 kW. The arrangement consists of a bank of generator gear fitted with oil circuit-breakers with group feeders connected to a bank of feeder gear fitted with medium rupturing capacity oil circuit-breakers. The generator gear is of the cellular type, equipped with single bus-bars, lever-type bus-bar isolation switches, and motor-operated spring-controlled oil circuit-breakers. The bus-bars are divided into three sections by pole-operated, air-break isolating switches, provision being made for the future installation of an oil circuit-breaker for coupling sections 2 and 3. The oil circuit-breakers are of the explosion pot type, with two 10-in. diameter solid drawn steel cylinders per phase, the making and breaking contacts being mounted in oil and the main current-carrying contacts on the outside at the top of the pots, in air. A separate compartment is provided for each phase and for each piece of apparatus. The cubicles are arranged on two floors, the top floor carrying the oil circuit-breakers, and the lower floor the bus-bars, instrument transformers, and outgoing connections. The feeder switchgear is similar in design, but of smaller dimensions. Duplicate bus-bars are fitted, which can be divided into two sections by means of air-break isolating switches. All the switchgear was supplied by the British Thomson-Houston Co., Ltd.

This extension brings the total generating capacity of the undertaking up to 27,900 kW, but Mr. Purse, who recently arranged a personally-conducted tour of the works for representatives of the Press, informs us that a similar extension is contemplated in the near future.

Poland's Electrical Industry.—According to the recent report by H.M. Commercial Secretary at Warsaw, the Polish electrical engineering industry developed satisfactorily during 1921. The embargo on the export of electrical goods from Germany to Poland has emancipated the industry, and certain articles, such as projectors, regulators, &c., are now being manufactured in Poland, whilst before the war they were imported exclusively from Germany. The construction of dynamos and motors will be taken up before long by two factories, one at Warsaw and the other at Zychlin. The first is a Polish undertaking, whilst the second is subsidised by Swiss capital. The manufacture of cables has also begun, and two plants are in course of construction. Electric lamps are made in two factories in Poland, which are developing satisfactorily, but Dutch lamps are being offered and compete successfully with the local article. Although the importation of goods from Germany is hampered by great difficulties and takes place only in a roundabout way, German offers are cheaper than those which are received from Holland, France, Great Britain, and other countries with a higher currency.

THE VILLAGE POWER STATION.

By "ARCADIA."

Following the notification that small public generating stations below 50-kW capacity may be started without permission being obtained from the Electricity Commissioners, inquiries will probably be made as to how such ventures may be started with reasonable prospects of paying their way. There are two or three ways in which such concerns are usually brought into being, but it may be said, as the result of considerable experience and observation, that there is only one method by which the best success can be attained.

In some cases a few public-spirited folk get together, discuss the matter, and then hand the project over to a firm of wiring contractors to carry out and run for them. In other instances, such a firm, or a manufacturing firm or syndicate, will offer to put the plant down if a certain sum is found in the district.

In neither case has the concern the best chance of success; and with such diminutive plant every point must be watched if any success worth having is to be achieved.

The wiring contracting firm is mainly concerned, and quite properly so, with profits made on each contract undertaken, and the greater the amount expended the greater share does it receive of the funds subscribed; in most cases it has not, or at any rate does not exercise, the necessary foresight and restraint in its hunt for immediate profits; nor has it the time or staff to devote to the correct organisation of the scheme. In many cases it is quite evident from the plant installed, the system advocated, and the amounts charged for plant and erection, that little is cared, and less understood, about the principles on which such concerns must be installed and run if they are to pay a return on the money laid out.

With a firm of manufacturers, or a contracting syndicate, the idea of immediate profit is also well to the fore; and whilst a portion of the purchase-money may be left over, or found ostensibly by the firm; yet the prices quoted and the amounts actually paid over on account by the supply company leave the contracting firm a reasonable margin; so that the outstanding charges which are in the nature of a lien on the whole concern, leave a handsome profit to the contractors and a swollen capital account for the supply concern. Even with the best intentions, such a firm owes its first duty to its own shareholders, and the supply company is under the decided drawback of being tied to one firm's products for its plant.

It may be urged that in both cases, moderation now will help the small supply concern to pay its way, order further plant, and so extend the use of electrical apparatus of all types; and that the contracting firms in question will recognise this fact and act on it. Whether they recognise the fact or not is not known; that they do not act on it is evident from many cases up and down the country, in which such small concerns are found unable to pay their way or raise further capital, although a paying load is at their doors almost pleading to be connected.

The only sound method of starting such supplies is to place the matter in the hands of an independent engineer who has made a special study of such concerns; to allow him to purchase plant in the open market, and to insist on his taking a good portion of his remuneration in shares in the company. He is then bound to do his utmost to make the concern pay, and pay well, both in order to obtain dividends from his holding, and to make that holding worth more than paper. Were this practice followed out, there would be few villages without a supply, and few farms in our agricultural districts lacking the benefit of electric power and light.

The villager, from squire to farm labourer, wants a better light; the former would be glad to be relieved of his own private plant, and the latter to be done with candles or oil lamps. Moreover, no farmer, after once experiencing the convenience of power on tap, would put up with the trouble and dirt of running his own engine. The farmer wants power in summer to help him through his mowing and reaping, and later on for his thrashing; in the winter he wants smaller amounts of power for root chopping, &c., rather more light, an electric iron or two, and an odd radiator for his *sanctum sanctorum*. On the other hand, the squire, who uses little light in summer, wants abundance in the winter; he will use several radiators and irons, and so make up for the farm plant, which gives its heaviest load in the summer and early autumn.

One of the rocks on which such concerns come to grief is that of charging too low a price for energy. What is a heavy and even preposterous price in a town of 30,000 inhabitants will be found attractive in small communities of 3,000 inhabitants or less; in pre-war days many such plants started with an initial charge of 6d. a unit, and could hardly make ends meet. Several places with which the writer was in close touch charged 8d. per unit, and paid their way comfortably on smaller outputs than places charging 6d. The reason was that electricity, even at what looked to the town dweller an extortionate price, was so much cheaper, better, cleaner, and more convenient than the older methods of illumination, that folks were more than pleased to pay at that rate; and stated that they found it economical compared with what they had previously used.

With such small concerns it must never be forgotten that the apparently contemptible sum of £25 may make all the difference between a 4 per cent. and a 5 or 5½ per cent. dividend; and that where 4 per cent. looks meagre, 5 or 5½ per cent. is treated as very passable. This may not be a philosophical view of the case, but it is the view which the majority of people will take; in short, it is human nature as it is, and the wise man works accordingly.

Whilst grave mistakes can be made in the choice of plant and site, undoubtedly the most serious are made in connection with the financing of such schemes: the policy here advocated is that of having no one drawing a profit from the concern unless he or they have a considerable personal stake in the venture, either in actual cash or in work for the concern.

On the matter of plant, the water-power plant is still one which must be treated with caution until it is thoroughly investigated. There is at least one concern to the writer's knowledge which started up with a considerable flourish on water-power, and then found out afterwards that the water belonged to someone else, who made an extortionate demand for the right to use the water; and, not being satisfied, promptly shut down the whole concern by stopping the supply to the turbine.

Another bugbear, and one which is nearly as deadly as the "existing adequate water-power" snare, is the suitable unused building. Often such places are too far from the centre of demand to be economical in the matter of mains; or they will cost too much for alterations and adaptation. The very fact that so many of these old places have walls of immense thickness may be an advantage if protection from possible air raids during future wars is the object; but they have no advantage over a light structure which can be MOVED and extended at one end at slight cost when necessary. Cases have arisen where such old buildings have been bought at what looked to be a very low price, in which the cost of alteration has been simply terrific. One [illegible] cut back a 15th century 3 ft. wall to a depth of 8 ft. over an area of nearly 400 sq. ft. for nothing: and yet this item appeared in the cost of putting in a [illegible] generating set in a village lighting works. Apparently the idea had been that, when wanted, space could be obtained by knocking down the end wall, and when this was about to be started on, the fact was discovered

that the wall was 3 ft. thick, and had been built better than the builder knew.

Another point on which many small concerns go astray is in not keeping proper books, and in not insisting on their assistants or officials getting a receipt with *full* details for all money spent. This, indeed, is a prolific source of what perhaps is best termed "leakage." Another point to be avoided at all costs is the receiving of accommodation from makers of plant or from firms of contractors. As a rule, extravagant interest is demanded and obtained for such accommodation, whilst the more serious drawback that the concern is tied hand and foot to that firm is, in itself, quite sufficient to prevent the supply company from paying its way.

Such concerns would be of immense use to the districts in which they worked, would create an electricity-using public against the time when the large area supply scheme can reach them, and would, above all, give profitable employment to many of our firms. They must, however, be administered strictly from the point of view of the supply company's interests, and not from that of any particular firm.

A VERY BAD CONSUMER.

By "DISTRIBUTOR."

I would explain that I represent the outside department of an electricity supply undertaking. The members of our inside department have for a long while past been very busy with their works costs. They are all enthusiasts, and have brought the business to quite a fine art. On the least provocation they will expatiate on the life history of the unit, tracing it by easy stages from its chrysalis stage as a calorie in the boiler-house, through its water stage as a British thermal unit, pausing to lament the terrific mortality in latent heat in the condenser, and finally pointing with pride to the finished article emerging as a fully-fledged B.O.T. unit from the 6,000-volt bus-bars. They will tell you exactly what it has cost to three places of decimals at any stage of its career. No secrets are hid from them, and they can state with confidence exactly what it costs them to supply each individual consumer.

It was only natural that such enthusiasm should arouse some echo, even in the more sluggish brains of the outside department. Hitherto, I fear, we had paid insufficient attention to the transit of the agile unit from the aforesaid bus-bars to the consumer's cut-out, and, provided that it arrived intact, without having strayed to earth on the way, we were duly thankful, and there the matter ended. But not so now. Recently we investigated the relative value to the undertaking of our different classes of consumers. Among these we found a very objectionable one from our point of view. He was among the first, if not the very first, of our consumers, when the undertaking started years ago. His demand, which in the early days of the undertaking had been almost negligible, had gradually increased until it had reached quite a considerable figure, to be exact, 180 kilowatts. The most unfortunate part of the business was that his maximum demand invariably seemed to coincide with our peak-load. In fact, he seemed to take a most unholy delight in coming on when we were in the worst position to deal with him. At week-ends and on early closing days he was conspicuous by his absence. Naturally we consulted the inside department about him, and with the aid of a pencil and the back of an envelope they were able clearly to demonstrate to us that he was actually costing them £8 per kilowatt and .8d. per unit at the bus-bars. I forgot to mention that his load factor was a quite insignificant figure, probably less than 10 per cent. On a demand basis alone he was therefore costing us £1,440 per annum. It was about this time that we made an appalling discovery. Readers in well-regulated departments must please spare their comments. This consumer *had never had a meter connected*. From the very start he had contributed absolutely nothing to our expenses. This was really a very serious matter for us, but I am inclined to think that we were no worse off than a great many other undertakings, and I think you will agree that this is so when I explain that our consumer was represented by our d.c. feeder system and that the apparatus wherewith he disposed of energy consisted of five direct-current cables of an average length of 1,100 yards and of quite substantial cross-section; in fact, none was less than .5 and one was a .7. They were none of them worked above 1,000 amps. per sq. in., and, generally speaking, we had considered that they were doing the job quite nicely. Now, at a peak-load of 1,500 kW, we found that we had to have a bus-bar pressure of 520 volts to give 460 volts at the feeder pillars, making a loss in kilowatts of $2{,}000 \times 60/1{,}000$, *i.e.*, reckoning approximately 2 amps. per kW, which comes out at our consumer's demand of 180 kW at the bus-bars.

Now, it happened that at this time we had in hand a 6,600-volt, 3-phase feeder to an outlying district, and I find that by incurring a trifling additional expense we can divert this through the centre of our d.c. area, which, fortunately, is of quite a small radius, although at an average distance of 1,100 yards from the works. We have at the works a 500-kW rotary converter which it would be possible to transfer to the centre of the d.c. area, the whole alteration being carried out at a cost of probably £2,000. It is interesting to consider the effect which this rearrangement will have upon our transmission losses. By taking up 500 kW of the d.c. peak-load on our three-phase feeder we shall ease the d.c. feeders by this amount, and as the losses vary as the square of the load carried, we shall reduce the loss in these *at peak-load* to $180 \times 1{,}000 \times 1{,}000/1{,}500 \times 1{,}500 = 80$ kW. We shall therefore have actually removed 100 kW from our peak-load, less the kilowatt loss in carrying 500 kW on our new three-phase feeder. The new feeder will probably be .2 sq. in. per phase, and therefore the loss can be calculated as follows:—Assume the new feeder to be already carrying 1,000 kW before the additional 500 kW from the d.c. system is put on it. Resistance per phase, .125ω. At unity p.f. 1,000 kW = 88 amps., and therefore the drop per phase $= 88 \times .125 = 11$ volts, and the drop between phases $= 11 \times 1.732 = 19$ volts.

The actual kilowatt loss will be $\sqrt{3} \times$ *drop between phases* $\times$ *current*$/1{,}000 = 1.732 \times 19 \times 88/1{,}000 = 2.9$ kW when the load conveyed is 1,000 kW. The 500 kW conveyed to the sub-station for conversion to d.c. will increase the load on the three-phase feeder to 1,500 kW, and the total loss up to the sub-station will vary as the square of the load carried, and will therefore be $2.9 \times 1{,}500 \times 1{,}500/1{,}000 \times 1{,}000 = 6.6$ kW. The additional loss, therefore, due to the 500 kW on the three-phase feeder will be $6.6 - 2.9$ kW $= 3.7$ kW, and this must be deducted from the saving of 100 kW mentioned above, leaving an actual saving of 96.3 kW.

The old and the new arrangements may therefore be contrasted as follows:—

Old Arrangement.		New Arrangement.	
D.c. peak-load, 1,500 kW; kW necessary at bus-bars to overcome mains drop	180	D.c. peak-load, 1,000 kW; kW necessary at bus-bars to overcome mains drop ...	80
		kW to overcome extra drop in three-phase feeder due to 500 kW load	3.7
Total	180	Total	83.7

Saving on new arrangement, 96.3 kW, at £8 = £770.4 per annum.

I have not included the running charges for the units lost in mains, but the saving on these will be in pro-

portion. Allowing for an attendant to run the rotary plant at the sub-station for a few hours over the peak-load each evening, we shall still have a considerable margin of saving, and, incidentally, we have also solved the problem of how to increase our d.c. capacity to meet an increased demand for some years to come without laying additional d.c. feeders, and this at a comparatively trifling cost.

Further, as we hope to install a system of remote control from the works, as described in one of your issues in, I believe, June, 1920, we may be able to dispense with the attendant entirely, with a consequent further saving. This system, I believe, required an attendant to start up the sub-station plant only, which then received the regulating portion of the field current from the central station. It had the advantage of being very cheap in first cost, and has, I understand, been working quite satisfactorily for some time in at least one undertaking.

Now to come to the moral of my tale. A man's prosperity is in proportion not to his total income, but to the difference between his income and his expenditure, and he may become better off either by increasing his income or decreasing his expenditure. And so with electricity supply undertakings. In these strenuous days we spend a lot of time finding new consumers and selling them a lot of units, often at a cut price, which leaves very little margin for profit. Thus a consumer who uses half a million units may very well only bring in a net profit of £200, and a saving such as that outlined above should therefore be equivalent to several such consumers, although it is seldom that this relative importance of saving in mains losses is appreciated to the extent that it should be.

ELECTRICITY SUPPLY IN LONDON.

L.C.C. Special Committee's Report.

The serious report by its Special Committee on London's electricity supply, of which Mr. G. H. Hume is chairman, that was submitted to the London County Council at its meeting on July 4th, needs careful consideration. The gravity of the matter apparently rests on the persistent efforts of certain private interests to obtain powers to build electricity generating stations that will, according to the report, delay or indeed render impossible, the establishment of a Joint Electricity Authority for the London and Home Counties Electricity District under the Electricity (Supply) Act, 1919.

The granting of the Electricity Commissioners' consent to the erection by the County of London Electric Supply Co., Ltd., of what would appear to be, in the light of the various utterances which have been made by the Commissioners from time to time, the first instalment of a super-power station for Greater London raises very important issues in relation to the further development of electricity supply in the area. The Commissioners' consent to the erection of a 100,000-kW station at Barking was (in the language of the agreement between the County of London Co. and the London Joint Committee, 1920, Ltd., that was read to the Commissioners at their inquiry) "for the needs of the County Co.'s own statutory obligations only." Whether or not that station would later be made a capital station for wider purposes was to be a matter for the consideration of the future Joint Authority, in the first instance, and for subsequent approval by the Commissioners. The latter, however, in their decisions upon the schemes submitted to them at the inquiry indicated that they proposed that the Barking site should be utilised for the construction of the first capital station for the London and Home Counties Electricity District.

In view of the fact that the Barking scheme had up to that time been considered solely from the standpoint of the erection of a station to enable the County of London Co. to fulfil its own statutory obligations of supply, it was felt by the L.C.C. Committee that this declaration by the Commissioners made the question and the conditions to be attached to their consent to the establishment of the station of the utmost importance. The broad impression which the draft consent originally proposed by the Commissioners created in the mind of the L.C.C. Committee was that it unduly favoured the County of London Co., and that it was framed in a way which was likely to make it difficult—to say the least—for the Joint Authority, when the time arrived, to exercise its right of purchase with due regard to the public interest.

The L.C.C. Committee is of the opinion that the conditions which have been imposed by the Commissioners on the County of London Co. still justify this general criticism, but it appreciates that the position has been improved by certain of the modifications which have been made at the instance of the L.C.C. Nevertheless, it still considers that it is a matter for regret that it has not been found possible to take the necessary steps for setting up a Joint Electricity Authority for Greater London before consent was given to a scheme which must largely predetermine the policy of that Authority.

The L.C.C.'s position as the purchasing authority of the undertakings of the London electricity supply companies was again involved during the recent inquiry by the Electricity Commissioners with respect to the applications made by the Managing Committee of the South-Eastern & Chatham Railway Co., and the West Kent Electricity Co., Ltd., for consent to the establishment of new electricity generating stations at Angerstein's Wharf, Charlton, and at Belvedere, Erith, respectively. The Railway Co.'s proposal was not opposed by the L.C.C., and it was admitted in evidence at the inquiry by the promoters of the West Kent Co.'s scheme that that counter scheme would fall to the ground if the Railway Co.'s proposal were to receive the Electricity Commissioners' approval.

The position of the West Kent Co. is a somewhat peculiar one: it is authorised under certain Acts of Parliament to supply electricity in various parts of Kent, and up to the present it has been financed by the South Metropolitan Electric Power Co., one of the London distributing undertakings which is purchasable in due course by the L.C.C. Moreover, the West Kent Co. has not so far built a generating station itself, all the electricity dealt with by it having been supplied by the South Metropolitan Co.'s station at Blackwall Point.

It was stated in evidence at the inquiry that all the shares in the West Kent Co. are held by the South Metropolitan Co.; in 1918 the shares of the latter concern were taken over by a group of companies so that the result of this financial adjustment is that of the total issued capital, £165,000, of the South Metropolitan Co., £97,082 is held by the Metropolitan Carriage, Wagon & Finance Co., £53,386 is held by Messrs. Vickers, Ltd., and £5,338 by a financial concern known as "Electric Holdings, Ltd." These three holdings represent 94.5 per cent. of the total issued ordinary capital of the South Metropolitan Co., and the relation of the latter with the above-named financing companies becomes of special importance when the financial proposals underlying the West Kent Co.'s scheme are considered.

The L.C.C. Committee contends, therefore, that if the scheme is sanctioned, the West Kent Co., as a statutory concern sanctioned by Parliament, with certain definite responsibilities and privileges, will cease to exist except in name and its place will, in effect, be taken by the various financial interests referred to above. Another point in connection with the West Kent Co.'s scheme that is of special interest to the L.C.C. is the purchasability of the new station if authorised. The application for permission to build it was submitted on the basis of the new station not being purchasable, but that it should belong in perpetuity to the West Kent Co. The promoters of the scheme are not prepared to accept a provision for the purchase of the Belvedere undertaking, similar to that which has been prescribed in the case of the County of London Co.'s Barking station.

During the inquiry the County of London Co. intimated that it was prepared to place before the Electricity Commissioners an alternative offer for the supply of electricity from its Barking station for the operation of the South-Eastern and Chatham Railway. From evidence submitted at the inquiry it appeared that in order to enable the County of London Co. to deal with the railway load it was proposed to install four 35,000 kW generating sets in the Barking station, making a total of 140,000 kW, in place of the 100,000 kW originally contemplated.

This point is of importance in view of the declaration by the Electricity Commissioners mentioned above, that their consent to the erection of the Barking station was for an installation of 100,000 kW for the needs of the County of London Co.'s own statutory obligations only, and that they did not desire in any way to fetter the freedom of action of any Joint Electricity Authority that might be set up thereafter, with regard to the arrangements to be made for the general supply of the London area. The L.C.C. Committee contends that if the Barking scheme is to be expanded in this indirect way before the erection of the station is even commenced, the Joint Authority will be committed to its development in a way which it is impossible to foresee or, if its development for other than its ostensible purpose be contrary to sound policy, to guard against. In this connection attention is drawn to the recent statement by the Parliamentary Secretary to the Ministry of Transport in reply to a question in the House of Commons, that in the event of the S.E. & C. Railway Co. accepting the offer of the County of London Co. a further inquiry under Section 11 of the Electricity (Supply) Act, 1919, would not be held in view of the increase now suggested by 40 per cent. of the capacity of the Barking station as originally proposed, the above omission is significant, having regard to the L.C.C.'s apprehension as to the real purpose of the Barking scheme and the extent to which the consent given thereto is likely to affect

the freedom of action of the Joint Authority, if not the possibility of setting up a Joint Authority at all on satisfactory lines.

The evidence given by Mr. W. F. Fladgate, chairman of the London Electricity Joint Committee, 1920, Ltd., towards the end of the recent inquiry as to the ability of the companies included in his group to supply electricity to the S.E. and C. Railway Co. during the first stage of the electrification of its suburban line, has an important bearing upon the establishment of a Joint Electricity Authority for the London area. Mr. W. F. Fladgate strongly favoured the possibility of two Joint Authorities being formed, one for the companies and the other for the local authorities. The formation of two such bodies would, he explained, not in the least prevent their combination for mutual benefit later, whereas they might have to wait indefinitely to combine both local authorities and companies in one undertaking.

He was perfectly certain that a very short delay would enable him to bring together all the important London companies; and he had every reason to hope that nothing would prevent the combination of the County of London Co. with his companies. The South Metropolitan Co. was prepared to join his group under certain conditions, to which he had no objection; the City Co. had not yet joined the Committee, but as a matter of fact it had done, or was about to do, what was of greater importance—namely, link up the high-pressure mains of his own company, the Charing Cross Co., with those of the City Co., which was the first important step towards the joining of the companies in London and was done at the instance of the City Co. The other outstanding companies were the Notting Hill Co., which was really more or less negligible, and the South London Co., as to the policy of which Mr. Fladgate knew nothing at that time, but for practical purposes he spoke for all the important London companies.

With regard to Mr. Fladgate's suggestion, the L.C.C. Committee remarks that Section 13 of the Electricity (Supply) Act, 1919, did not contemplate the transfer of a Joint Authority consisting solely of the representatives of purchasable companies of the statutory purchase rights in respect of their own undertakings.

The L.C.C. Committee recommends:—"That the Council endorses the statement made by counsel on its behalf at the recent inquiry by the Electricity Commissioners with respect to the applications of the S.E. & C. Railway Co. and the West Kent Co. for permission to erect generating stations at Angerstein's Wharf, Charlton, and Belvedere, Erith, respectively, and that in the event of consent being given to the proposals of the West Kent Co. the Council will feel called upon to review the whole position and, in particular, to reconsider its attitude with respect to the transfer to a Joint Electricity Authority of its purchase rights over the undertakings of the London electricity supply companies, and with respect to the furnishing, in certain contingencies, of financial assistance to the Joint Authority."

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

Electricity (Supply) Bill.—On July 4th, a Standing Committee of the House of Commons resumed consideration of this Bill.

On Clause 5, which deals with the power of undertakers, &c., to give financial assistance, Mr. Neal, Parliamentary Secretary to the Ministry of Transport, moved an amendment empowering local authorities of areas having a population of 50,000 and over to give, subject to the sanction of the Ministry of Health, financial assistance to the Joint Electricity Authority. Replying to Mr. G. Balfour, and other members who opposed the amendment, Mr. Neal pointed out that there was precedent for such an amendment, because in the case of other undertakings—railways, for instance—it had been the law since 1896. The opposers of the amendment suggested that the London County Council, which had a direct interest in the supply of electricity in the Metropolitan area, should not be allowed to assist in the development of electricity in London by giving certain financial assistance. That assistance was amply safeguarded.

On a division the amendment was agreed to by 25 votes to 10. Further amendments, subjecting the powers of the local authorities in these cases of financial assistance to the proceeds of a penny rate in the case of Councils which were authorised undertakers as well as those which were not, were negatived. An amendment giving the Minister discretion to authorise financial assistance beyond the limit of a penny rate was rejected by 24 votes to 13. Clauses 5 to 14, with a number of minor amendments, were agreed to, and the Committee adjourned.

On July 5th an amendment was proposed by Mr. Kiley, on which a general discussion took place, on Clause 16, which was inserted by the House of Lords for the protection of power companies. Mr. Neal said that while it was impossible for him to depart from the main object and intention of the Clause, he was not at all sure that it was not wider in its terms and did not, in fact, go beyond the objects of its promoters. He thought there was room for consideration of words, to see whether it was not possible, with the good will of everybody, to get a Clause which would in no way destroy the advantages which the Government conceded in the House of Lords, and yet, at the same time, would make it quite clear that the rights of the consumer, who was ultimately the real person to be considered, would not be prejudiced. He hoped that they would, at a later stage, be able to insert words satisfactory to everybody.

The amendment was withdrawn, and the Clause was agreed to by 23 votes to 6. Clauses 17, 18 and 19 were also agreed to, and the Committee again adjourned.

On July 6th, the remaining Clauses of the Bill were agreed to, as was also a new Clause, moved by Mr. Neal, to extend the period for the repayment of money borrowed by Scottish local authorities from 30 to 60 years.

A long discussion took place on another new Clause, moved by Mr. Hannon, to enable an authorised undertaker to continue generating electricity if it could do so at less cost than the Joint Electricity Authority, or other authorised undertaker, company or person. He said that it would be a great hardship to an authorised undertaker to have to accept electricity from a Joint Electricity Authority and have to pay, as might be the case under the Bill, a higher price that that for which he could provide a supply himself.

Mr. Neal said that he could not accept the new clause, which really attempted to interfere with the discretion placed in the Electricity Commissioners by the Act of 1919. After being pressed, however, by several hon. members to accept the principle of the clause, he said that there was really nothing between his views and those of Mr. Hannon, if the principle were accepted that the Electricity Commissioners were not likely to do a grave injustice. If it were desired to have words in the Statute which specifically directed their attention to that as a material factor to be considered in exercising their discretion, he would be very glad to try, before the Report stage, to insert such words. It was inconceivable that the Commissioners would go out of their way to do an injustice.

The new clause was withdrawn on the understanding that Mr. Neal would move an amendment on the Report stage.

Mr. R. Richardson moved a new clause to provide that wages and conditions of service under a Joint Electricity Authority should be governed by the Fair Wages resolution of the House, of March 10th, 1909, but this was negatived by 13 votes to 5.

The Committee then adjourned.

On July 10th, a new clause was added by the Committee to the Bill permitting provisions dealing with conditions of employment and giving representation to labour to be included in a scheme setting up a Joint Electricity Authority.

Mr. Hannon proposed a new clause prohibiting the taking of electricity supplies from any Government Departments. He said that he desired to prevent Government trading in the supply of electricity.

Mr. Neal, in opposing the new clause, said that with the general proposition that the Government should not go into trade, everybody would agree. There were three Government stations in the country—Queensferry, Beachley and Aldershot. The case was, he submitted, exceptional, and to meet it it would be necessary to have a clause so wide that it would rule out these three schemes.

The new clause was negatived by twenty votes to seven, and the schedule was agreed to. The Committee stage having thus been concluded, the Bill, as amended, was ordered to be reported to the House.

South Wales Electrical Power Bill.—On July 4th, a Select Committee of the House of Commons considered this Bill, promoted by the South Wales Electrical Power Co.

Mr. Tyldesley Jones, K.C., for the promoters, said that the objects of the Bill were to reduce the capital, to extend the area of supply, to empower the Electricity Commissioners to sanction a different method of charging to that provided in the Company's Acts, and to enable local authorities to which the company was authorised to supply electricity in bulk to subscribe to the capital of the company. That was the only part of the Bill which was opposed. One of the proposals in the Bill was to reduce the ordinary share capital of the company from £600,000 to £152,000. The prior lien debentures, the debentures and the preference stock were not affected at all. The company had been doing so comparatively well of late that it was in sight of a dividend on the ordinary stock, probably two per cent. on the reduced capital. With regard to the power sought for local authorities, at present these bodies could raise money to provide and run their own little electricity station and undertaking, but they could not raise money to extend the existing large station in order that they might get the advantage of the cheaper supply that would be available. In asking for this power for them, the company was inserting ample safeguards for those authorities by providing that the local authorities should not exercise the powers without the sanction of the Minister of Health and the Electricity Commissioners. The only opposition was from the Gas Co. of the district.

After hearing evidence and a statement by Mr. Clode, K.C., for the opposition, the Committee unanimously found the preamble proved.

Ayr Burgh Electricity Bill.—On July 5th this Bill, which had passed through all its stages in the House of Lords, came before a Select Committee of the House of Commons.

Mr. Tyldesley Jones, K.C., again presented the case for the promoters, and said that the capital cost of the scheme was estimated at £194,000. That departed from the figure which was put before the Select Committee of the House of Lords. Since last November when these estimates were first made, the cost of materials and labour had been falling rapidly, and now they were able to put forward a reduced estimate. The Bill would give power to borrow £123,000, in addition to the balance which it was sought to obtain from the Electricity Commissioners.

The Committee adjourned.

On July 6th, Mr. Tyldesley Jones criticised in detail the petition presented by Kilmarnock against the scheme. He said he agreed that whatever scheme was agreed to, it was most undesirable that uneconomical generating stations should be erected at present, but Ayr was putting forward an economical scheme which, on its merits, the Committee ought to pass. In the report of the Water Power Resources Committee there was a recommendation that the hydro-electric schemes should contain a purchase clause from the point of view of the State. That was provided for in the Bill, and in the Lochaber and Grampian schemes there were similar provisions.

The Committee then heard evidence, which was largely a repetition of that given before the Committee of the House of Lords which considered the Bill. The Committee adjourned.

On July 7th, further evidence was heard, and the Committee again adjourned.

Grampian Electricity Supply Bill.—On July 4th the Unopposed Bills Committee of the House of Lords considered this Bill, which had already passed the House of Commons. Evidence of a formal character was given, and the Bill was passed for third reading.

Torquay Electricity Bill.—On July 6th the Torquay Corporation (Electricity) Bill was read the third time in the House of Commons.

Electricity in Coal Mines.—During the debate on the Vote for the Ministry of Mines, on July 6th, Mr. Robertson raised the question of safety in coal mines and said that during the last few years, especially in the West of Scotland, there had been several explosions of fire-damp. These explosions had been caused by the use of electrical motive power in driving the coal-cutting machinery. Compressed air power could drive coal-cutting machinery, and was perfectly harmless.

Sir D. Maclean pointed out that Section 60 of the Coal Mines Act, 1911, stated: "Electricity shall not be used in any part of the mine where, on account of the risk of explosion of gas or coal dust, the use of electricity would be dangerous." If put into operation, that was a very effective section.

Mr. Bridgeman, Secretary for Mines, said that everything that was possible was being done to ensure safety in the mines. He also mentioned that, in order to arrest the spread of nystagmus, his department had recommended that where it was possible to use electric lamps they should be introduced.

Telegraph (Money) Bill.—During the debate on the second reading of this Bill, on July 3rd, Mr. Kellaway, the Postmaster-General, replying to criticisms of the telephone service, said that he had found the report of the Select Committee on Telephones of great advantage to him in coming to a decision on a number of matters, and the majority of the recommendations had been carried out in the spirit, if not in the form, recommended. But he was not prepared to carry out the Committee's recommendation for the complete separation of the telegraphs and telephones from the mails of this country. He had decided, however, to appoint a controller of the telephone and telegraph service. The new officer had his training under the National Telephone Co., and was one of the ablest men on the telephone side.

The Bill was read a second time.

British Empire Exhibition.—On July 5th, during a discussion on the third reading of the British Empire Exhibition Amendment) Bill, Sir M. Barlow, Parliamentary Secretary to the Ministry of Labour, stated that the contractors were under contract to finish the staging of the exhibition by next April 1st.

Cables to Ireland.—On July 5th, Mr. Pike Pease, Assistant Postmaster-General, informed Sir F. Hall that the Irish ends of submarine cables between this country and southern Ireland fell under the control of the Irish Provisional Government, but for the present any necessary repair work which could not be done from land would be undertaken by one of the Post Office cable ships. Those cables had not been interfered with, any interruptions which had occurred having been on the connecting land lines in Ireland.

Weather News by Wireless.—On July 6th, Lieut.-Col. Moore-Brabazon asked the Secretary of State for Air, whether the meteorological information now sent out by the Air Ministry in Morse could be changed to telephony, in order that the information might be interpreted more easily by farmers and others equipped with receiving apparatus.

Capt. Guest replied that the telephonic transmission would be additional to, and not in place of, the present telegraphic transmission, and the cost of such a duplicate service would involve a capital expenditure of £5,000, and an annual [illegible] be considered when funds were available.

[illegible] Magdeburg, Mr. Baldwin, President of the Board of Trade, said that since the Merchant Shipping Advisory Committee reported on the question of watchers, 27 cases of alleged inefficiency had been brought before the Board of Trade, in some of which there was *prima facie* evidence of technical inefficiency. Those cases would be inquired into. The whole subject of watchers was being carefully followed, but there was not a sufficient case at present to justify an amendment of the existing regulations.

Imports from Germany.—Mr. Hogge asked the President of the Board of Trade whether he was aware that, under Part II of the Safeguardian of Industries Act, a complaint was recently referred to a committee in respect of scientific instruments imported from Germany on which the complainants desired the duty to be increased from 33⅓ per cent. to 66⅔ per cent.; that the Electrical Importers' and Traders' Association inquired at his department whether this application covered electrical instruments, and was informed that it did; that on account of this information steps were taken at considerable expense to formulate evidence in respect of electrical instruments; whether he was aware that, on the introduction of the evidence in question, the complainants stated that they did not propose to press their application for a duty in so far as electrical instruments were concerned; and whether he would take steps to see that the precise scope of these complaints was more accurately defined before such proceedings were started, in order that traders might not be involved in entirely unnecessary inconvenience and expense.

Mr. Baldwin said that the scope of this complaint, as originally defined by the applicants to the Board of Trade and the Committee, included electrical instruments, but he was informed that at a later stage of the inquiry the applicants withdrew that part of the complaint which related to electrical instruments of 24 specified classes. Every effort was made to ensure that the scope of complaints referred to Committees was defined so far as was practicable.

Prices of Electricity and Gas.—Mr. Leonard Lyle asked what were the relative prices of gas and electricity in the metropolitan area now and for the last five years; and whether they reflected the decreases in the cost of labour, coal, and materials.

Mr. Baldwin said that the question of prices charged for electricity was a matter for the Ministry of Transport. As regarded gas prices, he was having the figures looked into and would furnish a statement in the course of a few days.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Gold and Paper Marks.

In the article on "German Reparation Offers and deliveries," No. 2,324 of the Electrical Review, on page 794 we find the statements that in 1921 the German electrical industry made offers which represented a milliard *gold marks* (£50,000,000) in lighting and power plant, and half a milliard *gold marks* (£25,000,000) in telephone and telegraph installations. We beg to draw your attention to the fact that the sums mentioned are not gold marks but *paper marks*, and that, therefore, the respective sums in £ must be £560,000 and £280,000.

We should be much obliged to you if you would insert a correction of this misprint to the knowledge of your readers.

Zentralverband der deutschen Elektrotechnischen Industrie E.V., Nachrichtenstelle.

Berlin, *July 5th*, 1922.

Where are the Young Men of the I.E.E.?

With reference to "Younger Member's" letter in your issue of June 30th, 1922, under the above heading, I would like to state that the corporate members of the Institution have always interested themselves and encouraged us in our efforts, technically and socially.

I think the existence of "Younger Member" has been particularly unfortunate. The superiority which seems to have hurt his sensitive feelings, as far as my observation goes and not only mine, but that of my colleagues, has been conspicuously absent. Indeed, we have always found the most friendly and cordial intercourse between members of all grades and ages. Possibly "Younger Member" should look elsewhere for the alleged fault.

Is it not rather bad taste for "Younger Member" to put forward the suggestion which his letter conveys regarding

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"lifts," &c.? Surely "Younger Member" does not understand that the memorandum of association of the Institution of Electrical Engineers, briefly summarised, is as follows:—

"To promote the general advancement of electrical and telegraphic science and its applications, and to facilitate the exchange of information and ideas on these subjects by means of meetings, exhibitions, publications, the establishment of libraries, the giving of financial assistance to inventors and experimenters, the provision of buildings for carrying on the business of the Institution, and, finally, any lawful deed conducive to the attainment of its objects."

R. T. Dickson,
Hon. Sec., Scottish Territorial Centre (Students' Section), Institution of Electrical Engineers).

Glasgow, *July 5th*, 1922.

This question has recently been asked with so much persistence that one feels constrained to help to a solution.

From the last report of the Council of the I.E.E., it will be seen that there are 120 out looking for a job.

One of Six Score.

Water Load.

It is required to rig up a water load to test a generator with an output of 100 kW, 50 cycles, 3-phase. What are the calculations necessary, and what is to be taken into account, bearing in mind that an inexpensive arrangement is required?

Qui Sait?

July 8th, 1922.

A Motor Problem.

A synchronous motor with a direct coupled exciter is running at 50 per cent. load, consisting of a number of flywheels. The field of the motor is over excited for the purpose of phase advancing. Two oil switches are in the motor circuit, one fixed in the supply station and the other on the motor control panel.

When the oil switch opens in the station the motor runs a considerable time, driven by the flywheels, and generates at an excessive voltage, up to double the working pressure, which is 3,600 volts, which decreases as the speed drops. Is the high voltage dangerous for the insulation of the stator windings, potential transformer, and oil switch of the motor panel, and are there means, other than that of decreasing the excitation amps. to prevent it?

Safety First.

July 8th, 1922.

Electric Water Heating for Domestic Purposes.

In the article under the above heading in your current issue, the statement is made that electricity at 1½d. per unit can favourably compete with gas at 4s. 6d. per 1,000 cu. ft.

At these prices three-halfpence would purchase 27¾ cu. ft. of gas, yielding 13,875 B.th.u., which is more than four times as much heat as can be obtained from one unit of electricity also costing three-halfpence.

No doubt strong arguments can be advanced in favour of electricity on account of health, cleanliness, and convenience, but advocates of the electrical method do not help their case by grossly overstating it.

Taking the calorific value of gas as 500 B.th.u. per cu. ft. the truth is that the price of electricity must not exceed one-halfpenny per unit in order to compete with gas for water heating at 4s. 6d. per 1,000 cu. ft.

Apart from cost, the advantages of the electrical method are so marked that very many people will be willing to pay more for it than for gas. There can be no very general demand for electric water heaters, however, until electricity supply authorities can see their way to charge three farthings per unit, or less.

It is always best to face the facts, and it can be proved by means of practical appliances that one B.th.u. electrically applied will heat the same amount of water in the same time, and to the same temperature as 1½ B.th.u. applied by means of a coal-gas flame.

The writer of the article does not appear to be familiar with the special features of the storage geysers made by my company, but I must not here deal with his criticisms of heat storage systems, as I have already trespassed too much on your valuable space.

C. Orme Bastian,
Managing Director,
Bastian Electric Co., Ltd.

London, S.W.1,
July 10th, 1922.

The Mangnall-Irving Thrust Borer.

I have read Mr. A. R. Porter's letter with interest, and I candidly admit that his suggested method of dealing with long runs would appear to be bound to work out cheaper than trenching for runs where one or two cables only are required, but to me there appears to be distinct limitations for the following reasons:—

1. Fibre conduits, or conduits of any description, could not be used for distributors or for cables off which services require to be taken.

2. A multiple run of cables would probably be better dealt with by trenching than by a series of parallel borings, and would certainly take less space, and space in a town is often the deciding factor.

There is one point in Mr. Porter's suggested method which I think is likely to cause trouble, viz., "making the line of conduits in the halfway pits by jointing a conduit to the projecting ends"—unless the borings from opposite directions come pretty nearly opposite each other and are both reasonably in the same straight line, a distinct "kink" in the line of conduits at this point would be the result with considerable possibility of damage to the cable when pulled in.

It seems to me that boring in one direction only would be best between any two cable draw pits, and that the cable draw pits would probably require to be 100 yards or more apart as a general rule, which would necessitate an extra intermediate pit being got out.

The thrust borer is, in my opinion, still very much in the experimental stage as far as cable laying is concerned. I admit it has certain advantages, and it is doubtless very useful under certain special conditions and for special cases, but its use at present appears to be strictly limited. In the writer's opinion it has "a long way to go" before it will eliminate trenching.

F. O. Trotman.

Sheffield, *July 9th*, 1922.

The Sale of Wireless Apparatus.

Before attempting the thankless task of forming a Wholesale Contractors' Federation, why does not your correspondent, Mr. R. J. Clarke, join the existing Electrical Contractors' Association, an old established body representing some 700 of the leading firms of the country? He would then learn what is being done to protect his interest in the sale of wireless apparatus.

H. Marryat.

London, E.C.1., *July 10th*, 1922.

As a fellow contractor, Mr. R. J. Clarke has my deepest sympathy. Like so many of us, he has no doubt invested some hundreds of his capital in purchasing goods, the demand for which he hopes to create among his clients, whom, of course, he has already circularised, and, moreover, he has also no doubt made a considerable display in his showroom or window. In addition, and this without any doubt, he has made a deep study of the subject, so that when the prospective tyro or amateur comes along he will be able to guide him along the correct path and help him to select the set suited alike to his ambition and purse. He will have made himself proficient in the construction of the "darned things" so that he can effect any slight repairs or adjustment; in fact, and to put it in a nutshell, he will have acted in the same sensible and business-like manner and adopted the same methods as, say, the ordinary gasfitter, plumber, sanitary engineer, or to use his own simile, the motor engineer and accessories dealer.

But how many of us, or how very few of us, have adopted the procedure which our friend Mr. Clarke has, of course, followed. The bulk of us have very little left of that £15 we borrowed from the wife's mother, or sister, or aunty, to start in business as an electrical engineer and contractor when we lost that last job as a wireman for reasons which are now too painful or palpable to go into. For that and other reasons we say Mr. Clarke does not go far enough by a long way. It is the manufacturer's job to create the demand for his goods. Surely, it is he who wants to sell them. He should spend his ill-gotten thousands in advertising far and wide and put our names at the end of his announcements, and then, when the queue of eager buyers comes along, we will graciously be pleased to procure the goods they want from the manufacturers or we will, provided the demand be kept up (by the manufacturer), be induced perhaps to keep a stock at his risk on sale or return so that the aforesaid eager buyers may be quickly supplied. This would be a considerable advantage to both of them and, of course, our reputation must not be allowed to suffer from the stupid manufacturer's neglect to be able to supply from stock. Besides, if at the end of x months we choose to return the balance of the stock of his goods, or perhaps all of it, carriage forward, and he writes us to say he is disgusted to find they are in such a filthy and unsaleable condition, whose fault is it? We undertook to sell them, not to keep them clean, and return them carefully packed. We are not packers or charwomen; we are *electrical engineers and contractors.*

The claim of the manufacturer that the brunt of the cost of progress of the electrical industry has been borne by him is a gross libel on us; surely it is we who have been first and foremost in all suggestions (as in this case) and, therefore, we who should have the first consideration.

If I had my way, I would, as a contractor, force every manufacturer, not only to protect our branch of the industry in the manner Mr. Clarke points out, but also to provide us with the necessary capital, brains, and energy to conduct our businesses in the way they should be conducted. Of course,

as a manufacturer, I might have alternative suggestions to offer, and being a bit of both I may be permitted to know something of both sides. It is needless to add that my sympathies from long years of experience are with the manufacturer.

Manufacturer and Contractor.

London, S.W.1.,
July 10th, 1922.

The Proposed Visit to Gennevilliers.

As one who has for years been interested in the Entente Cordiale, I am pleased to note that a visit of engineers, and others interested in electricity, is being arranged under the auspices of the Electrical Review, to the super-power-station at Gennevilliers, near Paris, with a possible extension to some of the water-power districts.

I think that, for those who could spare the time, it would be interesting on the outward or homeward journey if the Calais route could be adopted, and if from, say, Béthune the party could be taken in charabancs through the regions of Lens, Douai or Cambrai, then south in the direction of Noyon or Beautor to Compiègne, and perhaps on to Creil and Paris. On such a journey one could examine the methods in which the rural and industrial power lines are being reconstructed, visiting perhaps one of the coalfields' power stations and one of the rebuilt mines, and thus see the remarkable way in which the devastated area is rising from its ashes. For those with time, I believe that there are also very interesting installations in the Pyrenees.

It would perhaps also interest many engineers if, while in Paris, some of the outlines of the French systems of electricity and water power concessions and power line wayleaves could be explained, as further legislation may be required at home in the near future.

It is to be hoped that some of those engineers who did electrical work in France during the war will be able to join the party and meet, I hope, some of the French electrical men who did such yeoman service in the time of trouble.

Theodore Rich.

London, *July 11th*, 1922.

[Major Rich's suggestions are most welcome and helpful. No one in this country is more intimately acquainted with the electrical work carried out in the regions referred to than he is, and we are very glad to have his support and co-operation.—Eds. Elec. Rev.]

LEGAL.

British Thomson-Houston Co., Ltd., *v.* Padair.

In this case counsel, on behalf of the plaintiff company, moved before Mr. Justice Astbury in the Chancery Division for an injunction to restrain an infringement of plaintiffs' patent in connection with leading-in wires for electric lamps.

His Lordship asked if the defendants appeared.

Counsel said they did not, and he understood that their solicitors were willing that the plaintiffs should have an injunction. The defendants had not entered an appearance.

His Lordship: This is the patent I dealt with in another case?

Counsel: It is the same patent.

His Lordship asked if there was evidence of infringement.

Counsel said there was an affidavit by Mr. White, assistant to Dr. Oberlander, stating that certain lamps were purchased from the defendants, and that he found they were infringement of the plaintiffs' patent.

His Lordship granted an injunction until the trial of the action.

British Thomson-Houston Co., Ltd., *v.* Lofthouse.

Judgment was formally given by his Lordship in this case, in which the plaintiffs claimed an injunction against the defendants to restrain them from infringing their leading-in wires patent. Counsel moved for judgment in default of appearance.

His Lordship: Take the common order, with solicitor and client costs.

W. Mathwin & Son *v.* Electric Supply Corporation, Ltd.

Sheriff Lee, at Glasgow, has issued his decision in an action by plaintiffs, of Glasgow, against defendants, in which the pursuers sued for the contract price of a quantity of dross.

The Sheriff found that in April, 1921, the defenders ordered from the pursuers 150 tons of small dross to be delivered at St. Andrews. Owing to a strike of miners, there was a great scarcity of available fuel, and consumers were unable to obtain their ordinary supplies. The defenders were aware that the dross was not coal of a kind ordinarily marketable or such as in normal times could be used satisfactorily or economically in their works for the purpose of their undertaking as producers and suppliers of electric power. The pursuers did not sell the dross as coal of ordinarily merchantable quality, or represent it to be suitable fuel for the defenders' requirements. The dross, though fuel of very poor quality, was capable of being used, with skilful management under suitable conditions for the emergency purpose for which it was bought, in fulfilment of the order, and a further order given on May 1921, 295 tons 2 cwt. of dross was delivered to the defenders. The contracted price was 4os. per ton, and no part of the price had been paid. The Sheriff found in law that the dross having been delivered to them, the defenders were liable in the price of the dross. He also found the defenders liable in expenses. In a note the Sheriff says that the proof had failed to establish that the dross was unsaleable. There was evidence that dross from similar bings, both better and worse than the dross in question, was freely sold and used as the only available substitute for better fuel during the miners' strike.

The Attorney-General and the Birkdale District Electric Supply Co. *v.* Mayor and Corporation of Southport.

In the Chancery Division last week Mr. Justice Eve concluded the hearing of this action. Plaintiffs asked for an injunction to restrain the Corporation from supplying electric current for the tramway system and for public lighting in the Birkdale area.

Mr. Maugham, K.C., and Mr. A. C. Matthews were for the plaintiffs, and Mr. Tomlin, K.C., and Mr. H. C. Dreschfield for the defendants.

Mr. Maugham stated that the plaintiffs' claim was confined to an injunction to restrain the defendants from supplying electricity for traction purposes and for public lighting. The Birkdale District Electric Supply Co. had been entitled, under an Order of 1898, to supply energy in the Birkdale urban district since 1902, when it acquired by purchase from the Urban Council the latter's rights under the old Provisional Order, and since 1902 till the end of last year it had been supplying all the consumers of electric energy for lighting and the tramways. In 1911 the defendants obtained the Southport Extension Order, by virtue of which Order Birkdale became part of Southport, its district council ceasing to exist. There were, however, provisions in the Order which preserved certain rights and liabilities of the old Urban Council. The present position was that the Birkdale Council having been swallowed up by the Corporation, the latter conceived the idea that it could take away certain rights of the Birkdale District Electric Supply Co. in the supply of electrical power, thus diminishing the value of the undertaking.

His Lordship: Had the company the exclusive rights of supply in the Birkdale district?

Mr. Maugham: Yes.

Mr. Tomlin: That is one of the points at issue.

Counsel for plaintiffs went on to state that since November, 1921, the company had suffered loss by reason of the defendants working the tramways in the Birkdale district with energy supplied not by the company, but from a generating station in the Southport area. That the plaintiffs complained of, and also of the fact that the defendants now claimed that they were entitled to supply electricity for the lighting of public lamps in Birkdale and the public buildings, such as the Town Hall, from their Southport generating station. Plaintiffs said the defendants had no such rights, and the latter admitted they were not entitled to supply private consumers in Birkdale, narrowing the dispute down to whether the Corporation was entitled to supply the tramway service and public lighting.

Counsel proceeded to deal with a series of Orders and Acts of Parliament on the matter. In 1891 there was the Southport Electric Lighting Order, which gave powers to the Corporation to supply in its own area, and this was followed in 1898 by the Birkdale Order. The Southport Extension and Tramways Act of 1900 contained a clause which the defendants regarded as important to their case. The Act extended the Corporation boundaries to include Birkdale and other districts, authorised the construction of tramways and conferred powers regarding the supply of electricity and gas. Under it powers were given to purchase and work tramways in adjoining districts, and under Section 42, which defendants relied upon, they were empowered to work tramways leased to them either within or beyond the borough, and provide such buildings and plant as required for the working of them. Plaintiffs' case was that the section gave the Corporation running powers over the plaintiffs' lines, but did not empower it to supply the energy or to erect generating stations to supply such energy to an area which belonged to some one else. In fact, when taken with Sections 63 and 64, the matter was fairly clear. Under Section 63 it was provided that where a local authority desired to be supplied with energy in bulk, the Corporation might supply it. Section 64 provided that the Corporation or any company having powers partly within and partly without the area might enter into an agreement for the supply of energy by the Corporation, provided that the Corporation did not supply energy in any district outside the borough, except with the consent of any local authority or company supplying energy in the district under statutory authority. Here plaintiffs were the company supplying in the Birkdale district, and they not only did not consent, but strongly objected to any such act by the Corporation. The Birkdale District Council, by agreement, transferred its power to the plaintiff company, and it was provided that the Council should not consent to any order to any person or body in respect of the area of supply. The agreement was therefore binding on the Corporation, which took over the powers of the Urban Council, and it was precluded from supplying within the

plaintiffs' area. Defendants said that the word "supply" did not mean supplying themselves, but that was a wrong contention, for it was a supply all the same and forbidden by Act of Parliament. The object of the agreement was to protect the company for competition. It had to bear all the expense of supplying the district, and it was protected from competition by the Corporation or anyone else. The Corporation had no authority to supply outside its district without statutory authority, and there was an express provision of an Act of Parliament precluding it from doing so. Dealing with the provisions of the Southport Extension Order, counsel said this provided that the powers of the Southport Electric Lighting Order should not extend to the area of the Birkdale Order until the Corporation became the undertakers under the Order. Until that occurred all rights and duties of the Urban Council under the Order vested in the Corporation. It had not become the undertaker, and its rights had not been extended by the Extension Order, which in one article provided that any agreement made by Birkdale should be binding upon the Corporation. By February, 1918, Southport had acquired the tramway undertakings both at Southport and Birkdale. In October the plaintiff company agreed with the defendants to supply energy for lighting and tramways in the Birkdale area. In August, 1921, defendants served the plaintiffs with a three months' notice to terminate the agreement, having themselves made arrangements to generate the energy. Plaintiff company asked what power the defendants had to do this, and they replied that they were not going to supply in the way of selling, but that they were entitled to generate it for their own use, and they intended to use it for public lighting. They commenced supplying the energy for the tramways in November, but plaintiffs continued to supply that for the lighting to avoid a great public inconvenience. Thus for a year the plaintiff company lost profit at twopence per unit on the tramway energy. The present suit asked for an inquiry as to damages.

His Lordship asked whether Birkdale Council could not have lighted the Town Hall without infringing the rights of the plaintiffs.

Mr. Maugham said that the installation of an engine in a building to light it was a very different thing from running mains along roads to supply electric power for tramways.

Mr. Harold Bentham, managing engineer of the company till 1912, in his evidence, stated that most of the public lighting was gas. The plaintiff company was still lighting the tramway routes and public buildings.

Mr. Tomlin, K.C., for the defendants, said he could not agree with the contention put forward by plaintiffs that provisions in the Act and the various Orders, as well as particularly Section 23 of the Act of 1909 as to the supply of energy, covered the case of a man supplying himself. He submitted that those provisions had no application to anything being done in this case. All the Acts and Orders referred to the generation of current for other persons, but the public body had a perfect right to light its own town hall. A private person could not bring current across a road to supply his house, but the Corporation controlled all the streets and owned the generating station, and there was not a single act of a physical nature it had had to do to make the change over. The town supply necessitated the existence of two parties—the supplier and the receiver. On the agreement of 1902, under which Birkdale District Council transferred the powers to the plaintiff company, Mr. Tomlin contended that this provided that the company should generate all current required for public and private purposes. That did not bind the Council not to take energy from anyone else, and there was no obligation to take the supply at all. Clause 8 said the Council should not consent to the supply of energy by any company, corporation, body, or person within the area. It was said that obligation was being infringed, but it was not so, because the clause did not say that the Council could not itself generate current for its own use. The clause simply meant that the Council was not to be a party to the creation of any rival electrical supply company. Defendants were owners of the tramways, and were authorised to work them, and, having electricity available, surely they were entitled to use it for tramways as well as public lighting. They were not lighting the lamps and did not intend to do so.

Mr. Maugham: They have cancelled the agreement which includes public lighting.

Mr. Tomlin: But the Corporation has not taken any decision on the point at all, and it may be years before it does so, and there is no threat to obtain a supply from another source.

At the close of the legal arguments his Lordship reserved judgment.

Tramcar Driver Fined.

Ernest Aubin, the driver of an L.C.C. tramcar, was fined £2 and £5 3s. costs at Highgate Police Court on July 7th for neglecting to stop his car and thus avoid collision with a motor-car. The driver of the motor-car stated that he was passing along a road at Whetstone which was under repair, there being only sufficient space for the passage of a single vehicle. Witness brought his car to a standstill and held out his arm as a signal to any vehicles behind him. Aubin ignored the signal, and his tramcar crashed into the rear of witness's car, injuring a boy standing on the pavement and his (witness's) wife. For the defence it was stated that the brakes had been rendered ineffective by tar and oil on the rails.

Portarlington Electric Lighting Co.

In the Southern Ireland Chancery Division, Dublin, an application was made by Mr. Dickie, K.C., for Mr. P. J. Waynes, petitioner, for an order to wind up the above company.

Mr. Justice Samuels said that on the complainants' question, notwithstanding the Peace Treaty of last July and the Free State Act, the Companies Act remained, and companies could be wound up voluntarily in Ireland. This Portarlington company was, however, an English company, and as such could be wound up voluntarily in England, and if the English Court wanted any assistance in the matter it would receive it from the Irish Provisional Government. He had no jurisdiction in the matter, and even if he had, he did not think he would exercise it, because, as far as he could see, the liquidator, Mr. Crowley, who was well known, seemed to be acting rightly, and no case had been made against him. He dismissed the application, with costs.

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XC. of the Electrical Review, which will shortly be printed, will be supplied only to those who through the post specially apply for it. To them it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—Leslie Rowland Henson, electrical engineer, 23, Green Lanes, Islington, N.—This debtor petitioned the London Bankruptcy Court on July 23rd, and was adjudged bankrupt the same day. The first meeting of creditors was held on July 6th, before Mr. F. T. Garton, Official Receiver, who reported that the debtor had stated that during the war he was employed as an electrical engineer by various Government contractors. In June, 1919, he started business on his own account, when he took the above premises for the sale of electrical goods. His season was in the winter, and until June, 1921, he managed to earn sufficient to live upon, but since then trade had been very bad, to which fact and lack of capital the failure was ascribed. The liabilities were roughly estimated at £160, against assets valued at £70. In the absence of any offer the case was left with the Official Receiver to be wound up in bankruptcy.

Wyness & Bale, electrical engineers, 13, Commercial Street, Brighouse.—At Halifax County Court, on July 7th, a meeting of creditors was held. The liabilities were stated at £3,397, including sixty-nine unsecured creditors for £2,647; one fully secured for £703; and ten for rates and wages in full amounting to £46. The assets were estimated to produce £982, leaving a deficiency of £1,711. The causes of failure, as alleged by Bale, were "under-estimating a Cardiff contract, general falling off in trade, and heavy expenses." Wyness endorsed these alleged causes, but added "mismanagement of the Cardiff contract." Mr. Charles H. Baker, of Leeds, was appointed trustee, with a committee of inspection.

R. Springer, electrical engineer and contractor, 253, Plymouth Grove, Manchester.—Receiving order made July 5th on creditor's petition.

E. G. Rowe (Davies & Rowe), electrical engineer, 119, Dunraven Street, Tonypandy, Glamorgan.—Receiving order made July 3rd on debtor's own petition.

J. W. Hodgson and N. Hodgson (Hodgson Bros.), electrical engineers, Norton Street, Middlesbrough.—First meeting July 14th at the Official Receiver's offices, Stockton-on-Tees. Public examination July 28th at the Court House, Middlesbrough.

F. Ridgway (Ridgway & Tynan) (separate estate), electrical engineer, Bradford.—First and final dividend of 4s. 7d. in the £ payable at the Official Receiver's office, Bradford.

T. Tynan (Ridgway & Tynan) (separate estate), electrical engineer, Bradford.—First and final dividend of 10d. in the £ payable at the Official Receiver's offices, Bradford.

F. J. Gill, electrical engineer, 26, Hardwick Street, Buxton.—First meeting, July 19th, at the Official Receiver's Offices, Manchester. Public examination, August 1st, at the Court House, Stockport.

Thomas Green Coaton, trading as T. G. Coaton & Co., 16, Humberstone Road, Leicester, electrical engineer.—The public examination of this debtor was held recently at the Castle, Leicester. It appeared that debtor started business in April,

1914, with his brother, who subscribed £50 out of £250 capital. In 1918 they were joined by a third partner, who added £100 capital, and in the same year the debtor's brother withdrew, and his capital of £425 was paid to their mother by weekly instalments. In August, 1919, his other partner withdrew. After further questions the examination was adjourned.

Private Arrangement.—T. Keating, electrical engineer, 186, Westcombe Hill, Blackheath, London, S.E.—A meeting of creditors was held recently, when it was stated that the debtor was quite solvent, and the meeting had been called owing to the non-receipt of a considerable sum of money to which he claimed to be entitled. The statement of affairs showed liabilities of £735, and the assets were estimated to realise £856. The stock was stated to be in good condition, and the business had been carried on at a profit. The debtor had been identified with another business in respect of which certain proceedings were pending, and the creditors decided that the meeting should be adjourned until that matter had been settled. In the meantime it was decided that Mr. F. B. Darke, of 146, Bishopsgate, E.C., and Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, should supervise the business until the adjourned meeting was held.

The adjourned meeting was held last week, when it was stated that the action referred to had been settled on the terms that the debtor was to receive £450. After allowing for the costs, there would be a balance available of £350. The creditors expressed the opinion that the debtor should continue the business, and agreed to accept 15s. in the £, and it was also decided that a composition deed should be entered into with Mr. Darke and Mr. Osborne as trustees, together with a committee consisting of Mr. W. Hunt, the General Electric Co., Ltd., and the Electrical Supplies, Ltd. The following are creditors:—

	£		£
Electrical Supplies Co.	62	Sloan Electrical Co., Ltd. ...	24
Edison Swan Electric Co., Ltd. ...	11	South Metropolitan Electric and	
Falk, Stadelmann & Co., Ltd. ...	16	Power Co., Ltd.	20
General Electric Co., Ltd. ...	82	Watsham's Co.	38
Hunt Byron	17	Hunt, A. F.	220
Rose Bros. Electric Co., Ltd. ...	17		

Company Liquidations.—Swarren, Ltd., 10, Phœnix Place, London, W.C.1.—The summary of the statement of affairs, together with lengthy observations by the Assistant Official Receiver (Mr. J. Barwick Thompson), was issued under date July 7th. The accounts filed under the liquidation show total liabilities £11,582, assets valued at £1,806, and a deficiency of £43,793. As regards contributories, the issued capital amounts to £34,017. The chief item accounting for the deficiency is £33,750, written off in respect of patents and goodwill. The winding-up order was made in June, 1921, on the petition of a creditor. The company was promoted by C. W. Streeten and Sydney A. M. Rose, and registered in March, 1917, to carry on business as merchants, electrical engineers, &c. Immediately after formation it acquired from Streeten (trading as S. Warren & Co.) the "Swarren crutch seat," but the manufacture of this appliance was unsuccessful, and the accounts to the end of 1917 showed a loss of £164 on trading. Early in 1918 the company commenced trading as electrical engineers, and Rose was appointed manager. In August, 1919, the company acquired the goodwill of the business of the Lonsdale Electrical Works. The statement sets forth the details of this transaction and financial measures which followed it. In September, 1919, the capital was increased to £60,000 by the creation of 29,000 additional ordinary and 30,000 preference shares (7½ per cent) of £1 each. In December, 1919, an agreement was entered into with Rose under which the company acquired certain patents relating to a target-indicating device and an improved automatic steering apparatus for torpedos, and an interest in an invention for protecting safes and windows against burglary. The consideration was fixed at £30,000 in shares. No inquiries as to the value of the patents appear to have been made. The shares were allotted to nominees of Rose, who at that time was an undischarged bankrupt. The patents have not been assigned and no work has been done in connection with them, which, according to Rose, is due to disputes between the directors which resulted in his removal from the board in March, 1920. He commenced actions against Orrick, Redman, and the company, asking for an injunction to restrain them from excluding him from the control of the company's affairs and directing the allotment to him of 29,498 shares, but the applications were not proceeded with. The business was carried on at a loss throughout. The bank pressed for payment toward the end of 1920, and a receiver was appointed. The assets are valued in the statement at £1,806, and unpaid calls included therein (£750) are due by Ogilvy. There is uncalled liability of £2,700 in respect of 3,000 shares allotted to St. Clair. The failure of the company is attributed by Picknell to lack of working capital, heavy overhead charges, and the slump in trade.

Clarendon Manufacturing and Engineering Co., Ltd.—A petition for the winding up has been presented to the High Court by Mr. N. T. Belaiew, of 33, Elvaston Place, Queen's Gate, London, a creditor, and will be heard in London on July 18th.

W. Mansfield & Co., Ltd.—Winding up voluntarily. Liquidator: Mr. Thos. Keighley Moulsdale. Meeting of creditors, July 17th at India Buildings, Liverpool.

National Electric Supply Co., Ltd.—Particulars of claims to be sent to Arthur Both to the liquidator, Mr. W. H. Ainsworth, 11, Winckley Street, Preston.

Albert Lee & Co., Ltd.—Winding up voluntarily. Liquidator: Mr. T. Keens, 25, College Hill, E.C. Meeting of creditors, July 24th, at the London Chamber of Commerce, Oxford Court, Cannon Street, E.C.; particulars of claims by July 17th.

Letchworth Electricity Co., Ltd.—Liquidator, Mr. J. C. Morris, Official Receiver, The Parade, Northampton, released July 5th.

Melvin Engineering Co., Ltd.—Winding up voluntarily. Liquidator: Mr H. F. Inkson, 23, King Street, E.C. Meeting of creditors, July 19th.

Wholesale Electrical Co., Ltd.—Meeting called for August 11th, at 4, Charterhouse Square, E.C., to hear an account of the winding-up from the liquidator, Mr. E. H. Hawkins.

Dissolution of Partnership.—Central London Electrical Installation & Maintenance Co., Ltd., electrical engineers, 29, Bedford Row, W.C.—Mr. C. Saunders and Mr. W. H. St. Aubrey Davies have dissolved partnership. Mr. Davies will attend to debts and continue the business on his own account.

Trade Announcements.—Messrs. Kendrick & Co., electrical engineers, of Mariscow Street, Westbury, Wilts, have completed extensions to their premises, and have added a wireless installation.

The Oriental and General Trading Co., electrical apparatus dealers, of 3 and 5, Oldham Street, Liverpol, announce that they are relinquishing business.

Messrs. Dorman & Smith, Ltd., have appointed Mr. H. J. D. Thompson to represent them on the N.E. coast, and he has opened an office at 28, Grainger Street, Newcastle-on-Tyne, to deal with inquiries for switchgear, fittings, &c., on their behalf.

Mr. Charles Erith, A.M.I.Mech.E. (trading as Charles Erith & Co.), has removed to Palace Chambers, Bridge Street, S.W.1, where he is carrying out the construction and installation of Riley patent stokers for all types of water-tube boilers at home and abroad. Telephone: "6145 Victoria."

The interests of the Vincent Switchgear Manufacturing Co. in Yorkshire are now in the hands of Mr. H. Holt, Messrs. Hinchcliffe Green Manufacturing Co., Airedale Works, Holbeck, Leeds.

Messrs. Griersons, Ltd., have removed from Wardour Street, W., to 43, Bloomsbury Square, London, W.C.1.

Messrs. Goldfarb & Bottom, of Leadenhall Street, E.C., have dissolved partnership, and the business is under the sole control of Mr. M. H. Goldfarb, who will trade under his own name at 95, Great Portland Street, W.1. Telephone number: "Mayfair 5020"; telegraphic address: "Electengin, Wesdo, London."

Messrs. Sutcliffe Bros. have this week removed their offices and warehouse to 42, Southwark Street, London, S.E.1. The name of the firm has been changed to Hulburn & Co., and the business will be carried on by the partners of Sutcliffe Bros. (Messrs. E. G. Hoare and L. E. Milburn) and Mr. J. H. Hull, who has been taken into partnership.

Mr. W. Blackburn, late repair manager of Messrs. C. A. Vandervell & Co., Ltd., has commenced business as W. Blackburn (Kew), Ltd., automobile electrical engineers, at 110, Kew Green, London, S.W.

Holophane, Ltd., has this week removed to Elverton Street, Vincent Square, Westminster, London, S.W. The telephone number and the telegraphic address are unaltered.

Messrs. W. Warburton & Co., Ltd., Turbine Works, Halifax, have appointed the London Factors & Agents, Ltd., of 38 and 39, Parliament Street, S.W., their sole agents for London, the South of England, and South Wales.

As announced in our other pages this week, a manufacture and sales arrangement has been concluded between the Hotpoint Electric Appliance Co., Ltd., of 21, Berners Street, London, W.1, and the Falkirk Iron Co., Ltd., of Craven House, Kingsway, London, W.C., and Falkirk, N.B., whereby the Falkirk Iron Co., Ltd., will manufacture, and the Hotpoint Electric Appliance Co., Ltd., will conduct the sale of the "Falco" heating and cooking specialities in addition to "Hotpoint" appliances. It is anticipated that this arrangement will be found to possess advantages for both the trade and the public, and its progress will be watched with interest.

Catalogues and Lists.—Messrs. W. F. Henley's Electrical Works Co., Ltd., Blomfield Street, London Wall, E.C.2.—A set of six booklets dealing with the application of the "Henley" wiring system to various classes of buildings. The brochures are very fully illustrated and admirably demonstrate the breadth of the system's application.

Messrs. William Sanders & Co., Falcon Electrical Works, Wednesbury.—Fully priced list of moulded switch and fuse gear with terms of business.

Mr. F. Pratt, 23, Queen Anne's Gate, London, S.W.1.—List of reduced prices of safety cartridge fuses.

The Hackbridge Electric Co., 24, Broad Quay, Bristol.—An illustrated booklet dealing with the "Kenova" [illegible] system.

The London Factors & Agents, Ltd., 38 and 39, Parliament Street, S.W.1.—Net price list of electrical accessories for July.

The Electric Construction Co., Ltd., Ingersoll House, 9, Kingsway, W.C.2.—An illustrated and priced pamphlet dealing with commutator stones.

The Electrolytic Apparatus & Battery Co., Ockford Works, Ockford Corner, Godalming, Surrey.—Two priced leaflets dealing with Niblett's electrolysers and "Lithos" secondary cells.

Automatic & Electric Furnaces, Ltd., 281-283, Gray's Inn Road, W.C.1.—A well-illustrated descriptive catalogue of "Wild-Barfield" furnaces for the correct hardening of steel; fully priced.

Messrs. Pratt & Co., 23, Queen Anne's Gate, Westminster, S.W.1.—An illustrated pamphlet dealing with the "C. & H." wireless telephony receiving set. Priced.

We have received from Messrs. Robert Stelling & Co., of 88, Chancery Lane, London, W.C.2, a booklet describing the advisory service that they render as consulting industrial engineers in connection with the problems of management, organisation, costing, and the improvement of production methods by the application of scientific principles.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., U.S.A. Catalogue M.—A well-illustrated publication describing apparatus and line material for use in mines. Priced in U.S. dollars.

"The Coventry" Chain Co., Ltd., Spon End Works, Coventry.—A well-illustrated catalogue of chain gear for power transmission purposes, giving dimensions, weights, strength, &c.

Mr. H. B. Turner, 79, Playford Road, N.4.—Two illustrated descriptive pamphlets dealing respectively with "A.T.M." crystal detector sets and loud-speaking receivers.

Messrs. John Jardine, Ltd., Deering Street, Nottingham. Sheet No. 71—B. Dept., illustrating and describing a new type of cast-iron split pulley. Priced.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Monthly Magazine for July, containing stock-lists of a.c. and d.c. motors, and d.c. generators, notes on their construction and working, &c.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—July stock list (in French)) of motors, dynamos, transformers, and switchgear. Illustrated.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—List No. 362, describing and illustrating "Sunco" rotary converters for accumulator charging. Also a list of reduced prices of "Apex" switchgear.

Messrs. Herbert Alexander & Co., Ltd., Charmouth Street, Leeds.—An illustrated booklet describing several types of "Clayden" portable cranes.

Stoker Contracts.—Among the more important orders recently secured by the Underfeed Stoker Co., Ltd., are the following for electric light and power stations:—St. Helens, two travelling grates; Amsterdam, two travelling grates; Dover, two class "E"; Penarth, one class "E"; Belfast, ash conveyor; Sydney, N.S.W., ash conveyor; Osaka Electric Co., ash conveyor.

Book Notices.—"Industrial Welfare," July, 1922. London: Industrial Welfare Society. Price 9d. net.—This issue contains several articles of importance in these times of labour troubles. "Pulling Together" is a statement regarding the profit-sharing scheme instituted by Messrs. Rowntree & Co., Ltd., who have brought into being many methods of working conducive to good fellowship in their factory. Sir William McKenzie writes on "The Human Factor" in industry with the authority born of experience. Other articles are:—"Safety in Foundries," by Mr. R. W. Patmore; "The New Conception of Management"; "A Central School of Printing"; and notes on world conditions in industry.

"L'Union d'Electricité et la Centrale de Gennevilliers." By Ernest Mercier. Pp. 52; figs. 53+5 folding plates. Paris: *La Revue Industrielle*. Price 13 fr., post free.—A complete account of the new 200,000-kW power station of Gennevilliers, erected to supply electricity to Paris and the adjoining district, including the system of distribution, and particulars of the present and future conditions of the supply. An edition in English is in preparation.

"The Brown-Boveri Review" (English edition), May, 1922. London: Brown, Boveri & Co., Ltd.—This number contains an exhaustive description of single-phase express passenger locomotives with the Brown-Boveri individual axle drive, and also of the new single-phase locomotives supplied for the Rhaetian Railway.

"The M. & C. Apprentices' Magazine," Summer Number, 1922. Glasgow: Messrs. Mavor & Coulson, Ltd.—In this issue. Mr. Sam Mavor gives his views on the recent engineering lock-out; Mr. Henry Edmunds continues his "Reminiscences of a Pioneer"; an article on the Caucasus, by Mr. George Dey appears, as well as the usual record of events.

Messrs. H. K. Lewis & Co., Ltd., 136, Gower Street, W.C.1, have sent us a list of text-books and works of reference in science and technology. The catalogue covers a diverse field, ranging from botany to electrical engineering, and the price and the date of publication of each book are given.

"Wireless for the Home," by N. P. Hinton. Pp. xii+87; figs. 34. Price 2s. net. "Electric Cables," by F. W. Main. Pp. viii+96; 26 figs. Price 2s. 6d. net. London: Sir Isaac Pitman & Sons, Ltd.

Scientific Paper No. 436, of the U.S. Bureau of Standards, "Interference Methods for Standardising and Testing Precision Gauge Blocks. (37 pp.) Washington: Government Printing Office. Price 10 cents.—This gives in detail the system adopted in testing precision gauges used as standards for checking micrometers, and also as distance pieces for precise mechanical work. The apparatus used is fully described and illustrated by line drawings and diagrams.

Chinese Note.—An electric light company was recently organised in Yuan-hwa, Chekiang.

The Engineering Trade Negotiations.—As a result of the joint conference of representatives of the Engineering and National Employers' Federation and the Engineering Trades Unions last week, the employers' proposal for a reduction of the war bonus by 16s. 6d., the reduction to be effected by three instalments, namely: 5s. 6d. on July 31st, 5s. 6d. on August 28th, and 5s. 6d. on September 25th, is being submitted to the members of the respective organisations on a uniform ballot-paper, the votes to be returnable by July 25th.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Geyselec. No. 425,572.—Electric geysers. De la Hey Moore, 20, Richmond Hill, Clifton, Bristol. June 14th, 1922.

Hecla. No. 419,443. Class 18.—Electric heating apparatus. Clarence W. Marriott, 56-62, Little Bourke Street, Melbourne, Victoria (address for service in this country, G. E. Folkes, 35, Temple Row, Birmingham). June 21st, 1922.

Railodon. No. 425,962. Class 22.—Electrically-operated luggage trucks. Industrial Appliances, Ltd., 38, Victoria Street, London, S.W. July 5th, 1922.

S (letter and design). No. 412,137. Class 8.—Fitted electrical switchboards. No. 412,138. Class 13.—Electrical devices, accessories, and fittings of metal. No. 412,139. Class 16.—Electrical devices, accessories, and fittings, wholly or partly of porcelain or earthenware. Wm. Preston, trading as William Sanders & Co., Falcon Electrical Works, Redding Lane, Wednesbury. July 5th, 1922.

Giant. No. 414,516. Class 6.—Pneumatic and electric machine tools. Consolidated Pneumatic Tool Co., Ltd., 170-173, Piccadilly, London, W. July 5th, 1922.

Design No. 425,371. Class 13.—Water, gas, and electrical fittings of ordinary metal. Samuel Booth & Co., Ltd., Cheapside Works, Cheapside, Birmingham. July 5th, 1922.

Local Exhibition.—The Housing and Health Exhibition, promoted by Glasgow Corporation, will be opened on Monday, October 2nd, and will run to October 21st.

Patent Application.—Application has been made for the restoration of patent No. 10,253, of 1914, granted to Hubert Alexander Gill, for "Improvements in and relating to variable speed generator and storage battery systems."

For Sale.—Beckenham U.D.C. electricity department has for disposal one 120-kW Belliss-Fowler alternator and one 1,250-kW Fowler alternator.

Darlington Corporation Electricity Committee invites offers for one 250-kW Allen-Parker steam generator.

Burnley Corporation electricity department invites offers for one 250-kW triple-expansion Belliss-Dick, Kerr generating set.

Hammersmith B.C. electricity department invites offers for one 2,000-kW Curtiss turbo-alternator, condensing plant, &c.

The London County Council tramways department has for disposal six water-tube boilers, with superheaters and chain grate stokers, also three Green's economisers. (See our advertisement pages to-day.)

Annual Outings.—The employés of the Wolverhampton Corporation electricity department held their annual trip on Saturday. Stratford-on-Avon was their destination. After visits had been paid to places of interest, boating attracted quite a number of patrons, and all assembled at the Old Red Lion Hotel in the afternoon for tea, provided by the Mayor of Wolverhampton (chairman of the Electricity Committee), who unfortunately could not be present owing to an official engagement at Stafford. Mr. S. T. Allen (borough electrical engineer) presided. Sports were held in the Recreation Grounds, and the prizes were distributed by Mrs. Allen.

Wages in the Plymouth Electricity Department.—In May last, owing to the extension of the Plymouth electricity works, the latter came under class D instead of class C in the schedule of salaries, and the staff consequently received an all-round increase of salary. The Plymouth branch of the Electrical Trades Union is circularising the District Joint Industrial Council, pointing out that in that area (No. 12), which contains Plymouth only, the basic rates of pay are the lowest in the country, and that on July 20th a resolution will be submitted to the Council recommending that the rates paid in No. 11 area shall become operative as from April 1st, 1922. No. 11 area contains many towns smaller than Plymouth, which indeed would be the second in point of population, and has made a net profit of £14,290 on the electricity undertaking during the past year. On the face of it, the E.T.U. has a very strong case for the proposed amendment.

"Wireless" Exhibitions.—A Radio Exhibition and Wireless Convention is to be held at the Central Hall, Westminster, from September 2nd to 8th. This will provide an opportunity for manufacturers of "wireless" apparatus to display their products. Particulars may be obtained from Messrs. Dale, Reynolds & Co., Ltd., 46, Cannon Street, E.C.4.

A similar exhibition is announced to take place in the Champ de Mars, Paris, from August 25th to October 5th.

The World's Copper Production.—The organisation formed by American mining interests under the title of the American Bureau of Metal Statistics has now issued its second annual report concerning the world's production of certain non-ferrous metals. Having regard to the prominent position occupied by the United States in the matter of the output of copper and by the two countries directly dependent upon the States—Mexico and Chile—the figures for 1921 show very clearly how the industry was operated on short time in that year. In round figures the total production of the United States, Canada, Mexico, and Cuba is returned at 256,000 tons in 1921, as compared with 663,000 tons in 1920, and 1,019,000 tons in 1918, and the United States turned out 216,000 tons in 1921, as compared with 576,000 tons and 879,000 tons in the other two years respectively. The quantity apportioned to South America—Chile, Peru, and Bolivia—is 99,000 tons for 1921, 135,000 tons in 1920, and 146,000 tons in 1918; to Europe, 56,000 tons, 46,000 tons and 75,000 tons in the three years respectively; to Asia (Japan and other countries), 54,000 tons, 66,000 tons and 90,000 tons; Australia, 19,000 tons, 26,000 tons and 44,000 tons; Africa, 39,000 tons, 30,000 tons and 31,000 tons; and to other countries, 5,000 tons for each of the three years. As the aggregate for the whole world the statistics give 529,000 tons for 1921, 975,000 tons for 1920, and 1,412,000 tons for 1918. In addition, the world's production of zinc is mentioned at 458,000 tons last year, as contrasted with 727,000 tons in 1920 and 810,000 tons in 1918, while the corresponding figures for lead are 853,000 tons, 907,000 tons, and 1,190,000 tons in the three years respectively.

Russo-Italian Trade.—M. Feinstein, a commercial representative of the Soviet Government, who recently returned to Moscow after a prolonged stay in Italy, is reported to have stated that the value of the trade transacted between Russia and Italy in the first quarter of 1921 amounted to 20,000,000 lire. At present the Russians are in course of exporting to Italy scrap metals, petroleum, and coal. On the other hand, Italy will deliver to Russia railway material, machinery, agricultural implements, and electrical plant.

Lead.—Messrs. James Forster & Co., in their report dated July 8th, state:—"Consumption, particularly in the cable trades, seems to be slightly better, and makers are disposed to purchase metal further ahead than has been the case during the last few months. On the other hand, supplies should be more ample this month, though there is little likelihood of any surplus, as we are still feeling the effects of the shortage last month."

Glasgow Tramways Jubilee.—To celebrate the "Jubilee" of the municipal tramways on August 18th the Council has decided to present every employé of the department with £1, and to give a luncheon, reception, and dance to which members of the Council will be invited. There are over 7,000 employés in the Tramway Department.

Holidays.—Messrs. Higgs Bros., of Birmingham, announce that their works will be closed for the annual holidays from August 4th to 14th.

The French Electrical Industry.—An optimistic note is sounded in the recent report of the French Thomson-Houston Co. It states that the electrical industry has not been so deeply affected by the general depression owing to the vital part it now plays and will play in future. Every undertaking is feeling an urgent need for extensions to meet the growing demand for electricity, and many schemes are well in hand. In addition to the development of the steam stations in the regions of Paris and the Nord, hydro-electric construction is being speeded up. The harnessing of the *houille blanche* is resulting in a network of distribution lines covering very wide areas, as well as the electrification of railways.

Schemes have been drawn up for the conversion of 5,456 miles of line. There has also been great progress in electric heating, particularly in the mountain regions, where the delivery of coal is difficult, but which are easily accessible to electricity. There is also a great scope for the telephone industry; there are ten times more subscribers in America than in France per capita. As a result of negotiations between the Société d'Etudes pour l'Electrification des Chemins de Fer and the principal railway authorities, many contracts have been placed, or are projected, having a total value of about 200,000,000 francs. The method uniformly adopted is the high-pressure direct-current system.

"Volt" Wire Lamps.—The report of the N.V. Metaaldraad Lampenfabriek "Volt," of Tilburg, Holland, states that if the year 1920 had been referred to a year ago as having been not specially favourable, the result was at all events a profit which permitted of the payment of a small dividend. But 1921 closed with a loss of 474,000 florins, owing to the unsatisfactory prices realised for old stocks, and the necessity for writing off 262,000 fl. on the stocks remaining. As to the future, the report states that it is probable that the influence of the debit balance will be felt beyond the new financial year, particularly as the position of the smaller glow lamp works is far from satisfactory, and it would be necessary in future years to take into consideration the writing down of shares held in associated companies, which are now booked at their nominal value.

LIGHTING AND POWER NOTES.

Accrington.—Increased Discount.—The General Purposes Committee has considered the question of electricity charges, and has decided that the present discount of 2½ per cent. shall be increased to 7½ per cent. The increase will date from July 1st.

Birkenhead.—Deferred-payment Wiring.—The Corporation Electricity Department has introduced a scheme for wiring houses, the cost of which is recouped from the consumers by means of payments spread over a long period. Lighting only is provided for, plain drop fittings and lamps being installed at a maximum cost of £50. The cost is payable in quarterly instalments over a period of four years. The work is to be carried out by contractors.

Cannock.—Electricity Supply.—The Urban Council has applied for an order to enable it to supply electricity to Hatherton.

The Urban Council has also sealed an agreement with the Cannock and Rugeley Colliery Co., Ltd., for a supply of electricity for a period of five years.

Continental.—France.—The Société d'Electricité Surgères-Aigre Feuille-Mauze has applied for a concession to distribute electricity for traction, lighting and power purposes in 14 communes of the *département* of Charente-Inférieure and in seven communes in the *département* of Deux-Sèvres.

Application has been made by the Intercommunal Electrical Syndicate for authority to erect and work an electricity supply network to serve 52 communes in the Chartrain district of the *département* of Eure-et-Loire.

Croydon.—Year's Working.—The Corporation Electricity Department (engineer: Mr. A. C. Cramb) has issued its report and accounts for the year ended March 31st last. The total revenue for the year was £174,697, as compared with £163,984 in the previous year. Against this was charged a total expenditure of £107,339, as compared with £149,727, leaving a gross profit of £67,358 (£14,257). Interest, income tax, &c., absorbed £22,068, and sinking fund and loan repayments £19,128, resulting in a net profit of £26,162. This was an extremely favourable result, comparing with a deficit of £19,436 in 1920-21. The total number of units sold remained at almost exactly the same level—about 10,770,000. The large reduction in working expenses was accounted for partly by a decrease in the cost of coal, but a saving of £7,000 was made by the use of oil fuel during the coal shortage. The cost of production was actually reduced from 2.96d. to 2.05d. per kWh. The capital account shows an expenditure during the last two years of £214,105. This large amount is due to the reorganisation of the plant, and includes such items as:—Two 5,000-kW and one 3,000-kW turbo-alternators; rotary converters and transformers; condensing plant; building work; switchgear, &c. Two of the new turbo-alternators are reported to be running satisfactorily; the other has not yet finished its tests.

Darlington.—Loan Sanctioned.—The Town Council has received sanction to borrow £31,731 for plant, mains, &c.

Eastbourne.—Year's Working.—The report of the borough electrical engineer (Mr. J. K. Brydges) upon the undertaking, for the year ended March 31st last, shows that the total income was £71,025 and the working expenditure £41,155, comparing with £62,895 and £41,381 in the previous year. This left a gross profit of £29,870 (£21,514). Capital charges absorbed £20,415 (£17,729), making the net result a profit of £9,455, as against £3,785 in the previous year. The capital expenditure during the year was £16,657, the principal item being £13,325 for mains and services. The total number of units sold rose from 3,767,320 to 4,318,370, the maximum demand from 2,186 to 2,300 kW., and connections from 10,000 to 11,071 kW.

Edinburgh.—The Lighting of Princes Street.—At the meeting of the Corporation on July 6th, although the view was expressed that it was unfortunate that the Gas and Electricity Committees should compete in the matter, it was agreed by a large majority that Princes Street should be lighted by 200-W (gasfilled) electric lamps with Holophane globes, two on each centre pole, and that where necessary electric lamps of 300 watts should be used. It will be recalled that some time ago there was a test of both gas and electric lighting.

A discussion also took place over the question whether the electricity or gas mains should be extended to Cramond. The cost of extending the electricity main was put at £1,100 and of the gas main £7,000. The proposal to extend the electricity main was approved.

Electricity District.—East Midlands.—The local inquiry in respect of the above-named area, which the Electricity Commissioners were to have held at Nottingham on July 11th, has been postponed.

London.—St. Marylebone.—*Year's Working.*—The accounts of the borough electricity undertaking (engineer: Mr. C. H. Smyth) for the year ended March 31st, 1922, record a total income of £377,094, as compared with £359,211 in the year 1920-21. Working expenses (including an item of £17,599 for repairs and maintenance) amounted to £220,428, as against £219,810, leaving a gross balance of £156,666 (£139,401). The net result, after payment of capital charges, &c., was a profit of £30,111 (£28,061). This, with a balance brought forward, &c., made a total of £62,966, of which £12,805 was expended or provided for improvements, &c., and the balance of £50,161 carried forward. A total of 24,218,918 units was sold, as compared with 21,322,480 in the previous year. The maximum load increased from 14,947 to 15,920 kW. The cost of fuel per unit sold fell from .877d. to .786d.; the 1915 cost was .318d. During the year the plant capacity was increased from 19,000 to 27,000 kW. The capital account shows the year's expenditure to have been £222,932, including £159,247 for machinery and plant.

Marlborough.—Electricity Scheme.—The Town Council has consented to the application of the Gas Co. for a Special Order to supply electricity. A similar Order is being applied for by the Marlborough Engineering Co.

Oswestry.—Electricity Charges.—The Ministry of Transport has granted an Order to the Electric Light Co., empowering it to charge from July 1st a maximum of 1s. per unit, with a minimum of 10 units in the summer quarters and 15 in the winter quarters. The previous maximum charge was 8d. per unit.

Oxted.—Extension of Supply.—The Sevenoaks and District Electricity Co. is commencing forthwith the extension of mains to the Oxted and Limpsfield district, and it is hoped that a supply of electricity will be available by next winter.

Rotherham.—Loan.—The Town Council is applying for a loan of £53,500 to cover an accumulated deficiency on the electricity undertaking. The Electricity Commissioners have intimated that such a loan would be sanctioned on repayment within seven years.

Rothwell.—Electricity Scheme.—The Urban Council has applied for an Order to enable it to obtain electricity from local sources for lighting the new village at Rothwell Haigh.

Royton.—Electricity Supply.—The question of an electricity supply for the district is under consideration by a committee of the Urban District Council.

Rugby.—Electricity Charges.—The Urban Council has altered the charges for electricity for lighting to 6d. per unit, for the first 500 units per quarter; 5½d. from 500 to 1,000 units; 5d. from 1,000 to 1,500 units; and 4½d. per unit beyond.

Stourport.—Electricity in Bulk.—The Urban Council has applied to the Electricity Commissioners for an Order to permit it to obtain electricity in bulk for distribution in the town.

Stretford.—Loan.—The Urban District Council is applying for sanction to borrow £25,000 for extensions to electricity mains.

Torquay.—Loan.—The Town Council has applied for a loan of £5,000 for mains and services.

Price Reductions.—The charge for electricity for lighting and other purposes under the combined domestic system has been reduced from 2½d. to 2d. per unit; for cooking and heating, from 2½d. to 2d., and from 2d. to 1½d.; and for thermal storage and other uses for which a constant supply is required, from 1¾d. to 1¼d.

Warrington.—Year's Working.—There was a net profit of £11,215 on the working of the electricity undertaking for the past year, as against £12,037 for the previous year.

Wolverhampton.—Price Reduction.—The Electricity Committee is reducing the charges for electricity for lighting and power purposes, other than flat-rate lighting supplies, from 115 per cent. to 90 per cent. over the pre-war rate.

TRAMWAY AND RAILWAY NOTES.

Continental.—Spain.—The projected Urola railway between Zumaya and Zumarraga will be electrically equipped instead of steam operated. The system to be adopted will be d.c. at 1,500 V, and the trains will be of a similar type to those on the Sebastian to the French frontier line. The estimated cost is one and a half million pesetas more than for steam.

Croydon.—Track Renewals.—The Town Council has decided to renew a portion of the tramway track in London Road at an estimated cost of £8,516.

Huddersfield.—New Route.—Application is being made to the Ministry of Transport for sanction to construct a tramway line in Bradley Mills Lane and Bradley Mills Road.

Liverpool.—Loan.—Application is to be made to the Ministry of Transport for sanction to the borrowing of £160,000 for tramway purposes.

London.—Closing of Station.—Borough station, on the City and South London Railway, will be closed to traffic on and after Monday, July 17th, to facilitate the work of widening the tunnel.

Manchester.—Year's Working.—We have received a copy of the report and accounts of the city tramway undertaking for the year ended March 31st, 1922. A total income of £1,994,577 is shown; this includes £6,743 from the Parcels Department, and compares with £1,813,401 in the previous year. The working expenses totalled £1,519,838, including an item of £308,086 for repairs and maintenance; the previous year's expenditure was £1,507,567. The gross profit was thus £474,739, comparing with £305,834 in 1920-21. Adding £2,966, bank interest, an amount of £477,705 was available to meet capital charges, &c. These amounted to £221,132, and the balance was divided between the renewals fund (£218,842) and income tax (£37,730); the equivalent amounts for 1920-21 were £106,166 and £18,263. It is to be noted that the foregoing figures all include items relative to the motor omnibus services, which, however, are a very small percentage of the totals; the net revenue, for instance, was only £728. The outlay on renewals, from the Renewals Account, was £150,770; this consisted principally of expenditure upon the permanent way (£116,920). The car-mileage run increased from 18,711,007 to 19,465,734, and the number of passengers carried from 277,738,700 to 281,140,974. The consumption of energy per car mile fell from 1.746 to 1.723 kWh. During the year a total of nearly nine miles of single track was put into commission, making the total single-track mileage owned and operated 221, or 120 route-miles. An analysis of the revenue shows that it is mainly derived from 1d., 1½d., and 2d. fares, the percentages of the total being 36.54, 22.17, and 18.77 respectively.

Newcastle-on-Tyne.—Light Railway Order.—The Minister of Transport has granted the Newcastle-upon-Tyne Corporation Light Railway Order, 1922, authorising the construction of light railways in the city and county of Newcastle-upon-Tyne and in the urban district of Longbenton and the rural district of Castle Ward, in Northumberland.

West Ham.—Year's Working.—The accounts of the municipal tramways for the year ended March 31st last record a total income of £308,523, as compared with £305,883 in the previous year. The working expenditure was £276,067, as against £299,333, leaving a gross balance of £32,456 (£6,550). After the deduction of capital charges, cost of reconstruction defrayed from revenue, &c., the net result was a deficiency of £57,301, compared with £23,319 in 1920-21. A sum of £58,642 was expended from revenue upon track renewals, car bodies, &c., and so the result was not so unsatisfactory as the debit balance would suggest. An analysis of the statistics shows that while the working costs per car mile decreased from 21.110d. to 19.957d., the income per care mile rose from 21.572d. to 22.391d.

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—Bruges.—Wireless Station.—A feature of special interest in the large wireless station being erected near Bruges is the arrangements that are being made for the rapid transmission by telegraphy of messages in the form of writing, photographs of the actual writing being transmitted by wireless. The method has been devised by the well-known Belgian telegraph engineer M. Charbonelle, and should the experiments prove a practical success a very high speed of operation may be attained.—*Daily Mail.*

France.—St. Assise Wireless Station.—A new wireless service between France and the United States was inaugurated on July 5th, when the powerful Sainte Assise station (Seine and Marne Dept.) was tested with satisfactory results, says the *Daily Mail.*

The station, which has taken two years to construct, will be placed at the disposal of the general public as soon as the authorisation of the Government has been accorded.—*Reuter.*

Telephone Apparatus.—A competition is being arranged by the Service d'Etudes et de Recherches Techniques department of the Postes et Télégraphes in order to obtain a choice of the best type of telephone apparatus with central battery to be introduced into all future installations erected by the Administration. The apparatus should be capable of being converted into an automatic appliance.

Gambia.—New Wireless Stations.—The Colonial Office's annual report on Gambia for 1920 discloses the fact that there is no telegraph service in the colony, but it is reported that before the end of 1920 wireless telegraph and telephone stations were in course of erection at Bathurst and at MacCarthy Island, 176 miles distant. The service is intended for internal communication.

India.—Inland Wireless System.—A scheme is outlined in a memorandum issued by the Government of India to establish an inland system of low-speed wireless stations. The scheme does not include wireless communication with Britain, but will be adaptable to the imperial wireless scheme when this is in operation. The rapidity of the development of the scheme depends on the welcome accorded to it by local Governments and the Indian States.—*Daily Mail.*

A representative of Sir Wm. Meyer, Indian High Commissioner in London, has arrived at Vienna to inspect the works of an important Austrian firm which has tendered for the supply of materials for new telephone construction in India. If the Indian Government is satisfied of the firm's ability to carry out the work the contract will probably be placed there, as the Austrian terms are much lower than the British ones, says the *Daily Dispatch.*

Ireland.—Wireless Telegraphy.—"Rebels" are stated to have seized apparatus at the British naval wireless station at Banbeg last week and to have erected it at Glenveagh Castle, East Donegal, where they are concentrated to oppose the Free State forces.

Poland.—Telegraph Concessions.—The Polish Government, as the successor of the former Russian and German Governments, has given to the Indo-European Telegraph Co. a concession for that part of its line from London to Teheran which extends from Schneidemuehl on the west *viâ* Thorn and Warsaw, to Rowno on the east, which is approximately the frontier point between Poland and Soviet Russia. The Soviet Government has also promised the same company a concession for that part of its line extending from Rowno (Berdichew) to Djulfa, on the Persian frontier.—*Financier.*

South Africa.—Telephone Extensions.—The Government is placing £500,000 of the forthcoming loan estimates for the purpose of a comprehensive scheme of telephone extension.—*Reuter's Trade Service* (Capetown).

Storm Damage.—A gale swept the country during the early hours of July 6th and did extensive damage to telephone lines in London and the southern and eastern counties. Nearly 40 exchanges were affected in the London area, and the trunk services to several towns were entirely interrupted. The telegraph lines came through the storm much better; but there was neither telephone nor telegraph communication between London and Paris, and there was considerable delay in getting messages to other parts of the Continent.

In reply to a question in the House of Commons on July 10th, Mr. Kellaway, the Postmaster-General, explained that the number of telephone trunk circuits affected was 200, and, in addition, 50 short trunk circuits were damaged. The majority of the circuits were restored within 24 hours. The number of local circuits affected was 4,500, and practically all of them were restored by the night of July 8th.

Wireless Telephony.—Broadcasting.—A discussion took place at a meeting of the Cardiff Technical Instruction Committee on Wednesday last week relative to the wireless apparatus at the Technical College. The Principal recommended, in view of the decision to make Cardiff one of the provincial broadcasting centres, that the apparatus should be retained for the use of the existing departments of the college and be placed in charge of the head of the engineering department. It would then be available for popular lectures for the purpose of interesting the general public in wireless work, and it was possible that a class might later be founded in general principles and manipulation. This, he pointed out, could be done at a very small cost. The Principal's suggestion was adopted.

A difficult situation has arisen in connection with the wireless telephone broadcasting plan of the Postmaster-General (Mr. F. G. Kellaway), and may seriously hinder its development, says the *Evening News.* A number of firms which desire licences to broadcast were asked by Mr. Kellaway to submit proposals to him, because there were more applications than could be granted in the restricted area of Great Britain. The firms have now submitted proposals to the Postmaster-General. They lay down, however, this important condition of their undertaking the development of broadcasting in this country—that only British-made apparatus shall be permitted. German and American apparatus, with which, apparently, we cannot at present compete in price, must be excluded under a licensing system. But the principle of fiscal policy involved—as in the case of the Safeguarding of Industries Act—is so vital that the point had to be settled by the Cabinet, which is understood to have undertaken on July 11th to prepare the necessary steps for the prevention of the importation of such instruments.

It is reported that there are now 305 broadcasting stations licensed by the U.S.A. The University of South Carolina is to erect and maintain a broadcasting station by public subscription—an idea that might well be considered in this country.

Up to June 3rd approximately 11,000 receiving and 450 sending licences had been granted to owners of wireless installations, Mr. Pike Pease, Assistant Postmaster-General, stated in the House of Commons on July 4th.

Amateurs will be interested to learn that a means of running a valve from the ordinary electric light supply has at length been found—doing away with the necessity for an accumulator, the constant recharging of which is one of the few bugbears of wireless telephony, says the *Daily Mail.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—September 1st. Victorian Electricity Commissioners. Rate-of-flow controller. (Spec. 268.)

September 16th. Victorian Electricity Commissioners. Strain and pin-type insulators. (Spec. 261.) (June 30th.)

October 17th. Postmaster-General's Department. Automatic c.b. telephone equipment, with all associated equipment, including material for use at subscribers' premises. (Sched. 39 and 40.) (July 7th.)

September 26th. Postmaster-General's Department. Telephone parts. (Sched. V 53.)

September 27th. Telephone apparatus and parts. (Sched. 561.) (See this issue.)

Belgium.—July 20th. The municipal authorities of Nieuport are inviting tenders for the concession for the lighting of the town.

July 27th. Municipal authorities of Schaerbeek, Brussels. 550 electricity meters for single-phase l.p. mains and 10 meters for h.p..

Bulgaria.—Sofia.—July 20th. Fifty 4-volt accumulator batteries, with reserve materials.

July 25th. Supply of 15 telephone switchboards (100 lines) and 60 ditto (50 lines). Office National du Commerce Extérieur, 22-4, Avenue Victor Emmanuel, Paris.

Canaries.—July 31st. Installation of electric light on the La Lu Mole, Canary Islands. Ingénieur directeur des Travaux du Port de La Luz, or from the Office National du Commerce Extérieur, 22-4, Avenue Victor Emmanuel, Paris.

Dundee.—July 15th. Electricity Department. Three-core l.p. paper-insulated lead-covered armoured cable. (See this issue.)

France.—Paris.—August 2nd. Two electrically-driven travelling bridges for the sub-station of St. Germain-en-Laye and Chatou. Service Electrique, 43, Rue de Rome, Paris.

India.—July 21st. High Commissioner's Department. Automatic telephone sets, desk and wall cords for switchboards, &c., cells for accumulators. (June 30th.)

July 28th. Telephone switchboards and desk and wall sets. (July 7th.)

Kirkcaldy.—July 20th. Corporation. Steel work for annexe at electricity works. Kennedy & Donkin, 8, Broadway, Westminster, S.W.1.

London.—L.C.C. July 24th. H.p. switchgear for the Central Repair Depôt, Charlton. (June 30th.)

Metropolitan Asylums Board.—July 19th. Installation of the internal automatic telephones at the River Hospital, near Dartford; installation of electric lighting in ward blocks, boiler-house, &c., at the Grove Fever Hospital, Tooting, &c. (June 30th.)

Manchester.—July 22nd. Board of Guardians. Induced draught fan, with electric motor complete, for steam-raising plant at Crumpsall Institution, for Manchester Union. Mr. Hargreaves, superintendent of works, Union Offices, All Saints', Manchester.

Plymouth.—August 4th. Electricity Department. Transporter runway travelling trolley hoist. (See this issue.)

Sale (Cheshire).—Electric lighting installation, Trinity Wesleyan church, Northenden Road. Mr. Alexander Pask, consulting engineer, 12, George Henry Street, Eccles New Road, Salford.

Siam.—Bangkok.—October 31st. Local Sanitary Department. Four 3-ton motor vans for collection of city refuse.*

Warrington.—July 24th. Electricity and Tramways Committee. (a) Cast iron circulating pipes, (b) steam pipes, (c) tank, &c. Mr. F. V. L. Mathias, borough electrical and tramways engineer, Howley, Warrington.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Bangor.—Electricity Committee. Recommended:—

Two 250-kW rotary-converters, with transformers, starting gear and accessories, £2,985. Lagging [illegible] Co., Ltd., Preston Insulated & Hackney Cables, Ltd., £2,974. [illegible] Electric Co., Ltd. (£454).

Blackpool.—Tramways and Electricity Committee. Accepted:—

Car traverser in connection with Rigby Road engineering works. Hoyle bottom & Mannock.

Dartford.—Urban Council. Accepted:—
Reconstructing Crayford tramway track, £3,046.—William Griffiths and Co., Ltd.

Douglas (Isle of Man).—The plant to be supplied in connection with the Corporation electricity scheme by Messrs. Ruston & Hornsby, Ltd. (Elec. Rev., June 30th), will consist of two Ruston twin-cylinder cold starting oil engines of 340 b.h.p. Messrs. Handcock & Dykes are the consulting engineers.

Glasgow.—Corporation. Recommended:—
Electric lighting of Shettleston registration office.—Allan Arthur & Ure.
5-cwt. Massey pneumatic power hammer at the St. Rollox works (£420).—B. & S. Massey, Ltd.

Clyde Trust. Accepted:—
35-ton electric coal crane for Queen's Dock (£16,970).—Babcock & Wilcox.

L. & N.W. Railway.—Messrs. Clayton & Shuttleworth, Ltd., of Lincoln, have secured an order from the L. & N.W. Railway for five large-sized "Clayton" patent water-tube boilers of curved tube, drum type, complete with superheaters, economisers, mechanical stokers, and chimneys. The five boilers, which are similar to those being supplied by the firm to the L.C.C. for its Greenwich power station, are required by the L. & N.W. Railway for the Formby (Lancashire) power station, where important developments are being undertaken in connection with the extension of the electric railways.

London. — Hackney. — Electricity Committee. Recommended:—
Pipework and valves for the boiler and generating plant extension (£5,356).—Foster Bros., Ltd.; (sub-contractors for steam valves): Messrs. Hopkinson.

Stepney.—Electricity Supply Committee.

	£
25 disconnecting, 10 feeder, and 10 sub-feeder boxes	
Universal Electrical Manufacturing Co. (accepted)	438
W. T. Henley's Telegraph Works Co., Ltd.	550
British Insulated & Helsby Cables, Ltd.	552
W. Lucy & Co., Ltd.	565
Callender's Cable & Construction Co., Ltd.	862

250 condenser tubes (£155) (accepted).—J. Downton & Co., Ltd.
One mile of 3-in. earthenware pipes (£141) (accepted).—Sutton & Co., Ltd.
Spare impeller for circulating-water pump (£100) (accepted).—Escher, Wyss and Co.
Three 50,000-lb. boilers, with type 3 stokers and grit-catching pans Ferguson superheaters, economisers, induced-draught plant, chimneys, pipework, and ash-handling plant (£96,047).—Spearing Boiler Co., Ltd.

Maidstone.—Town Council. Accepted:—
Cables for the supply of electricity to the Mental Hospital (£385).—Pirelli-General Cable Works, Ltd.

Manchester.—Tramways Committee. Accepted:—
Copper trolley wire.—F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.
Silicium bronze trolley wire.—Collier Bros.

Education Committee. Accepted:—
Electric lighting installations at Bank Meadow School.—Maitland & Co.; and at St. Barnabas School and Smedley Road.—R. Seddon & Sons.

Preston.—Town Council. Recommended:—
Plant for the new electricity generating station:—
Turbo-generators, condensers, &c.—English Electric Co., Ltd.
Boilers, steam and feed pipes, and feed pumps.—Babcock & Wilcox, Ltd.
Switchgear and battery, &c.—Metropolitan-Vickers Electrical Co., Ltd.
The aggregate cost exceeds £248,500.

Salford.—Corporation. Accepted:—
Plant for the Agecroft power station:—
Three 10,000/12,000-kW turbo-generators, with condensing plant and house service plant (£178,734).—Metropolitan-Vickers Electrical Co., Ltd.
Six water-tube boilers, with steam and feed pipes and feed pumps complete (£132,660).—Babcock & Wilcox, Ltd., subject to the cancellation of the existing contract for two water-tube boilers for Frederick Road generating station, the £10,000 paid under the existing contract to be credited in respect of the contract for the six new boilers.

River Irwell Conservancy Committee. Accepted:—
Electrically-driven motors, pumps, &c., at the sewage works (£2,026).—Whitehead & Poole, Ltd.
Electrically-driven detritas dredgers (£4,965).—S. S. Stott & Co.

Electricity Committee.
1,000 yd. 3-in. stoneware pipe, with self-aligning joints (£71); 2,000 yd. 2-way 3½-in. stoneware conduit, with self-aligning joints (£354).—Albion Clay Co., Ltd.

West Bromwich.—Town Council. Accepted:—
Switchgear for rotary converter.—Metropolitan-Vickers Electrical Co., Ltd.

NOTES.

R.E. Roll of Honour.—An illuminated Roll of Honour containing the names of those members of the Corps of Royal Engineers who lost their lives in the war has been prepared, entirely by hand, for preservation in St. Paul's Cathedral. A formal deposition ceremony is to be held shortly. Among the names on the Roll is that of Lord Kitchener, who was a distinguished Engineer.

Appointments Vacant.—Assistant inspector of wireless telegraphy for the G.P.O.; electrical attendant for cold stores (75s.); telegraph inspector (£300+), for the Uganda Government; assistant foreman mechanic (£307), for the Sudan Government Post and Telegraph Department; combustion engineer and personal technical assistant for the Hull Corporation Electricity Department; electrical engineer (Rs.1,250 per month), for the Calcutta Electric Supply Corporation. (See our advertisement pages to-day.)

S.E. Lancs. Electricity Advisory Board.—At a meeting in Manchester on July 11th of the South-east Lancashire Electricity Advisory Board, Alderman W. T. Dagnall was elected chairman and Dr. Parshall, who is a director of the Lancashire Electric Power Co., vice-chairman. Alderman Dagnall is chairman of the Manchester Corporation Electricity Committee. The Advisory Board is an interim authority which will act until the Parliamentary Order is issued formally constituting the new body which is to control the electricity supply and development in South-east Lancashire. At Tuesday's meeting a committee of technical engineers was also appointed. —*Manchester Guardian.*

The Channel Tunnel.—Presiding at the annual meeting of the Channel Tunnel Co., Ltd., on July 3rd, Baron Emile B. d'Erlanger said that the new boring machine had not yet been fully tested by the company's engineer, but he felt certain that the appliance would be successful. The opinions expressed at the recent banquet by French and English statesmen had buoyed up the company's hopes of the materialisation of its project. The chairman hoped that the day would soon come when the patience of the shareholders would be duly rewarded. A recent estimate was that the construction of the tunnel would take five or six years.

According to the *Evening News*, the French Minister of Public Works, together with M. Poincaré, has been considering the question of German participation in the construction of public works in France. The revenue from these works will be earmarked for the reconstruction of the devastated regions. The schemes include work on the Channel Tunnel on the French side, and Germany will provide the labour and the materials. No doubt is expressed that an agreement will be come to with the Reparation Commission at an early date, which will allow of a start being made with the work.

S.s. "Volendam."—This vessel was launched at Messrs. Harland & Wolff's yard on the Clyde on the 5th inst. for the Holland-Amerika line. The hull is divided into numerous water-tight compartments, the doors of which are electrically operated from the bridge. The nine cargo winches are driven by electric power, as are also the boat derricks, windlass, warping capstans, steering gear, and ventilating fans. The main condensers—two-flow type—are electrically controlled.

Fatalities.—An inquest was held at Murton Colliery (Co. Durham) on July 5th into the death of Elliott Marshall (46), a labourer, who was killed on July 2nd. It was stated in evidence that deceased had worked with the electricians for 12 years. On the day of his death he was instructed to clean the switch insulators in the transformer house at the pit-head. The terminals were "dead." There were "live" terminals above, but these could not be cleaned, except by arrangement with the Electric Power Supply Co. They were screened by a locked door, but deceased had a key which fitted the lock. While working he was heard to shout, and when the assistant electrician reached him he was lying against the switchboard. Artificial respiration was tried for some time, but without effect. The assistant electrician found the screen of the "live" terminals open, and deceased appeared to have tried to clean one of the insulators. There was a pressure of 5,000 V upon the terminals. Ralph Longstaff, the assistant electrician, said that it was not part of deceased's duty to clean the insulators of the "live" terminals, but the key he possessed fitted other screens in different parts of the colliery. James Simpson, chief electrician, said in his opinion there was no doubt that the deceased had climbed up to the top insulators, as his finger marks were found upon them.—The Coroner entered a verdict of "Accidentally electrocuted while following his employment."

The circumstances in which a machineman lost his life in Bowhill Colliery, Fife, were detailed at a fatal accident inquiry at Dunfermline on July 6th. The man died from an electrical shock caused by a piece of wire rope being dragged by him coming into contact with a cable. A fellow workman said when he saw deceased his hands, which were behind his back, clasped a wire haulage rope. By means of a piece of wood witness knocked the rope out of his grasp and shouted to another man to switch off the electricity. Artificial respiration was tried without avail. A formal verdict was returned.

Electricity in Factories and Workshops.—The annual report of H.M. Chief Inspector of Factories and Workshops for 1921 was issued on July 6th, together with an abridged form of the electricity regulations made by the Secretary of State for the generation, transformation, distribution, and use of electrical energy in premises under the Factory and Workshops Acts, 1901 to 1920. The report (H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1, price 3s. net) is a much smaller volume this year than of late; in fact, the chapter by Mr. G. Scott Ram on the generation and use of electricity only occupies 4½ pages. During the year under review 92,565 accidents (including 951 fatal ones) were reported, as compared with 138,773 (1,404 fatal) in the previous year, which remarkable drop is almost entirely due, says the report, to phenomenal inactivity in industry throughout the year and the coal miners' dispute, which resulted in many large works being shut down. Only short summaries embodying some of the more important features of the valuable reports from the inspectors throughout the country have been included in the annual report this year, of which we hope to give details in forthcoming issues.

Educational.—The Swansea Electricity Committee recently considered applications from a number of students at the Swansea University College for permission to attend the electricity works during their vacation in order to gain practical experience; permission to do so was granted.

The Bradford Municipal Technical College has been added to the list of universities and colleges whose diplomas are accepted by the Institution of Electrical Engineers as exempting candidates from the associate membership examination.

An interesting lecture was given to the final year students in electrical engineering at the Regent Street Polytechnic on July 10th by Mr. P. Dunsheath, O.B.E., &c., head of the Research Department, Messrs. W. T. Henley's Telegraph Works Co., Ltd. The lecturer dealt with the design of "super-tension" cables, and in the course of his address discussed the modern trend of developments in research and manufacture. Special reference was made to dielectric losses, distribution of electric stress, and current and voltage ratings. The lecture was illustrated by a number of slides and interesting exhibits, one of the latter being a sample of the 33,000-volt cable recently manufactured and laid for the Birmingham Corporation.

The Welfare Workers' Institute.—On July 1st the Institute took over new premises at Leplay House, 65, Belgrave Road, Victoria, S.W.1.

Miners' "Pillarless" Electric Lamps.—Following on the experimental work on "pillarless" electric safety lamps, conducted by the Miners' Lamps Committee during the past two years, the committee has recommended to the Secretary for Mines that electric lamps of this type should be accepted for test with a view to their approval under Section 33 of the Coal Mines Act, 1911. The Secretary has approved, and announced that electric lamps of satisfactory design without fixed pillars will in future be accepted for official test in the same manner as other types of electric safety lamp. The chief object of the pillarless lamp is to avoid the alternate zones of light and darkness produced by the pillars.—*Evening News.*

Radium Finds.—A deposit of radium ore has been discovered in the Ferghana Valley, Turkestan, Central Asia, and is being worked by the Soviet Mining Council. A highly radioactive mineral has also been found in the Belgian Congo, and at a recent meeting of the French Academy of Sciences it was stated that the new mineral would be called "Soddite" in honour of Prof. Soddy. The ore is very rich in uranium, with which radium is always present in the definite proportion of 3½ parts in ten millions.—*Daily Mail.*

Institution of Electrical Engineers. — South-Midland Centre.—The report of the Committee to the annual general meeting that was held in Birmingham on April 26th, for the 1921-22 session, shows that there have been nine general meetings, and that the average attendance for the session was 96 per meeting. The total membership of the Centre is 796, an increase of 103 over last session. At the annual dinner, held in Birmingham on December 2nd, 1921, the attendance was 138; the next annual dinner will be held on November 24th, 1922. The office holders for the 1922-23 session are as follows:—*Chairman*: W. Cramp, D.Sc. *Vice-Chairmen*: J. D. Morgan, B.Sc., and W. Lawson. *Ordinary Members of the Committee*: J. Anderson, A. T. Bartlett, B.A., W. Brew, F. W. Carter, M.A., F. J. Moffett, B.A., W. F. Higgs, W. E. Groves, S. H. Holden, T. Plummer, W. Wilson, M.Sc., E. A. Reynolds, M.A., T. A. G. Margary. *Hon. Secretary*: H. Hooper.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. R. A. Dalzell, C.B.E., who has been appointed Director of Telegraphs and Telephones, is a son of Mr. Nicholas A. Dalzell, Conservator of Woods and Forests, Bombay, and was born in India in 1865. He was educated at Dulwich College, and for the last forty years he has been connected with the telephone service, first with the Globe Company then with the United Company, and afterwards with the National Telephone Company. Mr. Dalzell was transferred to the Post Office when the National Telephone Company's undertaking was taken over by the State in 1912, and since 1916 he has acted as Chief Inspector of Telephones and Telegraphs.

Regarding a recommendation that Mr. J. R. P. Lunn, electrical engineer, should receive a commission of 5 per cent. on the reduction of costs of production, there was a lengthy discussion at a meeting of the Darlington Town Council on July 6th. Councillor Maw, who moved that the matter should be referred back, said that the Labour Party were at all times opposed to the principle of payment by commission for hypothetical savings. He moved that the Electricity Committee should also be instructed to arrange with the engineer for an inclusive salary. The commission had mounted up until on the last occasion it reached £564, and that in addition to a salary of £800. The workers in that particular industry had suffered progressive reductions during the course of the year, and he contended that if those reductions had entered into the computation of costs, it was not only a travesty, but a tragedy. The maximum bitterness was being roused by these payments. Councillor Best seconded the amendment, and said that Mr. Lunn was acting in a dual capacity. They were proud of his ability as manager of the electricity undertaking, but, on the other hand, he was manager of the tramways, and it was unfair that he should be paid commission on the savings of one department while nothing was done regarding the losses on the other. Alderman Pease said that these savings were not hypothetical; they were absolute. In about 20 years Mr. Lunn had got the undertaking to such a pitch that it was run at the second lowest cost in the British Isles, and with absolutely the lowest selling price. In comparison with other towns they were paying the engineer a low salary. In depriving Mr. Lunn of his commission they would take away that little bit of speculation from his work. Alderman Sir C. Starmer (chairman of the Committee) said he could not agree to take the matter back to the Committee, as they were morally committed to an arrangement with Mr. Lunn for five years. He was glad that the commission had reached over £500, and he hoped it would go higher, for every shilling that he got by way of commission meant 19s. to the ratepayers. The amendment was lost by 14 to 4, and the recommendation was therefore carried.

The *Industrial Australian* states that Mr. Herbert Broadbent, M.I.E.E., formerly electrical engineer to the Perth (W.A.) Corporation, has joined the firm of Herbert del Cott Pty., Ltd., engineers and contractors, who specialise in overhead line construction.

Doncaster T.C. has decided that the salary of Mr. Potts, general manager of the borough tramways, shall be increased to £450 per annum, inclusive of all bonuses, with two subsequent half-yearly increments of £25 to £500 per annum, as from July 1st, 1922.

Mr. H. White, late of the Yorkshire Electric Power Co., has been appointed assistant mains engineer to the Wakefield Electricity Department.

The St. Helens Electricity Committee has recommended the appointment of Mr. F. N. Rendell Baker, acting electrical engineer, as engineer and manager of the electricity works from September 1st next, at a salary of £750 per annum, inclusive; also that a supervision fee of £200 be paid to Mr. B. T. Hawkins, late electrical engineer, for his services during the six months following his resignation.

Last week the West Hartlepool Town Council adopted recommendations from the Finance Committee, one of which included the reduction of the tramway manager's salary from £600 to £500, while another was that the salary of the electrical engineer—£750—should not be reduced.

The Tunbridge Wells Lighting Committee has recommended that all bonuses be abolished, and that the following salaries be fixed as from August 1st next:—Mr. R. N. Torpy, chief electrical engineer, £800; Mr. F. Crooks, chief clerk, £250; Mr. G. B. Tovey, stores clerk, £180; Mr. E. Coomber, consumers' clerk, £180; Mr. L. Davey, junior clerk, £130.

We regret to learn from the Manchester Press that Alderman Dagnall, chairman of the Manchester Electricity Committee, was taken seriously ill last week. On Sunday he was reported to be out of danger.

On his retirement after 48 years' service in the electrical department of the London and North-Western Railway Co., Mr. Thomas Handley, of Llandovery, has been presented with a gold watch.

Mr. John C. Holden has resigned the post of assistant charge engineer at the Islington Borough Council electricity works to take up that of relief charge engineer to the Dundee electricity undertaking. He was presented with a silver épergne by the staff on the occasion of his resigning his position at Islington.

The Worcester City Council has appointed Mr. C. D. King (who is now in charge of the removal of the plant at Southampton) senior engineering assistant at a basic salary of £455 per annum (subject to the sliding scale), to take effect from October 1st.

Auckland (N.Z.) City Council has appointed Mr. A. E. Lowe acting manager of tramways, Mr. T. E. de Gueriere tramways and electrical engineer, and Mr. W. St. J. Clarke chief accountant.—*Tenders.*

On Saturday last at the staff sports ground of the Eastern Associated Telegraph Companies at Twickenham, Sir Denison-Pender, G.B.E., K.C.M.G., was presented with an illuminated address and a volume containing autograph signatures of a staff numbering 8,000, also gifts in platinum and diamonds of the insignia of the orders of G.B.E. and K.C.M.G. The presentation was made by the secretary, Mr. A. E. Harris, on behalf of the staff, in celebration of the fiftieth anniversary of the incorporation of the companies. A bed is to be endowed at St. Bartholomew's Hospital in memory of the late wife of Sir John.

Mr. Thomas Richardson, who recently retired from the position of head of the Transfer Department of the Eastern Telegraph Co., Ltd., was presented by the staff with a silver kettle, fruit stand, entrée dish, and cigar box.

Sir William Larke has been appointed director of the National Federation of Iron and Steel Manufacturers. He will take up his duties on September 1st.

On July 10th, Mr. Creighton Anderson, chairman of the directors of the Harland Engineering Co., Ltd., of Manchester, was presented with a canteen of cutlery by the united staffs of the company on the occasion of his marriage, which took place on June 21st. The presentation was made by Mr. Bull, the oldest employé.

Obituary.—Mr. H. Bowthorpe.—We regret to record the death of Mr. Harry Bowthorpe, of the General Electric Co., Ltd., which took place at his home at Norwood, S.E., on Sunday, July 2nd. Mr. Bowthorpe had been associated with the G.E.C. for 29 years, and had represented them in the South of England. He had a wide circle of friends in the electrical trade, and was held in high esteem. The funeral took place on July 5th at West Norwood cemetery.

Will.—The late Mr. Nicholas Kilvert, who was connected with the Lancashire Dynamo & Motor Co., Ltd., Browett, Lindley & Co., Ltd., and other companies, left £176,863 gross and £128,591 net.

NEW COMPANIES REGISTERED.

Radiant Electrical Co., Ltd. (182,866).—Private company. Registered July 3rd. Capital, £100 in £1 shares. To carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, &c. The subscribers (each with one share) are: D. Morman, 24, Thorney Court, Palace Gate, W.8, merchant; C. T. Brown, 164, Chorley New Road, Bolton, merchant; F. G. Fox, 44, Church Road, Richmond, S.W., Indian Police (retired). F. G. Fox signs as director. Solicitors: McKenna & Co., 14, George Street, Hanover Square, W.1.

Electrical and General Cleaning Co., Ltd. (182,849).—Private company. Registered July 3rd. Capital, £100 in £1 shares. To carry on the business of cleaners of the exterior of all kinds of buildings, machinery and articles by electrical and other methods, decorators, manufacturers of and dealers in all kinds of cleaning, disinfecting and dirt removing apparatus, &c. The first directors are: S. E. Neame, Linthorpe, Finchley Road, Golder's Green, N.W.; A. W. Furbank, 23, Magdalen Terrace, St. Leonards, Sussex. Qualification: 2 shares. Registered office: 4-5, Warwick Court, Holborn, W.C.1.

Electricity House, Ltd. (182,937).—Private company. Registered July 6th. Capital, £750 in £1 shares. To adopt an agreement with H. C. Tudor and to carry on the business of electrical engineering generally. The subscribers (each with one share) are: H. C. Tudor, 35, Queen Street, Wolverhampton, electrical engineer; A. S. Warner, 20, Queen Street, Wolverhampton, hairdresser. H. C. Tudor is first director. Qualification: £100. Secretary: Ethel Tudor. Registered office: 35, Queen Street, Wolverhampton.

British Electrical Maintenance and Insurance Co., Ltd. (182,942).—Private company. Registered July 7th. Capital, £1,000 in £1 shares. To insure and maintain electric light and other electrical installations against breakage or other accidental damage (except by fire), &c. The first directors are: Capt. G. A. G. Garveys-Gadd, 39, Hyde Park Gate, S.W.7 (managing director); S. Bradsworth, 262, Soho Road, Birmingham, gentleman; W. E. Gadd, Roydene, Alumdale Road, Bournemouth, gentleman. Qualification: 100 shares. Registered office: 68, Aldersgate Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lighting, Heating and Power Installations Co., Ltd.—Particulars of £300 debentures, authorised June 27th, 1922, charged on company's property, present and future, including uncalled capital; whole amount issued.

Marston Billington, Ltd.—Satisfaction in full on June 16th, 1922, of debentures dated February 19th and May 3rd, 1921, securing £9,000 and £1,000 respectively.

H. E. Steel, Ltd.—Mortgage dated June 24th, 1922, to secure £1,000, charged on 85, Westgate Street, Gloucester. Holder: Mrs. A. M. Dodge Wyndon, House Somworth, Devon.

Associated Battery Co., Ltd.—Sir Francis W. Pixley, of 38, Cannon Street, E.C., was appointed receiver on June 27th, 1922, under powers contained in debentures dated November 3rd, 1903.

Spensers, Ltd.—F. A. Caddick, of 7a, Laurence Pountney Hill, E.C., ceased to act as receiver or manager on June 30th, 1922.

City of Oxford Motor Services, Ltd. (91,106).—Return dated June 19th, 1922, of £150,000 in £1 shares, 63,000 shares taken up. £1,067 paid. £61,993 considered as paid. Mortgages and charges, £70,000. Last return made up to May 11th, 1922. Shows a further 25,000 shares allotted, credited as fully paid pursuant to an agreement of same date.

Chelsea Electricity Supply Co., Ltd. (20,468).—Return dated May 29th, 1922, of £800,000 in 74,000 ordinary and 6,000 preference shares of £10 each. 49,426 ordinary and 6,000 preference shares taken up. £5 per share called upon 35,750 ordinary and 6,000 preference. £218,850 paid. £58,330 considered as paid on 11,666 ordinary shares. Mortgages and charges, £94,675.

Ferranti, Ltd.—Satisfaction in full on April 29th, 1922, of second mortgage debenture dated July 25th, 1905, securing £30,000.

Barbadoes Electric Supply Corporation, Ltd.—Particulars of £25,000 debentures authorised June 27th, 1922, charged on the company's undertaking and property, present and future, including uncalled or unpaid capital; present issue £22,000. A commission of 10 per cent. is paid to the subscribers for £11,000 of the debentures.)

CITY NOTES.

New General Traction Co., Ltd.

For the year ended March, 1922, the revenue was £18,501, and the expenditure, including debenture interest and income tax, £8,502. The profit was £9,999, plus £9,813 brought forward. £10,480 is to be appropriated to the payment of a dividend of 4 per cent. (less income tax), and £9,332 is to be carried forward. The reports and accounts of the Norwich Electric Tramways Co. and the Douglas Southern Electric Tramways, Ltd., accompany the report. The trade depression and consequent unemployment have operated unfavourably upon the traffics of the Norwich tramways. The volume of traffic decreased, but the increased fares (which, however, were only in operation for a portion of the period) resulted in increased takings. This increase was insufficient to offset the increased expenditure for the whole period. In view of the amounts required for reconstruction of the track and renewal of equipment, the directors of the Norwich Tramways again considered it wise to transfer the whole balance of profit to reserve for these purposes. The current year is showing an improved position, the company having the benefit of the increased fares from the beginning of the period, and a gradual reduction having taken place in the cost of materials, also in wages in accordance with trade-union agreements. The Douglas tramway system also suffered loss of traffics owing to the miners' strike in 1921, with no relative saving of expenditure, but the net earnings were sufficient to maintain the same rate of dividend on both classes of shares as in the previous year. The directors proceed to refer to the sale of the company's holding of $729,000 Darby, Media and Chester Street Railway 4½ per cent. first mortgage bonds, and to the purchase of £141,000 (nominal) of the company's outstanding debentures, which have been cancelled, thus relieving the company of this overhanging liability. While these transactions involve some loss of future income, the financial position of the company has been thereby liquefied and materially strengthened.

Vickers, Ltd.

The report for 1921 shows a disposable balance of £1,304,035. A 5 per cent. dividend on the ordinary shares (less income tax) absorbs £431,042. The directors say that owing to the progress of the settlement of the accounts with the Government, they feel that they can safely recommend the dividend mentioned, while preserving sufficient liquid resources. The unfavourable conditions which prevailed for the company's products described in the report for 1920 were intensified during 1921. The armament business of the company, except for an order for armour plate received from the Japanese Government, was virtually stagnant. As regarded the company's other manufactures, there was no improvement in the purchasing power of foreign countries, while in the United Kingdom the heavy weight of taxation and the condition of the money market maintained the general inability of purchasers to incur expenditure on extensions, new enterprises, or requirements which in ordinary times would be counted necessities. Stocks were again heavily written down owing to the fall in the prices of raw material, and stand in the books as at December 31st, 1921, at their realisable value or at cost, whichever was the lower. The impediment to production caused by labour troubles is reflected in the results.

United Electric Tramways of Montevideo, Ltd.

The report for the year ended March, 1922, states that the operation of the tramway system for the year ended October, 1921 (the fiscal year of the Uruguayan Co.), shows gross receipts, at an exchange of $4.7 to the £, of £555,725, being an increase of £39,595. Operating expenses, however, increased by £48,649, mainly due to the various new Social Laws brought into operation, and the increase in wages and the additional charges resulting therefrom. The exchange remained at a heavy discount during the whole year, and remittances were seriously affected by the fall. Passengers carried, 67,759,388 (increase 4,538,513); car-miles run 9,416,660 (increase, 586,548). The 19 new motor cars and 14 trailer cars were all in service during the greater portion of the year. Owing to the increased expenditure, the company has not received any return for the increased traffic.

There has long been urgent need for an increase in tariffs to meet the burden of new and onerous charges imposed since the concessions were granted, and to enable the company to make a further advance in wages to meet the higher cost of living. Although an increase in tariffs was applied for as far back as February, 1918, and a basis upon which the tariffs should be increased was agreed with a Special Committee appointed by the Uruguayan Government in June, 1920, the necessary authority has not been granted yet. It is disappointing that opposition, apparently of a political character, has, hitherto, defeated the recommendations of the Uruguayan Government, which are in accord with the accepted rule that companies which serve the public are entitled to receive fair compensation for the services they render.

The company's employés had received a ten per cent. advance in January, 1920, and were promised a further increase when the new tariffs came into operation. They waited, with exemplary patience, notwithstanding repeated postponements, for the necessary legal authorisation. When another postponement by the legislative authority took place, in the early part of January, 1922, they apparently lost hope, and practically all the men in the traffic department came out on strike. This strike continued for about three weeks, when the Municipality of Montevideo resolved to take possession of the company's property, and resume normal services under municipal control, granting the strikers the promised increases in wages, without providing any fund from which they were to come, and forcibly withdrawing from the company the monies required to pay these increases. The board were advised that this extraordinary and arbitrary action, gravely affecting the principle of private ownership and the safety of foreign capital invested in the Republic, exceeded the powers of the Municipality. The company appealed against the

intervention, and invoked the protection of the Uruguayan Courts, in which they at once commenced an action, claiming damages. The intervention lasted until June 1st, 1922, when the Courts decreed that the measures for the seizure of the company be temporarily raised, the increased payments being continued without prejudice to the company's claim until the whole question has been decided finally by the Courts.

The profit and loss account, after providing for administration expenses and charging £46,449 for debenture interest, shows a credit balance of £26,194, making, with £8,417 brought forward, £34,612. There has been put to redemption of debenture stock £6,081, and to redemption of the preference and ordinary share capital £2,500. Dividends on the cumulative preference shares at the rate of 6 per cent. per annum, less income tax at 6s. in the £, have been paid, leaving £5,090 to be carried forward. The balance carried forward has been reduced by £3,387 to permit of the payment of the preference dividend. This encroachment would not have been required if it had not been necessary to provide £4,948 for Corporation Profits Tax. Under the circumstances which prevail in Montevideo, the results do not allow the payment of any dividend on the ordinary shares, but it is hoped that the avowed intention of the Uruguayan Government to grant an increase in tariffs, now long overdue, may yet be fulfilled, and the company be restored to a reasonable measure of prosperity.

London Underground Railway Companies.

Interim dividend announcements for the half-year ended at June have been made by the various companies in the London Underground group :—

Metropolitan District Railway Co.—Dividends on the 4 per cent. guaranteed stock of 2 per cent.; on the 4½ per cent. first preference stock of 2¼ per cent.; on the 5 per cent. second preference stock of 2½ per cent.; and on the ordinary stock of 1½ per cent. (comparing with nil for the same period of 1921).

London Electric Railway Co.—Dividends on the 4 per cent. preference stock of 2 per cent. and on the ordinary shares of 1¾ per cent. (comparing with 1½ per cent. for the same period of 1921).

City and South London Railway Co.—Dividends on the 5 per cent. preference stocks, 1891, 1896, 1901 and 1903 of 2½ per cent., and on the consolidated ordinary stock of 1¾ per cent. (comparing with 2 per cent. for the same period of 1921).

Central London Railway Co.—Dividends on the undivided ordinary stock of 2 per cent. (comparing with 2 per cent. for the same period of 1921), and on the preferred ordinary stock of 2 per cent. (comparing with 2 per cent. for the same period of 1921).

Underground Electric Railways Co. of London.—Six per cent. first cumulative income debenture stock (payment of 3 per cent.) and on the 6 per cent. income bonds of 2 per cent. (free of British income-tax), comparing with 2 per cent. for the same period of 1921.

Automatic Telephone Manufacturing Co., Ltd.

Sir Alex. Roger, presiding at the annual meeting, held on July 6th at Liverpool, said that whereas sundry creditors in the last balance-sheet stood at £344,265, in the present accounts they were £133,000, so that the reduction in creditors was approximately the same as the item of £210,000 for the debentures issued. They did not anticipate that there would be any further heavy capital expenditure for some time, as the works and machinery were in first-class condition. Stock-in-trade and work in progress showed a decrease of £99,261, accounted for both by acceleration of output and by completion of a number of contracts started in 1920. Sundry debtors were greater by £48,752, brought about also by increased turnover. The profit for the year was £28,579, after arriving at a final settlement in respect of excess profits duty. These figures showed an improvement on last year's figures of £13,209. They regretted that they were again unable to pay a dividend on the ordinary shares.

Sir Alexander said that during the year he was invited to join the board and become chairman with a view to relieving Mr. James Taylor and Mr. D. Sinclair as far as possible, as these gentlemen found it impossible to give the same attention as formerly to the company. The speaker referred to the great deal that the company owed to these gentlemen for the masterly way in which they had piloted the company through the troublous waters of the past few years. During the year considerable progress was made in extending their foreign business, and automatic telephone exchanges in Harbin (Manchuria), Shanghai (China), Poona and Lahore (India), and Basra (Mesopotamia), were among their latest foreign shipments, while considerable progress was made with the equipment being manufactured for the automatic telephone systems in the city of Buenos Aires (Argentina), Dalny (Manchuria), and Teishinsho (Japan). With regard to home automatic and manual exchange orders, these were principally concerned with extensions to existing equipments, but the Post Office authorities showed a growing determination to modernise and extend the telephone service of this country. Great Britain represented a more fruitful field for telephone development than probably any other country in the world to-day. The chairman went on to refer to the need to keep their organisation at a high degree of efficiency if they were to cater efficiently for the more important telephone network schemes for the principal cities of the world. In this connection they were in a unique position by reason of their arrangement with the Automatic Electric Co. of Chicago. The speaker alluded to the department of the business devoted to the manufacture and supply of railway signalling apparatus and electric signalling systems. In other departments, [illegible] mine signalling, and domestic electrical [illegible] suffered in the general slackness in trade, but [illegible] been further retarded by the stress of [illegible]. However, they believed had now been [illegible]. Referring to the A.F.M. design of apparatus for wireless broadcasting, the speaker said that during the year the company had turned out a large volume of work on which the actual manufacturing profit was satisfactory, but the coal strike practically shut them down for three months with no means of cutting down substantially the heavy overhead charges. They had again suffered this year in the same way owing to the engineering lock-out, which lasted for three months. It was almost impossible to estimate what these stoppages cost the company, apart altogether from what they cost the workers. There had also been the heavy fall in values. They had been fully alive to the danger of carrying large stocks of material, but in spite of every precaution they had been obliged to provide substantial sums to enable the stocks to be written down to current market value. This had naturally made inroads into the profits. Trade generally, in his opinion, was not going to revive rapidly, but the company could reasonably expect to have its full share in any improvement that took place in world trade.

Electric Supply Corporation, Ltd.

The annual meeting was held on July 4th, Mr. J. G. E. Stone (chairman) presiding. Before presenting the report and accounts, the chairman expressed the board's regret at the death of Mr. Reeves, who had been connected with the company since its formation. Turning to the accounts, the speaker said that the revenue account showed a profit of £27,196, as compared with £17,791 in the previous year, while the profit on the working of the various undertakings increased from £12,916 to £22,560. The interest on investments showed a slight decrease. This reduction was considerably greater, owing to the inability of the Dumbarton Tramway Co. to pay a dividend on its ordinary shares; in 1920 the dividend was £1,046. The balance of net revenue carried to the balance-sheet amounted to £12,214, as against £3,403, an increase of £8,811. In the net revenue account an increase of £465 was shown in the transfer to repairs and renewals fund. The cost of repairs and renewals had been heavy, and it was not expected that this item would improve during the current year, for although costs were down, a large amount of work delayed by the war remained to be carried out. The connections made during the year were equivalent to 38,223 32-watt lamps. The output in units showed a decrease of about 535,000, but this was due to a fall of 678,000 units in the Dumbarton output. The shipping industry, on which Dumbarton depended, was at present almost at a standstill. The increase of £2,578 in the capital account represented, mainly, expenditure on mains and meters. No change had been made in prices to consumers during the year, and the demand was well sustained.

The Exmouth local authority had agreed to the company's obtaining an Electric Lighting Order, which would cancel the existing arrangement under which the company was restrained from obtaining a proper price for its supply. In Hitchin matters were not so satisfactory, but negotiations were proceeding, and the chairman trusted that in the end the company would obtain fair treatment.

The Hendon company had again yielded a dividend and bonus amounting to 15 per cent., free of tax. Barwash, in which the company had a small interest, had paid 5 per cent. dividend. North Berwick had had a better year, but owing to debit balances brought forward from previous years had not been able to distribute any of the profit. During the year more of its own debentures had been purchased by the company, and it now held £12,574 of this stock.

Sir Home Gordon seconded the motion, which was adopted.

Subsequently, an extraordinary general meeting was held, at which the shareholders were asked to approve variations of the articles of association which (i.) would permit the appointment of an additional director; and (ii.) provide for the reduction of the capital from £250,000, divided into 50,000 shares of £5 each, to £150,000, consisting of 150,000 shares of £1 each, the reduction to be effected by extinguishing capital which had been lost, or was unrepresented by available assets, to the extent of £2 per share upon each of the 50,000 shares which had been issued and were outstanding. The chairman explained the reasons for this reduction. The contingent liability of £41,714 advanced to the company by the Auxiliary Electrical Co., Ltd., was the subject of a contract, arranged with Messrs. Crompton & Co., Ltd., that a 5 per cent. dividend would be paid for the first four years. It was provided that when the profits amounted to 5 per cent. on the share capital, plus 1 per cent. on the capital expenditure, the amount of these advances should, from that date, bear interest at 5 per cent., and that any sum by which the profits exceeded 6 per cent. on the share capital and 1 per cent. on the capital expenditure should be handed to the Auxiliary Co. in liquidation of its claim for interest and repayment. Unfortunately the profits of the company necessitated the payment by the Auxiliary Co. of the amount mentioned, and the reserve of 1 per cent. on the capital expenditure was quite insufficient to provide for the repairs and renewals fund. After negotiations the directors were able to arrange with Messrs. Crompton & Co., who had

acquired the debt from the Auxiliary Co., that they (Crompton's) should take payment as to £10,000 in ordinary shares at par and the balance in cash. This £10,000 was subject to the same writing-down as the rest of the capital, and would become £2,000 nominal. The £100,000, which it was proposed to extinguish, was made up as follows: £30,975, representing preliminary expenses and discount on debentures, not represented by any tangible asset; £21,172, the realised loss on obsolete plant; £4,778, expenditure upon undertakings not proceeded with; and £43,875, provision for the depreciation of plant now in use. The first resolution was necessary to permit the appointment of Mr. A. A. Campbell Swinton, representing Messrs. Crompton & Co., to the board. Both resolutions were carried unanimously.

Barcelona Traction, Light, and Power Co., Ltd.

This company held its annual meeting in Toronto, Canada, last week, and a brief report of the proceedings appears in *The Times*. Mr. E. R. Peacock (the president), pointed out, in the course of his speech, that in Spain, as elsewhere, social and financial conditions had been unsettled for some time past, the cost of living had been high, and business more or less stagnant. In the past few months, however, there had been a notable revival in the textile trade throughout the area in which the companies were operating, and this improvement was reflected in the earnings of the controlled companies in Spain, which, for the first five months of the current year were as follows:—Gross earnings, 18,897,507 pesetas; operating expenses, 7,298,669 pesetas; net earnings, 11,598,838 pesetas. The new constructional work on hand was small as compared with that that of previous years, and was mainly in connection with the extension of the distribution system, the chief item being the construction of a large sub-station in the busy factory district. The funds for this work had already been provided. The Electric Railway (F.C. de Cataluna) was working satisfactorily, and the extension to Sabadell was opened for traffic on June 1st last. The system was increasing the earnings substantially. The general outlook was encouraging, but the board viewed with considerable anxiety the burden of the constantly increasing taxes in Spain.

Calcutta Tramways Co., Ltd.

In presenting the report and accounts at the annual meeting on July 4th, Mr. J. G. B. Stone (chairman) said that the capital account had been overspent, and to meet the loan from the bank an issue of £250,000 7 per cent. second debentures had been made last month. The issue was largely over-subscribed. The result of strikes was seen in the revenue account; no less than 57 days were lost during the year due to this cause. Although the decisions of the Arbitration Committee, whose appointment was mentioned at the last meeting, had been loyally carried out, further strikes had occurred upon questions of discipline and management. The board would not consider any interference with such matters, and the men returned to work unconditionally. A new scheme of fares was introduced in February last; this had resulted in a satisfactory increase in the company's earnings. Political and labour conditions in India appeared to be improving.

The directors had been faced with the necessity for increasing the generating plant, but as an alternative a bulk supply from the Supply Corporation was considered and a satisfactory agreement had been arrived at. The Wonapooka powerhouse would be retained in active commission.

In conclusion, Mr. Stone said that notwithstanding the year's temporary set-back the company represented a sound and profitable enterprise, supplying a progressive demand in Calcutta.

General Electric Co., Ltd.

The directors report that the net profits for the year ended March 31st, 1922, were £566,582, to which is added the balance brought forward £348,094, giving a total of £914,676. The following are deducted: debenture stock interest, £182,431; depreciation, £161,745; contribution to pension fund, £15,283; dividend of 6½ per cent. per annum on "A" preference shares for the year, £110,876; dividend of 7½ per cent. per annum on "B" preference shares for the year, £121,718. There remains an available balance of £322,623, which it is proposed to appropriate as follows: dividend of 5 per cent. per annum on the ordinary share capital for the year, £105,599; leaving to be carried forward, subject to corporation profits tax for two years 1920/21 and 1921/22 and excess profits duty for the year 1920/21 (if any), £217,024. The report reads:—

"As foreshadowed by the chairman at the last general meeting, the year just completed has been one of difficulties and disappointments. The results of the year are better than at one time anticipated, but on the whole are a reflection of the industrial condition of the country, which showed itself in a reduced demand for the company's products, and did not permit the recently extended works to be fully employed. The effects of a number of strikes in various industries, culminating in the recent engineering lockout, which continued into the current year, have been most serious. In addition, the company has suffered from a fall in value of the comprehensive stock of finished electrical material of every description, which, as a matter of necessity, it has to carry. Unfortunately, the company's overseas branches have also suffered, the countries in which they are situated having all encountered crises, different from our own, but with the same depressing effect on trade. The increase of £500,000 in 'land and buildings' and £285,000 in 'plant and machinery' is mainly accounted for by final payments made in connection with the company's new buildings at Witton and Hammersmith and the head office in Kingsway, and the completion and equipment of the new glassworks and research laboratory at Wembley. With the exception of small amounts outstanding, the company has no further capital commitments in connection with its building programme. The decrease of £580,000 in the item 'stock and work in progress' is largely the result of a considered policy of stock reduction, which has been carried out throughout the year. The reserve remains at the figure of £707,000. Your directors deem this adequate having regard to the sums which have been written off in this and previous years for depreciation. The number of the company's employés has inevitably decreased during the year, and now stands at a total of 12,000. Great credit is due to the individual efforts and sacrifices made by all concerned to meet the position. A satisfactory feature of the year's trading is that there has been no reduction in the number of transactions, but they have been of smaller amounts, thus demanding increased work from the company's staff. Mr. M. S. Conner, the director in charge of the telephone undertakings of the company, has resigned from the board on his return to America. The directors congratulate themselves on having secured as his successor Sir William Noble, formerly Engineer-in-Chief to the General Post Office. His appointment will be submitted to the shareholders for their confirmation."

Meeting: Tuesday, July 18th, at Magnet House, Kingsway, W.C.

[Comparison with the statement issued by the directors a year ago shows that the net profits are returned at £566,582 for the past year, as against £796,149 for the preceding year. The amount brought forward this time, £348,094, included the sum formerly put to reserve, owing to the state of the industry, and as the 1920-21 accounts had benefited from a substantial amount from premiums on the new issue of capital; the carry forward this year is £217,024, apparently also including the reserve provision. The available total is £914,676, as compared with £971,817 for 1920-21, but debenture stock interest (7 per cent. on £3,500,000 stock which largely took the place of loans, absorbs £182,431, whereas for the previous year this item only required £8,000. Depreciation allocation in the present account is £161,745, against £157,915. The contribution to pension fund was £17,266 in the last account, and is £15,283 in the present one. The 6½ and 7½ per cent. preference dividends total much about the same for the two years, but the 10 per cent. dividend on the ordinary capital for 1920-21 needed £211,197, so that for 1921-22 the recommended 5 per cent. will require £105,599. The number of employés, which at March 1921, was 16,000, has fallen to 12,000.]

Crompton and Co., Ltd.

Mr. Alan A. Campbell Swinton presided at the annual meeting, held on July 6th. He gave a few figures from the balance sheet, calling attention to the fact that the expenditure on freehold land and premises, &c., had increased to £418,744, the difference, less depreciation, representing the completion of the works which were in hand at the time of the last meeting. The new Diesel engine-house had been brought into service, and had given great satisfaction from the point of view of economy in working. The company was thus in a position of having a modern factory, wholly equipped with modern machinery, which would enable it to compete satisfactorily with other manufacturers making similar classes of goods. Stock in trade had been reduced to less than half the figure at which it stood last year. A further fall in prices had occurred since March 31st and the stock had again been written down. Reserves had been increased by £19,500 set aside last year, and bank loans had been reduced to £30,000. It was proposed to pay a final dividend of 3½ per cent. on the preference shares and a dividend of 5 per cent. per annum on the ordinary shares, placing £10,000 to reserve for future taxation and leaving £18,084 to be carried forward. Taxation had been fully provided for, but as prudent men they should keep something in hand against the three years' average. Those who were shareholders many years ago—before the present company took over—would remember that an advance of some £42,000 had been made to the Electric Supply Corporation, on the condition that the sum should be refunded out of the future profits of the Electric Supply concern when this should be possible. When the present company took over the claim for what it was worth it did not place any real value on it, and did not expect to get anything from it. The prospects of the Electric Supply Corporation (in which they already held 6,000 shares) however, were now better, and the corporation desired to get rid of this obligation. An agreement had been arranged by which, in respect of the claim Crompton & Co. would receive 8,000 shares of £5 each, fully paid, and £2,700 in cash. The Electric Supply Corporation proposed to reorganise and write down its capital also, and to pay an interim dividend for the half-year ended June. Thus the Corporation got rid of

a contingent liability which was like a mill-stone round its neck, while Crompton's obtained 8,000 fully-paid shares of a nominal value of £3 when written down, on which an immediate dividend would be paid. The cash received in this connection had not been regarded as profit, but had been written off the first item in the balance sheet. Generally speaking, the electrical industry had not suffered so severely as some others from the depression in trade, and it was likely to be one of the first to feel the effects of trade revival. There were the questions of electric railways and hydro-electric schemes, at home and in the colonies, which were now receiving much attention. That the demand for electricity was improving was reflected in the latest returns of electricity supply in this country. It was difficult to forecast results of the company's operations for the current year, but the inquiries received so far had been greater than in any year during the company's history. There was a tendency still, however, to hold up orders. The engineers' lock-out had had a bad effect on the company's business, and the recent settlement had had a beneficial effect. He hoped next time to be in a position to give a more encouraging and hopeful account of the business of the company. He moved the adoption of the report and accounts, the resolution being seconded by Mr. Saxton Noble, and carried unanimously, after a few remarks by Mr. Garroch congratulating the board on having arranged the agreement with the Electric Supply Corporation.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a :—

Calcutta Electric Supply Corporation.—125,000 new ordinary shares of £1 each, issued at 22s., 5s. paid, Nos. 800,001 to 925,000; and 125,000 new five per cent. cumulative preference shares of £1 each, 5s. paid, Nos. 2,250,001 to 2,375,000.

The undermentioned have been ordered to be officially quoted :—

Fairbairn Lawson Combe & Barbour, Ltd.—150,000 ordinary shares of £1 each, fully paid (Nos. 900,001 to 1,050,000).

Indian Electric Supply and Traction Co., Ltd.—30,000 ordinary shares of £1 each, fully paid (Nos. 90,001 to 120,000).

Madras Electric Supply Corporation, Ltd.—4,350 ordinary shares of £1 each, fully paid (Nos. 189,470 to 193,819).

Melbourne Electric Supply Co., Ltd.—£166,784 consolidated ordinary stock.

Royce, Ltd.—According to the Manchester *Daily Dispatch*, there is a loss of £4,241 on the past year's working. Before arriving at this total, the directors have paid or provided for all trade expenses, made liberal depreciation of buildings, machinery, plant, &c., and charged income tax, repairs, and replacements to revenue. The credit balance brought in was £9,242, and after deducting the loss there is £5,001 to be dealt with. The preference dividend absorbs £1,468, and it is proposed to pay a dividend of 5 per cent., less tax, on the ordinary shares and carry forward £996. For each of the previous six years ordinary shareholders received a similar rate of distribution, but free of tax.

Commonwealth Edison Co.—Net electric operating revenues for 1921 totalled $12,743,675, less uncollectable operating revenue $139,671. Taxes assignable to electric operations, $2,700,000; municipal compensation, $1,116,259; leaving net operating income $8,787,744, plus other income $739,585, making $9,527,330. Rent for plants and machinery and interest on current loans absorbed $1,326,503, interest on funded debt $2,834,041, leaving available $5,366,785. Dividend at the rate of 8 per cent. absorbed $4,307,126, leaving balance carried to surplus of $1,059,659, making total surplus $9,183,217.—*Financial Times.*

Electrolytic Zinc Co. of Australasia.—Dividend on the cumulative participating preference shares at the rate of 8 per cent. per annum for the half-year ended June 30th. *The Times* states that it is intended to make subsequent distributions at half-yearly intervals, and the directors will shortly take into consideration the payment of the whole or part of the interest which has accumulated on the preference shares up to December 31st, 1921, which at that date amounted to 1.1326s. per share.

International Automatic Telephone Co., Ltd.—Sir Alex. Roger presided at the annual meeting, held at Liverpool on July 6th. In reviewing the year's business, he said that the profit was £11,799 and the preference dividend absorbed £11,782. He regretted the profit was insufficient to pay a dividend on the ordinary and deferred shares.

Reduction of Capital.—Turner, Atherton & Co., Ltd., and Reduced.—A petition for the confirmation of the reduction of the capital of the company from £175,000 to £140,116 has been presented to the Chancery Court of the County Palatine of Lancaster, and will be heard in Manchester on July 24th.

St. James' & Pall Mall Electric Light Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the preference shares and 10 per cent. per annum on the ordinary shares for the half-year ending June 30th, 1922.

Greenwood & Batley, Ltd.—Final dividend for the year ended March 31st of 3½ per cent., making 6 per cent. for the year.

Metropolitan Electric Supply Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum for the half-year ended June 30th, compared with 4 per cent. paid last year.

Telegraph Construction and Maintenance Co., Ltd.—Interim dividend of 6s. per share, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets are hesitating, and do not seem quite to know why. The slump in the value of the mark and the further fall in the franc have led to uneasiness amongst the investing classes. At the same time, speculation has fallen away to a ripple, as compared with the volume of business current four or five weeks ago. But shortly, the lurking fear is that bankruptcy on the part of Germany might entail severe loss upon France, which, in its turn, would be reflected upon our own country. As usual, the fears are magnified by the fog of obscurity and uncertainty which hangs over the situation. A certain amount of investment takes place day by day, but it is not sufficient to counteract the effects of the selling, and, also of the cancellation of buying orders which goes on more or less automatically. People are not anxious to do anything at present, the result being that prices tend to sag, and speculation to dwindle. Talk of a moratorium being granted to Germany, led to a better sentiment in the markets, and prices rallied substantially from the worst.

Amongst the gilt-edged stocks, London Electric and City and South London 4½ per cent. debentures have both given way to ⅝ premium, after the prices had been a little over 1 premium. A further issue of electric railway Government-guaranteed stock is anticipated in the near future, though it may be observed that further issues of various kinds which were to have made their appearance before the August holidays are being delayed, where possible, until times are more propitious. It was stated, for instance, in the Stock Exchange that two or three more Indian electric undertakings were about to appeal for funds, but these apparently have thought better of it, for nothing is mentioned in the underwriting market so far as we are aware, though there is a big light and power scheme on the stocks which may put in an appearance within the course of the next week or so.

The Home Railway companies have started to declare their interim dividends, and the electric list was the first to publish its announcements. The most striking is the District's dividend at the rate of 1½ per cent., as against nothing for forty years past. The price of the stock advanced to 39¼, but reaction took the price back to 38. The London General Omnibus is to pay 4 per cent. tax-free, against 4½ per cent. a year ago. The City & South London's 1¾ per cent. is ¼ less, and the Underground Electric income bonds receive 2 per cent., the same as a year ago. Prices in the railway market are lower all round, but the Undergrounds have been able to show more resistance than the steam stocks, and Metropolitans are 30s. higher on the week. British Electric Traction ordinary advanced to 52, and the 6 per cent. participating preference to 89, both these prices being ex dividend.

Amongst electricity supply shares, the St. James's & Pall Mall Co.'s announcement of an interim dividend at the rate of 10 per cent., as compared with 7 per cent. a year ago, had a strengthening effect upon a number of prices in this department. St. James' shares have risen to 8⅞. City Lights are up to 40s., and the second preference rose 1s. to 27s. 6d. Metropolitan preference strengthened to 3⅞. Chelseas at 5¼ and Charing Cross ordinary at 7 are both ½ up. The market, moreover, is a good one, and it is difficult to obtain any shares. Westminsters came in, and the price drooped to 7½. There are some who think that the St. James' declaration may be taken as a hint that the company intends to make its half-yearly distributions more equal, and that the dividend for the full twelve months will be the same as that, namely, 12 per cent., for last year. Others, however, are more hopeful, and regard the outlook as favouring the idea that the dividends will be on a higher scale. The progress of the Electricity Bill is noted with satisfaction, and the next stage arouses lively interest as to what is likely to occur.

Midland Electric 7 per cent. preference shares at 21s. 9d. are easier, and there is no change in Newcastle-upon-Tyne Electric shares, although the report of the Cleveland and Durham company reflects the labour conditions and the stagnation in trade, which have been a melancholy feature of the last year. General Electrics at 18s. 3d. are practically the same as a week ago, the dividend reduction, from 10 per cent. net to 5 per cent. less tax, bringing in a few sellers whose shares were readily taken by people who had sold in advance, and were glad to get in again at a profit. For it is held that the results of the present year are likely to be, at any rate, no worse than those just announced in respect of the past period, but that, with the stocks drastically written down, the company should now be in a better position to make some substantial profits. English Electric strengthened to 1s. 6d., a rise of 2s. 6d., and the company's 5½ per cent. first mortgage

debentures advanced to 97. Other manufacturing shares are quiet. Cruppts us have dropped to 15s. Amongst the cable issues, Telegraph Constructions at 26 are 5s. to the good.

There is little change in the group of cable companies' shares. Anglo-American deferred at 2⅝ is ¾ lower, and Great Northerns at 28¼ show a similar loss. Marconis continue depressed. The parent shares have dropped to 2 3/16, and anticipations are rife of a reduction in the dividend to 10 per cent., as against the 15 per cent. paid for last year. It may be remembered that the interim dividend was 5 per cent., and anticipation looks for this to be supplemented by a similar amount early next month. The Marconi Marine dividend for last year was also 15 per cent., and here again the cautious are inclined to regard 10 per cent. as likely to be the outcome of the year's trading. No doubt the depreciation of the Italian exchange must have hit both companies hard. Pending the declaration of the dividends, the market is going very softly.

In the foreign list, Brazilian Tractions recovered to 52. British Columbia deferred, after a drop to 72 rallied to 74½, at which the price shows a gain of 1½ on the week. The company's 4½ per cent. debenture at 79 is 1 down. Anglo-Argentine Tramways second preference gave way to 3⅜. The Mexican utilities are uninteresting, the market still hanging upon hopes of favourable news from Mexico with regard to recognition of the country by Great Britain and the United States.

Rubber shares have relapsed into stagnation, the price of the produce falling to the neighbourhood of 7¼d. per lb. There is vague talk of a big shipment returning from the Near East before long, and adding to the super-abundant stocks at present held in this country. The armament group is inclined to ease off now that the effect of the Vickers dividend has passed off, but iron and steel shares, generally speaking, maintain a steady front, though business is meagre.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price July 11, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	7	—	6 8 7
do. do. 4½ Pref.	4½	4½	3¾	—	5 16 2
Chelsea	6	6	5⅞	+ ⅛	5 4 4
City of London	14	14	2	+ ⅛	7 0 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1⅞	-	6 2 0
do. do. 6 per cent. Pref.	6	6	1⅞	—	5 13 0
Kensington Ordinary	9	10	7⅛	—	7 18 7
London Electric	2½	4	2¼	+ ⅛	5 14 0
do. do. 6 per cent. Pref.	6	6	5	—	6 0 0
Metropolitan	7	7	5⅜	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3⅛	+ ⅛	5 16 2
St. James' and Pall Mall	12	12	8⅞	+ ⅛	6 17 2
South London	7	7	5½	—	8 0 0
South Metropolitan Pref.	7	7	1⅝	—	5 18 0
Westminster Ordinary	10	10	7¼	— ⅛	6 18 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104	—	5 15 5
do. Def.	1½	34/6	23⅜	— ¼	7 7 6
Chile Telephone	6	6	6⅞	—	4 15 1
Cuba Sub. Ord.	7	7	8⅜	—	8 4 8
Eastern Extension	10	10	18⅝	—	5 7 5
Eastern Tel. Ord.	10	10	187½	—	5 6 8
Globe Tel. and T. Ord.	10	10	19	—	5 5 3
do. do. Pref.	6	6	11	—	5 9 1
Great Northern Tel.	24	22	28¼	— ¼	7 16 3
Indo-European	10	10	37⅛	—	6 8 5
Marconi	25	15	2⅛	— ⅛	6 17 0
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	7⅛xd	—	*5 12 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18½	—	*5 8 0
Home Rails.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	48½	+1½	4 12 9
do District	Nil	1	8⅝	1	2 12 8
Underground Electric Ordinary	Nil	Nil	2⅜	—	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	2	4	81½	—1	*4 18 0
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	84	—	7 17 2
do. do. 2nd Pref.	Nil	5½	3⅝	— ⅛	7 6 8
do. do. 5 per cent. Deb.	5	5	81½	-	6 4 3
Brazil Tractions	Nil	Nil	52	+1	7 13 10
British Columbia Elec. Rly. Pce.	5	5	80½	—	6 4 3
do. do. Preferred	5	93/-	69⅛	—	*6 13 0
do. do. Deferred	3	124/-	74½	+1½	*8 6 6
do. do. Deb.	4¼	4¼	79	—1	5 7 7
co Trams. 5 per cent. Bonds	Nil	Nil	71¾	—	—
do. do. 6 per cent. Bonds	Nil	Nil	87¼	—	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	52	—1	Nil
do. 1st Bonds	Nil	5	68½xd	—1	7 6 0
Manufacturing Companies.					
Babcock & Wilcox	15	16	3	—	5 6 8
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2¼	—	7 1 2
Callenders	15	15	2⅛	—	7 5 3
do. 6% Pref.	6½	6½	1⅞xd	—	5 9 5
Crompton Ord.	10	10	15/-	— ⅛	—
Edison-Swan	10		4/6	—	—
do. do. 5 per cent. Deb	5	5	64xd	—	7 16 4
Electric Construction	10	10	1¼	—	8 0 0
English Electric	8	8	17/6	+ ¼	5 14 3
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/- xd	—	5 18 2
do. Ord.	10	5	18/-	+3d.	5 9 7
Henley	15	15	2¾	—	6 13 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India Rubber	10	—	½	—	—
Met. Vickers Pref.	8	8	2⅛	—	6 11 2
Siemens Ord.	10	10	1⅞	—	*7 12 4
Telegraph Con.	20	20	26	+ ¼	*4 12 2

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 12th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb. 8d.	...
a Ammoniac, Sal	per ton £63	...
a Ammonia, Muriate (large crystal)	,, £52	...
a Bisulphide of Carbon	,, ...	...
a Borax	,, £30	...
a Copper Sulphate	,, £27	10s. dec.
a Potash, Chlorate	per lb. 5d. to 5½d.	...
a ,, Perchlorate	,, 7¼d.	...
a Shellac	per cwt. £18 15s.	...
a Sulphur, Sublimed Flowers	,, £12	...
a ,, Lump	,, £11	...
a Soda, Chlorate	per lb. 3¾d.	...
a ,, Crystals	per ton £6	...
a Sodium Bichromate, casks	per lb. 5½d.	...
METALS, &c.		
b Aluminium, Ingots	per ton £120	...
b ,, Wire	per lb. 1/9 to 2/6	...
b ,, Sheet	,, 1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I	per ton net £147	£2 inc.
Grade II	,, ,, £106	£1 inc.
Grade III	,, ,, £61	...
c Brass (rolled metal 2' to 12' basis)	per lb. 9½d.	...
c ,, Tubes (solid drawn)	,, 11¾d. to 1/-	...
c ,, Wire, basis	,, 9¾d.	...
c Copper Tubes (solid drawn)	,, 1/1½	...
c ,, Bars (best selected)	per ton £94	...
c ,, Sheet	,, £94	...
c ,, Rod	,, £94	...
d ,, (Electrolytic) Bars	,, £71 15s.	15s. inc.
d ,, ,, Sheets	,, £145 10s.	...
d ,, ,, Wire Rods	,, £81 15s.	15s. inc.
d ,, ,, H.C. Wire	per lb. 10⅞d.	½d. inc.
f Ebonite Rod	,, 3/6	...
f ,, Sheet	,, 3/-	...
n German Silver Wire	,, 2/6	...
b Gutta-percha, fine	,, 12/6	...
b India-rubber, Para fine	,, 10d.	...
l Iron Pig (Cleveland Warrants)	per ton 90/-	...
l ,, Wire, galv. No. 8, P.O. qual.	,, £25	...
g Lead, English Pig	,, £25 15s.	...
g Mercury	per bot. £11 10s. to £12 10s.	5s. dec.
e Mica (in original cases) small	per lb. 3d. to 3/-	...
e ,, ,, medium	,, 4/- to 8/-	...
e ,, ,, large	,, 10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,, 1/1	...
p ,, drawn bars and rods	,, 1/3	...
p ,, rolled strip & sheet	,, 1/2½	...
p ,, wire	,, 1/3½	...
o Platinum	per oz. £19 10s.	...
d Silicium Bronze Wire	per lb. 1/1	...
r Steel, Magnet, in bars	,, 1/-	...
n Tin, Block (English)	per ton £152 10s./£153 5s.	...
n ,, Wire, Nos. 1 to 16	per lb. 3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Summer Time.—On the motion for the third reading of the Summer Time Bill, Mr. Shortt, Home Secretary, replying to questions as to the changes made in Committee, said that there had been a slight shortening of the period of summer time, and the recommendations of the Departmental Committee of 1917 were taken as a standard. The Committee recommended that the period should be from the second Sunday in April until the day after the third Saturday in September. The Bill recommended a period from the third Sunday in April to the day after the third Saturday in September. So that they had only met the agricultural industry by a shortening of about seven days. The period of shortening appeared to be long, if summer time this year was taken as a standard. But the period this year was abnormally long and was fixed by agreement with France, which had fixed so long a period that there had been in that country an almost complete revulsion of feeling with regard to summer time. The Bill was read the third time.—*The Times.*

The "Leader" Cable.—On the recent departure of the Pacific Steam Navigation Co.'s *Orbita* from Southampton for Hamburg, the vessel was navigated for some distance by the aid of a submarine electric cable. The experiment was carried out by Admiralty officials with a 20-mile armoured Admiralty cable that is laid from a point some six miles south of the Nab Light Tower, off the east coast of the Isle of Wight, and well out to sea, in an almost direct line to the entrance to the narrow channel that leads into Portsmouth Harbour, and for some distance up the channel. Its land end is at Fort Brockhurst, where it is energised by a motor generator.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

THE ANNUAL CONVENTION AT WOLVERHAMPTON.

(*Continued from page 9.*)

Sub-Station Equipment including Automatic Control.

By R. A. Chattock,
City Electrical Engineer, Birmingham. (*Abstract.*)

Types of Sub-Station Plant.

For the purpose of the paper the following conditions are assumed:—

An incoming supply of 11,000-volt three phase alternating current.

An outgoing supply of 500-volt direct current, for power and lighting purposes, having a regulation of 5 per cent. above and below normal, or of 1,500-volt direct current for railway traction purposes.

A speed of 500 r.p.m.

A.—Sub-Station Plant used for Transforming A.C. to D.C.

1.—*Rotary Converter.*—In fig. 1 is shown a comparison of the over-all efficiencies of various types of standard sub-station transforming plant, including transformers, where they are used. The efficiency of a 1,000-kW rotary converter equipment supplying direct current at 500 volts varies from 92 per cent.

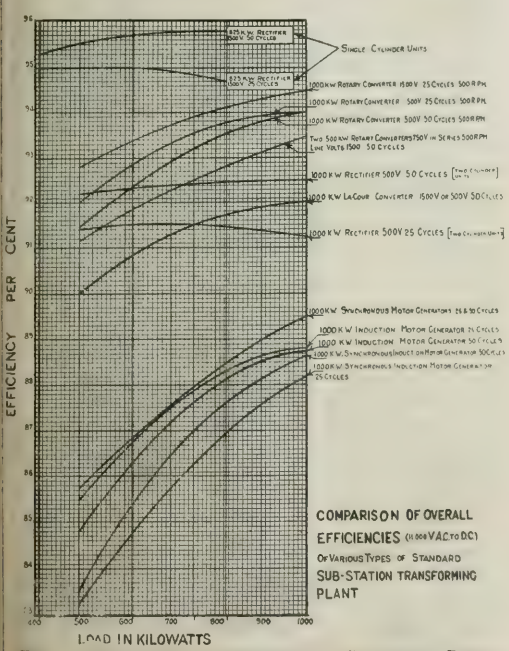


Fig. 1.—Comparison of Efficiencies of Sub-station Plant.

at half-load to 94 per cent. at full load when supplied with 25 cycles, and from 91.4 per cent. at half-load to 94 per cent. at full load when supplied with 50 cycles, whilst when a direct current voltage of 1,500 is required—as will be the case with modern railway traction—the efficiency of a 1,000-kW 25-cycle rotary varies from 92.8 per cent. at half-load to 94.5 per cent. at full load. When 50-cycle rotaries are used for this direct current voltage, it is necessary to run two 500 kW sets in series in order to obtain 1,000-kW capacity. Under these conditions the efficiencies of such a combination vary between 91.1 per cent. at half-load and 93.5 per cent. at full load.

By arranging suitable excitation the power factor can be kept either at unity or with a leading characteristic (see fig. 2). This is a great advantage on systems that have to carry a large inductive load.

The present-day costs of rotary converter equipments of 1,000-kW capacity are as follows: 500 volt, 25 cycle, £6.10 per kW; 500 volt, 50 cycle, £5.23 per kW; 1,500 volt, 25 cycle, £6.41 per kW; 1,500 volt, 50 cycle, £7.37 per kW.

2.—*La Cour Motor Converter.*—This machine in operation is not quite so efficient as the rotary converter. It is only advocated for dealing with alternating currents of 40 cycles or over. It is quite possible to construct such machines having a capacity of 1,000 kW and supplying direct current at 1,500 volts, without the necessity for running two in series, as is the case with 50-cycle rotary converters.

The efficiency of a La Cour converter varies from 90 per cent. at half-load to 92 per cent. at full load (see fig. 1). The power factor can be adjusted to unity (see fig. 2). The cost per kW at present-day price amounts to £1.37.

3.—*Synchronous Motor-Generator.*—This machine consists of a separately excited synchronous motor driving a direct-current generator, the efficiency varying from 85.8 per cent. at half-load to 89.5 per cent. at full load (see fig. 1). A special starting motor is required. The power factor can be kept at unity, or given a leading characteristic (see fig. 2). The cost at present-day prices is £6.89 per kW for 25 cycles, £6.5 per kW for 50 cycles.

4.—*Induction Motor-Generator.*—The efficiency is slightly higher on 25 cycles than on 50 cycles, and varies from 85.5 per cent. at half-load to 88.8 per cent. at full load (see fig. 1). The power factor of this type of machine cannot be adjusted, and varies from 84 per cent. lagging at half-load to 90.5 per cent. lagging at full-load when running on 25 cycles, and 74.5 per cent. lagging half-load to 85.5 per cent. lagging at full load when running on 50 cycles (see fig. 2). The cost at present-day prices is £5.84 per kW for 25 cycles, and £5.65 per kW for 50 cycles.

5.—*The Synchronous Induction Motor-Generator.*—This machine starts up as an induction motor, and when it reaches full speed the rotor of the induction motor is separately excited from a small exciter driven by the shaft, with the result that it pulls into synchronism.

Although the efficiency of this type of machine is the lowest of any referred to, it has an advantage over the induction motor-generator from the fact that the power factor can be adjusted to unity at full load, and with constant excitation

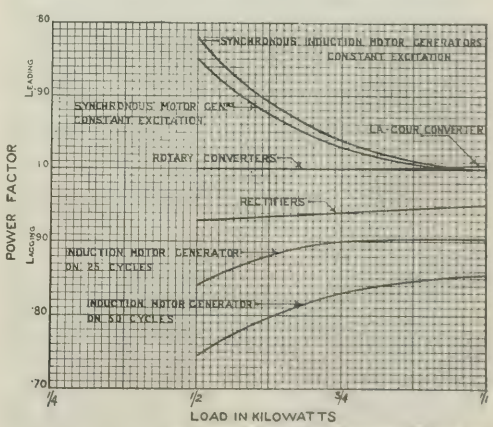


Fig. 2.—Comparison of Power Factors of Different Types of Transforming Plant.

it has a leading characteristic at lower loads (see fig. 2). The cost at present-day prices is £6.40 per kW for 25-cycle plant, and £6.18 per kW for 50-cycle plant.

6.—*The Mercury Arc Rectifier.*—This apparatus has recently been described at considerable length in the technical Press. It will be seen from fig. 1 that a 1,000-kW rectifier with two cylinders, supplying 500-volt direct current, has an efficiency varying from 92.2 per cent. at half-load to 92.5 per cent at full load when run on 50 cycles, and 91.4 per cent. at half-load to 94.2 per cent. at full load when run on 25 cycles. When, however, the direct-current voltage is increased to 1,500, the efficiency of a single-cylinder 825-kW capacity rectifier rises to 95.3 per cent. at half-load and to 95.8 per cent. at full load on 50 cycles, and from 95 per cent. at half-load to 94.7 per cent. at full load on 25 cycles.

For a 1,500 volt direct-current supply this type of apparatus is, therefore, more efficient than any type of rotary apparatus on the market, and if the pressure is increased to 3,000 volts the difference is still more marked.

The power factor remains practically constant at a value varying from 93 per cent lagging at half-load to 95 per cent. lagging at full load (see fig. 2). The cost at present-day prices is:—Two cylinder—1,000 kW, 500 V, 25 cycles, £87 6 per kW.

Two cylinder—1,000 kW, 500 V, 50 cycles, £7.48 per kW. These prices include induction regulator on h.p. side. Single cylinder —225 kW, 1,500 V, 25 cycles, £6.38 per kW. Single cylinder —225 kW, 1,500 V, 50 cycles, £5.04 per kW.

Recently a glass-bulb rectifier for 50 to 100 kW has been put on the market.

7.—*Storage Battery.*—The storage battery is a valuable adjunct to the direct-current sub-station, its special feature being that it guarantees reliability of supply by meeting emergencies when short interruptions occur on the alternating-current system. It also maintains a steady pressure, which is so necessary for lighting requirements. The efficiency of a storage battery regarded as a sub-station unit with its charging boosters and its necessity for drawing transformed energy from the alternating-current system amounts to about 63 per cent. When the cost of the current passed through the battery is, however, taken into account, a much higher economic efficiency results. The storage battery being charged up at night time, can be supplied at the cost of the coal only, whilst at times of emergency the supply returned to the line is practically priceless, and at times of peak load the value is at a maximum.

Taking the two-hour rate of discharge as a measure of the capacity of a battery, and including the cost of the battery, regulating switch, and charging booster, the cost per kW at present-day prices is £35.

B.—Sub-Station Plant Used For Transforming A.C. to A.C.

1.—*Static Transformer.*—The efficiency of this apparatus varies between 96 per cent. at half-load and 98 per cent. at full load. The cost at present-day prices is £2 per kVA for small sizes up to 100 kVA, and down to £1 per kVA for larger sizes.

2.—*Frequency Changers.*—The efficiency varies from 89.5 per cent. at half load to 92.5 per cent. at full load. The power factor can be adjusted to unity, and the cost at present-day prices is £5.16 per kW.

APPLICATION TO VARIOUS CLASSES OF SUPPLY.

A.—Lighting and Power.

Most thickly-populated centres of supply in this country are dealt with by means of direct current supplied through three-wire distributing networks, fed by sub-stations equipped with rotary converters or La Cour motor converters.

The advantage of using direct current in a thickly populated district is largely due to the possibility of installing storage batteries, by means of which the reliability of the supply can be properly safeguarded, and also the more satisfactory handling of small motors on the circuit. The extra cost involved in supplying such districts, which is fairly considerable, can be justified for this reason alone.

The overall efficiency of working a rotary-converter sub-station equipped with a storage battery, over a period of twelve months, and converting an output of about nine million units, amounts to 87 per cent. per annum.

The present day cost of such a sub-station, including land, buildings, plant, battery and switchgear, at present-day prices amounts to:—

£19.9 per kW for a two-storey sub-station.
£17.4 per kW for a single-storey sub-station.

Experience is now showing that there is a limitation to the capacity of the direct-current sub-station due to the loading up of the low-pressure feeders. It would appear that the best way of handling such a condition is to install automatic rotary transforming plant or mercury arc rectifiers in the outlying parts of the districts, which can be arranged to feed back into the distributing network at times of heavy demand. For this purpose simplicity of operation is an essential factor, the efficiency not being so important, as the apparatus is only required to run occasionally. The choice would therefore seem to lie between the induction motor-generator and the mercury arc rectifier. Apparatus of this kind can be made entirely automatic in its operation, the cutting in and out being controlled by the local variation in the pressure in the immediate neighbourhood, or it can be made semi-automatic by connecting it to the main sub-station through pilot wires, by means of which the attendant can, from his knowledge of the demand in the district, arrange for the apparatus to cut in or out automatically.

The present-day cost of such plant installed in single units of 250 kW capacity in small sub-station buildings amounts to:—

For the automatic rotary converter equipment, £23.7 per kW.

For the mercury arc rectifier equipment, £17.1 per kW.

When, however, the supply to a thinly populated residential district is considered, the use of direct current is hardly justified on account of the heavier cost, and the relatively less reliable system of low pressure alternating current supply has to be adopted.

Taking a suburban residential area of about 13 square miles, with a total load of 300 kW: as the smallest size of mercury arc rectifier is 230 kW, and the rotary converting plant for automatic operation is not considered desirable under 250 kW capacity, such sets are too large to be economically adopted in such a district.

The comparison of the cost of three schemes for dealing with such an area at present-day prices works out as follows:—

Three automatic mercury arc rectifier sub-stations, £65 per kW. Three automatic rotary converter sub-stations, £58.5 per kW. Six static transformer sub-stations, £26 per kW.

The efficiencies of these three systems of supply, reckoned from the high pressure input to the supply delivered at the consumers' premises, and assuming a load factor of 15 per cent. per annum, work out at 89, 84.5, and 95 per cent. respectively.

B.—Tramway Traction.

Where the tramway runs through country districts, automatic sub-station plant is likely to be adopted. Control of such automatic apparatus can be conveniently obtained over very great distances from a single centre by means of pilot wires operating relays which control the automatic starting and stopping of the plant. The saving is chiefly represented by the elimination of labour costs in sub-stations and of long and costly low pressure feeder cables.

C.—Railway Traction.

Although the Advisory Committee of the Ministry of Transport has recently recommended that the standard pressure for adoption on the railways of this country should be 1,500 volts direct current, it does not appear that this is being accepted without question. Advocates of the single-phase a.c. system at a pressure of 11,000 volts insist that this is cheaper than the d.c. system, whilst, on the other hand, it would appear that d.c. pressures higher than 1,500 volts can be used with safety.

The mercury arc rectifier can be adapted to supply direct current at a pressure of 3,000 volts, whilst rotary converters can be utilised in the same way by coupling the direct current ends in series.

It is doubtful whether rotary converters will be suitable for these higher pressures. Special measures to counteract flashing over, whilst very ingenious, and doubtless effective to a certain extent, do not recommend themselves as being altogether desirable. It is very much better to use apparatus which does not require such extraordinary protection in order to obtain reliable service, although it may not be quite so efficient in operation.

It is essential that sub-stations for railway traction should be automatic in operation, and for this purpose La Cour converters, induction motor-generators, and mercury arc rectifiers can be conveniently adapted.

The use of single-phase alternating current for ordinary traction purposes requires only very simple sub-station equipments.

(To be concluded.)

Administration and Control of Electricity Departments.

By Edward Calvert, M.I.E.E., M.I.Mech.E.,
Chief Electrical Engineer, Finchley. *(Abstract.)*

It is essential that the committee and the management responsible for such an undertaking as an electricity department shall have a reasonable freedom, comparable with that of the managing director and manager of a company, and not be unnecessarily confined to procedure which may be suitable in connection with non-trading departments.

In order to successfully conduct such a highly specialised department, it is necessary to appoint an officer as chief engineer and general manager, who will, in effect, occupy the position of, and have a similar status to, that of general manager to a commercial company. It may be assumed that the office of managing director is, more or less, undertaken by the committee of the local authority in charge of the particular undertaking. The general manager must be fully qualified both technically and commercially, owing to the varied nature of his responsibilities.

No matter how accountancy matters may be arranged or re-arranged, the general manager with his technical staff must remain responsible for the real financial administration. To deal with this satisfactorily, he will require to have complete and ready access to all records, statistics of financial transactions and the results, for his guidance.

To enable the general manager to advise on financial questions, particularly, perhaps in the case of scales of charges for electricity supplied for various uses, he must be conversant with the cost of money and the charges for appropriate sinking funds.

All of this being the responsibility of the general manager, there remains little for any other principal officer of the authority, except the actual raising and liquidation of loans and book-keeping; that is to say, the entering of the results of the work in books of account.

The detail books of account are necessary to the department for constant reference; the ultimate financial statement is not only required for departmental use, but for the local authority concerned and the public in general.

The question of municipal accounts has received much consideration, particularly during the past fifteen years. The Public Health Acts do not appear to contain any specially detailed method of control or accounts, but they appear to contemplate that officers, other than the Treasurer, will handle money.

In the year 1906, the Local Government Board appointed a Departmental Committee to report with regard to the system on which accounts of local authorities in England and Wales should be kept. The report of this Committee was issued in 1907, making recommendations the effect of which would be the placing in the hands of the Finance Committee financial powers which could conceivably take away power from the local authority itself. Considerable opposition to the recommendations was raised by those responsible for the conduct of municipal trading undertakings, and no further action upon the matter appears to have been taken by the Local Government Board.

There has recently been evidence of a revival of the movement in favour of the recommendations of the Departmental Committee, and the Council of the Incorporated Municipal Electrical Association passed the following resolution in connection therewith: "That this Association views with great dissatisfaction and distrust efforts that have been, and are being made in various quarters to place the general control of electricity departments under any officer other than the chief electrical engineer and general manager."

The general principle underlying the recommendations of the Departmental Committee is analogous to that which has been in force in the London County Council since the year 1889, and the Council appointed a Special Committee on the 21st June, 1921, to examine the organisation of the Council's service and report, *inter alia*, generally what steps should be taken to secure the greatest possible efficiency coupled with economy.

The Committee, in its report, says: "The present system is, as will be seen, a highly centralised one. . . Most serious in our opinion is the division of responsibility between the heads of the executive departments and the head of the accounting and checking department. No effective organisation can be based upon divided responsibility, and in our opinion it would be essential to remove this defect even were no other change desirable.

"Having regard to the enormous and continuing growth of the Council's administration, a change has become advisable, and we are of opinion that this should take the form of a system of decentralisation, with adequate safeguards. . . . Under a complete scheme of decentralisation the Comptroller would be Financial Adviser, Paymaster-General, and Receiver-General and Auditor, and would keep the main accounts of the Council. The heads of the executive departments would have the entire and undivided responsibility for all payments for which they are the certifying officers; for the collection of revenue in connection with the work of their department, and for the keeping of the departmental accounts. As is the practice in commercial undertakings for safeguard, reliance would be placed on the Comptroller's audit."

These considered opinions, arrived at by the London County Council Special Committee in face of an organisation which had existed for many years, are conclusive arguments on general principle, and may lead to the deduction that a chief executive officer cannot effectively and efficiently carry out the work of his department unless his committee holds him solely responsible for the financial position of his undertaking. The many and constant questions which arise, both between the customers and the department, and the suppliers of materials and the department, can only be satisfactorily dealt with by the technical officer and his staff; the intervention of a third party would probably result in delay and confusion.

In conclusion, the publication of the following considered opinion of the Council of this Association may be opportune:—

In municipal trading departments which have to be run on business lines, it is imperative that the chief electrical engineer and general manager should bear the full responsibility for the working and development of the undertaking. If the financial control is taken away from him and placed under another officer, a state of dual control is set up and the usual evil results will inevitably follow.

In Electricity Departments questions of commercial management and financial details are so dependent upon technicalities as to render these inseparable; they can only be satisfactorily dealt with by one who has high engineering qualifications for dealing with all branches of the Department's business.

Discussion.

Ald. A. Senington (Bristol) said that the analogy drawn by the author between company and local authority administration was not quite fair. Decentralisation might be essential in London, but not in a provincial town. Demarcation of duties in a trading department was very important; they might get into financial chaos if one official were allowed to control another. He asked whether Electricity Committees felt that the whole of the financial affairs of the department should be under the control of the electrical engineer, and said that they wanted guidance from the Association.

Mr. F. W. Purse (West Ham) said that no effort had been made by the Financial Officers' Association to gain control, but many insidious efforts were being made to that end in various localities. A number of Councils had set up "economy" committees, which recommended that certain additional financial matters should come before the finance committees, thus increasing the extent of their control, and some borough treasurers were assuming the title of "controller." Raising loans and keeping books were matters rightly dealt with by the Finance Committee, but for extensions of plant and mains the engineer alone should be responsible.

Mr. C. H. Wordingham said there was a supposition that an engineer, however capable as such, was no good at administration or finance. Opposing that view, he claimed that an engineer not charged with the financial part of the work was a contradiction in terms—it was essential that the engineer should deal with the financial side of the undertaking, which could not be divorced from the engineering side. To transfer financial control to another official would be disastrous. Every engineer should have a knowledge of accountancy and law. These were trifling compared with the technical training that he had to acquire. He should be given full responsibility and judged by the results he obtained.

Mr. N. Staniland (Hornsey) thought the tone of the paper was unnecessarily antagonistic to the accountants. The comparison between corporation and company finance was wrong—they were essentially quite different. He knew of a case where the treasurer by co-operation with the engineer had saved £2,000 in one year. They ought to think more about co-operation. Talking about antagonism developed antagonism, and he thought it would be a mistake to press this matter, except in individual cases of "poaching."

Councillor F. Burgess (Bristol) was surprised to learn that engineers were good accountants. In Bristol they were experimenting with centralisation, but there was much technical detail, in which the treasurer could not interfere with advantage. Co-operation was needed, not antagonism.

Mr. W. C. P. Tatter (Stepney) said the question was not one of personal feeling between officers, but of efficiency; at present there was much duplication. The engineer must have immediate access to necessary information; the accounts should be kept by an accountant under the electrical engineer and manager, and the borough accountant should carry on a continuous audit.

Councillor E. R. Dymond (Hereford) said a successful trading department was that which gave the largest possible supply at the lowest possible price. Who was to be responsible for its control? Dual control was incompatible with efficiency. It was almost impossible to give ultimate responsibility to one who had not the necessary technical knowledge to enable him to depend on his own judgment, and therefore the financial officer could not be supreme in technical matters. The electrical engineer must be responsible, not only from day to day, but for the results of the year's working.

Major C. R. Attlee (Stepney) deprecated the overweighting of the engineer with too many duties. In large companies, he said, specialisation was adopted. Companies sought to make profits, municipalities to serve the public. If too much power were placed in the hands of the technical officer he would be inclined to consider the interests of the consumer rather than those of the ratepayer.

Mr. J. W. Beauchamp pointed out that accounts should not be collected like taxes, and paid in the town hall; they should develop the idea of an electrical shop, have them paid in a showroom, and adopt ordinary traders' methods, not those of a post office.

Mr. L. L. Robinson (Hackney) said that his relations with the borough treasurer were those of cordial collaboration; they had a liaison officer in the engineering offices to keep the departments in touch. He agreed that the finance department must not touch commercial or engineering matters, but the treasurer should have full facilities to keep a running audit. The books and accounts were kept in the engineering building, and the idea of an electrical shop was realised.

Bailie W. Crawford (Paisley) said that at Paisley they had an advisory committee to confer with the engineer, who had absolute freedom with regard to extensions, &c., but submitted his proposals to the committee for discussion. All engineers should also be commercial men.

Councillor A. J. Ward (Sheffield) thought that engineers were not generally possessed of commercial qualities, and the engineer should be provided with a fully qualified colleague to look after the commercial side of the business, while he took care to provide a cheap and ample supply of electricity.

Councillor Wilkins (Derby) said that at Derby they had a quarterly account of the working of the electricity undertaking, but the borough accountant's annual report was not ready for several months after the end of the financial year. A quarterly balance sheet was helpful.

Replying to the discussion, Mr. Calvert advocated co-operation to the fullest extent between the municipal officers. He thought the engineer nowadays should be a general commercial manager, with a sound knowledge of engineering. The paper arose out of the feeling of unrest with regard to the attempts of borough treasurers to usurp powers out of their sphere.

Proposing a vote of thanks, which was heartily accorded, Lieut.-Col. Vignoles said that engineers were prepared to accept full responsibility for their departments.

Report of the Council.

The report of the Council for the past year shows that the number of undertakings belonging to the Association is 38, representing a total population of nearly 20 millions, and comprising 81 per cent. of the undertakings eligible for mem-

bership; five have joined, two have resigned, and one has been absorbed in a larger undertaking. Forty-five members of the Association have been engaged on its own Committees and on Joint Committees: the Association has five standing Committees, and four special Committees, of which three confer respectively with the B.E.A.M.A., E.L.M.A., and E.C.A., and is represented on the E.D.A., B.E.S.A., on 21 sub-Committees of the I.E.C., the Electric Vehicle Committee, three I.E.E. Committees, and other bodies. The B.E.A.M.A. Committee having completed standard schedules of guarantee and performance for turbo-alternators and condensing plant, is about to prepare schedules for transformers and rotary converters. The conferences with the E.C.A. have so far been inconclusive. The Electric Vehicle Committee has decided that the time is not opportune for the formation of an Electric Vehicle Association, but has been engaged in propaganda work and in pressing upon managers of electricity supply undertakings the necessity of providing charging facilities where they do not yet exist. Mr. Frank Ayton, having resigned on leaving municipal work, was co-opted as a member of the Committee, and re-elected chairman; Mr. E. E. Hoadley was elected hon. secretary. As instructed at the annual general meeting in 1921, the Council considered the question of the payment of expenses incurred by members of the Executive in attending meetings, and found that if the Council met 10 times a year in London, the total sum involved would be £1,500 per annum; first-class railway fares alone would amount to £950. To cover the former amount, the revenue from subscriptions would have to be doubled. The Council was of opinion that the expenses should be borne by the Association, but considered the time inopportune for increasing the subscriptions. [At the annual meeting the matter was deferred for 12 months.]

Prizes of £10 each were awarded to Mr. C. W. Charlesworth and Mr. W. M. Miles for their papers read at the 1921 meeting, both being so good that the Council could not give preference to either.

The accounts show that the total receipts for the year were £2,090, and the total expenditure was £1,808. The surplus of assets over liabilities at March 31st, 1922 was £1,378.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—III.

ANNUAL CONGRESS AT BOURNEMOUTH.

Modern Improvements in Rolling Stock.

By C. J. Spencer, M.I.E.E., &c.

(*Abstract.*)

For some strange reason the cars of to-day, with the exception of some very minor details, are almost exactly of the same type as those manufactured and put into service some 20-25 years ago. The above, whilst being generally true of this country, cannot be said to be absolutely true of some foreign systems, but that was fully discussed at the 1920 Congress.

The development and improvement of the rubber-tired vehicle during the last ten years has undoubtedly modified the views of transport men. There are many routes whereon to-day the traffic is handled by tramcar, which could be operated, to say the least, to greater public advantage by rubber-tired vehicles, and, under some circumstances, more economically, whether the rubber-tired vehicle be of the self-contained or of the railless trolley type. There are also many districts where a large vehicle carrying from 70 to 100 passengers, and necessarily rail-borne, is required to adequately deal with the traffic. In fact, even with vehicles of this capacity peak load traffic is not satisfactorily handled, and much larger units are required. As far as one can see the limits to the possible capacity of a rubber-tired, road-borne vehicle are not so great as those of a rail-borne one. The question, however, is a two-fold one. With a certain critical density of car miles per mile of route the total cost per car mile (including capital charges) per passenger carried is less with a rail-borne than with a rubber-tired vehicle. There are great economic advantages in a system whereby heavy loads are carried on a steel rail with power supplied from a central station using home-produced fuel, as contrasted with a system of carrying a power station on each vehicle. The tramcar is by no means obsolete, but improvements in tramcar design and methods are urgently necessary if the tramcar is to retain even its present position in street transport.

Have we given full consideration to the merits of a wooden foundation as contrasted with a concrete foundation, with a paving substance of wood or otherwise, with the object of deadening wheel and rail noises? But with the obligations of the Tramways Act of 1870 as to the keeping of a perfect road surface a rigid bed seems to be the only possible course. I am not sufficiently acquainted with the tramway law of other countries to say whether these conditions are altogether peculiar to this country, but in the United States any attempt to achieve the impossible, *i.e.*, introduce a light railway on the highway without impairing the surface, is not undertaken.

Regarding the vehicle, what attention has been given to the elimination of unsprung weight? How far could the present weight of axle and wheel be reduced if some of the modern high tensile steels, or other metals, were employed and a really scientifically designed wheel and axle adopted? How far is it necessary to carry more than half the weight of the motor with heavy gears on the car axle, and how far would it be feasible to carry the motor as sprung weight driving the car axle by some other means than a gear?

This also opens up the possibility of higher speed motors (in consequence of higher gear ratios), which means lighter machines, and it should also mean cheaper machines to manufacture. Some progress has been made during recent years in the direction of lighter motors, but we are not yet near the limit of possibilities. A well-known firm of motor bus builders is employing an electric motor on its vehicles of a total weight of under 25 lb. per h.p. output, whereas the lightest tramway motor I know weighs about 70 lb. per h.p. output. Designs of a motor as low as 20 lb. per h.p. output have recently been considered by my companies. This question of weight is extremely important from almost every point of view, and I feel confident that satisfactory results would be achieved if the problem was tackled in a scientific and thorough manner.

Some non-conductor of sound and vibration between the tire and the wheel centre, or between the wheel centre and the axle would kill two birds with one stone. Noises would be largely eliminated, and the premature destruction of many parts of the equipment by short wave vibration would be obviated. Maximum speed in the public highway is governed by the time taken to bring the car to a standstill without unduly straining the equipment, or the passengers, in the process. The whole question turns on the employment of power brakes as contrasted with our present very unmechanical hand-brake. A deceleration of from 4 to 6 ft. per second is a possible and practical proposition, and a rate at which cars could be brought to a standstill in a very short distance without inconvenience to passengers. This, together with better acceleration, would give an improved return to the undertakings, better service to the public, and lower working costs on account of a higher average speed. Average speed has never had the attention it well deserves. An average speed of from 7 to 7½ miles per hour is quite common, but it is in reality a poor performance for a vehicle with an almost unlimited amount of power at its disposal. The Metropolitan Electric Tramways have an average speed, including all lay-over time, of 9.19 miles per hour, but even that figure could be improved with newer equipment and without increasing the maximum speed.

I am not sure that we have not over-rated the advantages of the series-parallel control, and I suggest that shunt motors with an even acceleration, capable of running at any economical speed up to the maximum, are worthy of consideration, with the possibilities of regeneration of energy. Motor design has improved, and what was impossible in, say 1908, may be quite feasible to-day with ventilated and interpole motors.

Allied to this subject of speed control I must mention a recent development of considerable value, viz., the use of contactors in place of direct control of current from the platform. The present "box of tricks" on the car platform has continued too long a feature of every tramcar, and I welcome the efforts of certain eminent manufacturers to get rid of complications and substitute simplicity. Field shunting for control again comes well into view in consequence of commutation improvement, and the combination of all these new ideas should result in greatly improved and more economical service.

The present trolley pole is about the most unmechanical and absurd piece of mechanism it is possible to imagine. Recently some slight advance has been made in the adoption of sliding heads instead of wheels, and whilst I am aware that this is a subject on which a special committee of the Association is reporting, I append a summary of reports on experiments with a sliding trolley head on the Metropolitan Electric Tramways:—

"The sliding head has certain advantages over the trolley wheel from the running point of view, as it de-wires less frequently, but in the event of de-wirement it is not so readily replaced on the wire as the wheel is.

"The skid has an advantage over the trolley wheel from the mileage point of view, as not only has the cast-iron skid a considerably longer life than the wheel, but the maintenance of its parts is much less, and therefore it does not need the same attention.

"The number of de-wirements per 10,000 miles run on cars fitted with skids is 1.49; cars fitted with wheels, 2.35. Further, the sliding head, owing to its lightness and the fact that it is not liable to foul the overhead equipment on de-wirement, does not result in the same amount of damage as the wheel.

"On the other hand, the wear and tear of the trolley wire with this type of head is about double that with the trolley wheel, but there are hopes of being able to reduce this by the adoption of more suitable material, or means of lubricating the wire."

Dealing with the carriage work of the car, much could be learned by studying the latest methods of body construction employed by motor-bus builders.

The design of a car body is largely governed by the system of fare collection adopted, and I believe that this question needs close consideration. There is undoubtedly a great leakage in revenue due either to non-payment, or insufficient payment of fare, and under present conditions where a conductor is acting not only as fare collector, but as general porter and attendant, doing his work often under very difficult circumstances, to say nothing of the want of incentive to get every fare, and the proper fare, considerable inefficiency prevails.

Can it be said that everything has been done to make "Pay as you enter" possible?

In connection with the development of the one-man car on the London United Tramways we have given attention to the possibility of the fare transactions taking place on the platform, and have called to our aid several pieces of fare-collecting and ticket-issuing machinery which it has occurred to me might be of interest to the members of this Congress. I do not suggest that the exhibits before you of the Shanklin ticket-issuing machine, or the coin-changing machine, and the fare-box represent the last word in efficiency, but I submit that the use of machinery considerably simplifies the fare-collection problem. If tramway undertakings were successful in getting the correct fare from every passenger the revenue on our undertakings would be beneficially and appreciably improved.

Tramways will only become obsolete when new designs for tramcars have become impossible. It is lamentable, but none the less true, that what we require to-day was invented many years ago, was tried and abandoned, generally because the inventors were a little ahead of their day, and the tramway manager is prone to lose heart in a new thing if immediate success is not attained. The ideals of the early inventor are generally ahead of immediate practicability, but it is often worth while to review some past failures and hopeful attempts in the light of new conditions.

Discussion.

The final discussion, on Mr. Spencer's paper, was very discursive, ranging over many details.

Mr. A. Norton pleaded for more standardisation, especially in the matter of tires and gears.

On the other hand, Mr. W. V. Edwards was against the existing tires, believing that the decision to make the diameter of the wheels 27 in. was absolutely wrong; while, as for standardisation of gears, he though that the most effective way of arriving at that point, although not a very rapid one, would be to get several big manufacturers in the country to come together and agree to make their designs similar, for it was obviously very difficult for the tramway company with plant on its hands to alter its design, while if all new cars bought had gears of a certain design and a motor to fit those gears, proper standardisation would eventually be arrived at.

Mr. Richard Humphries pointed out how in rolling stock old ideas persisted. Not many years ago it was possible to trace on the railway carriage the lines of the old stage coach, and he had felt that the open-fronted tram-car was a relic of the old horse-car days, when the car had to have an open front for the driver to get the reins over. He showed his design of a car with a front-end exit on the near side, a completely vestibuled front, and with no bulkheads. The single-end operated cars in America undoubtedly lent themselves to passenger comfort and public service better than the double-ended car. To have the rear-end of the car cumbered with controllers and apparatus for the driver was very crude, and it was a distinct improvement to have the whole of that end given up to passenger service. It only necessitated a triangle at the terminus, which could be laid generally without any additional Parliamentary authority.

Mr. W. Thom said that in the Potteries he had a coupled-car unit for dealing with peak-loads; it was equipped with motor-driven air compressors, and ran very satisfactorily.

Mr. E. H. Edwards said that it appeared to him that Mr. Spencer's view was that because a thing was designed many years ago it was necessarily bad. But he recollected examining a pair of scissors at Pompeii which were practically identical with the instruments in use to-day. Was one, therefore, to abandon scissors because they were of extremely ancient design? Nearly all tramways were using motors that had been in operation constantly for twenty years or more; and this, so far from being an argument for scrapping them, was a wonderful tribute to the genius of those who devised tramcar equipment, now almost a generation ago. At the same time, with all his solicitude for the ancient, he believed that the gear box was an absolute abomination on any tram-car. An extraordinary amount of trouble had been taken over the designing of gear boxes on motor cars, while the old gear box on tramway cars remained almost exactly the same as it was years ago.

Colonel S. E. Smith said that with regard to brakes there were few systems in this country whereon the rheostatic brake was used in service, but on his system they had always used it, and with quite satisfactory results. Its use in this way, however, was not possible with the original installation of brakes, and some subsequent [illegible] necessary to get the correct relation between power and braking. Colonel Smith thought also that among the improvements which might be carried out the introduction of ball-bearings for the armature shafts was one of the most important.

Mr. H. W. Laing and Mr. A. W. A. Chivers both spoke of the advantage of ball or roller bearings, the latter stating that nearly twenty years ago at Southport the whole of the cars of the undertaking were fitted with roller bearings, and they continued to run up to the day when the undertaking was handed over to the Corporation. At first they were not altogether satisfactory, but ultimately the troubles were got over fairly well, and the general result fully justified the introduction. The resistance was so extremely small that one man could push the car along, and the current consumption on that system was amongst the lowest in the country—under 0.6 per car mile.

Mr. R. G. Cunliffe spoke of the advantage of roller bearings, and mentioned that one direction in which a great amount of money was being spent at the present time was that of the heat treatment of steels. More work was going forward in relation to this matter in the laboratories of the steel manufacturers than was generally known, and the possibilities of heat-treated steels, chiefly for gears, but also for axles, wheels, and various parts of car bodies, were being explored.

Mr. A. G. Conway suggested certain means for obviating noise which, in addition to its objectionableness, especially in residential districts, was an audible expression of wear and tear. He believed that the lighter the car the greater the prevalence of corrugation, and consequently of noise, and suggested that heavier cars be used. This view was contested by other speakers, who gave some instances in which both corrugation and noise attended heavy cars, and it seemed there was no relation between the weight of the car and the noise.

Mr. R. Ainsworth thought aluminium would be more used in the future in the construction of cars; as a means of reducing weight the metal had even been used in the construction of the motors by winding the coils with aluminium instead of copper.

Mr. R. J. Howley said that if tramcars were as carefully designed and maintained as the ordinary omnibus chassis, noise would be reduced very considerably. Again, tramway tracks were maintained very often in a manner which grated on the ordinary engineer, and if they could be rebuilt in an engineering manner that objection would disappear. Moreover, a more efficient braking system was required in order to maintain high average speeds. As to the proposal to use ball bearings on the armature shafts, and the various other suggestions for more efficient working, he pointed out that most tramway undertakings were now working beyond the purchase period, and were subject to seven-year purchase, and it was not likely that companies in this position would embark upon capital expenditure for the purposes mentioned.

Mr. Spencer, in reply to the discussion, said he had spoken frankly, and with what might be considered almost impertinence, but it was really a friendly talk on the part of a colleague. He mentioned that experiments [illegible] near London with the one-man car, to some extent on American lines; the preliminary troubles had been overcome one by one, and now it was a very workmanlike proposition. The real difficulty yet to be got over was that of handling the passengers quickly enough. The one-man car had a lot in its favour where the traffic was thin. As to corrugation, he did not think there was any relation between the weight of the car and corrugation, and as to standardisation, the trouble to-day was that when a design was settled there were so many formalities to be gone through that before the specification was published and actually in being the thing was out of date.

Electricity Supply Rifle League.—The following are the results of the remainder of the matches for the first half of the season: Central, 581; Fulham, 539; Central, 581; Metropolitan, 581; Central, 579; St. James', 550; City Co., 585; St. James', 566; City Co., 584; Fulham, 508; Shoreditch, 501; City Co., 577; Shoreditch, 588; Fulham, 506; County Co., 560; Fulham, 518; Shoreditch, 586; Central, 583; St. James', 566; Hackney, 443; Fulham, 542; Hackney, 563; St. James', 566; Hackney, 569; Metropolitan, 571; Fulham, 545; St. James', 546; Fulham, 528; City Co., 585; Hackney, 526; County Co., 576; Hackney, 524; Metropolitan, 575; County Co., 571; Shoreditch, 590; County Co., 569; Shoreditch [illegible] with 14 points.

THE EUSTON AND WATFORD RAILWAY.

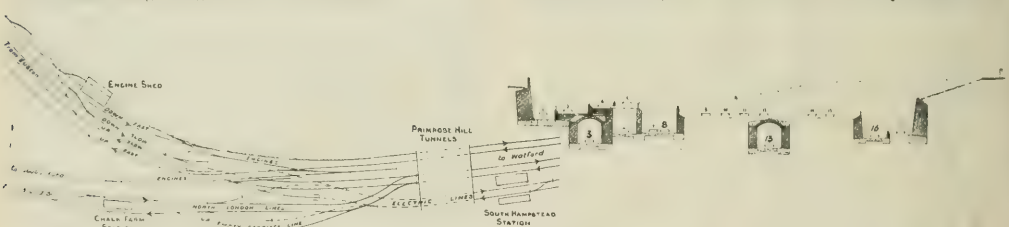
New L. & N. W. Electric Service.

The familiar assertion that facilities beget traffic has never been more strikingly proved than by the success that has attended the development of suburban electric railway services, not only in the metropolis, but in other parts of the country. The attraction of a fast and frequent service is all powerful, and this phase of railway enterprise was not overlooked by the London & North-Western Railway Co., as it obtained Parliamentary powers as far back as 1907 to electrify portions of its London suburban lines; and the opening of the last section to be electrified (*i.e.*, that from Euston and Chalk Farm to Queen's Park) on July 10th marked the completion—for the greater part—of the original scheme for developing that open stretch of country between Willesden, Watford and Croxley Green. The electrification of the outstanding portion, namely, the Croxley Green branch line, is to be put in hand forthwith.

An important feature of the work involved in electrifying the new section is that is has allowed scope for improving the steam services in and out of Euston.

The engineering work on the Willesden and Watford portion was commenced in 1909, but the war considerably delayed operations (they were for a time wholly suspended), and the various sections were opened for traffic in the following sequence:

The Willesden and Harrow section was opened for steam-driven trains in June, 1912, on which date the Watford to Croxley Green branch was also opened for steam traffic. The extension from Harrow to Watford was opened in February, 1913, steam still being the motive power. During the intervening years to 1915 the Bakerloo tube was extended from Paddington to Queen's Park, and opened early in that year, the electric trains from the Elephant and Castle running through to Willesden in May, 1915, and onward to Watford in April, 1917, the electric service between Watford and Broad Street being inaugurated at the same time.



Figs. 1 & 2.—Arrangement of Track at Chalk Farm.

The engineering task of providing a new line from Queen's Park to Watford for the electric service—formidable as it was—did not present such complex problems as that for extending the line from Queen's Park to Euston, and providing at the same time a more expeditious route from Watford to Broad Street (City), and the solution of this problem was a complicated undertaking, both from a constructional point of view and from a traffic working aspect. It will perhaps suffice to say that 20 sets of plans were necessary, and these were in many cases subdivided several times. When it is borne in mind that every running line, loop, or siding at Chalk Farm has been moved from its previous position (except the down main line, and that has been raised) the magnitude of the work involved is apparent. Owing to the lay-out of the main lines before the alterations were taken in hand, it was necessary, in order to berth the incoming main line trains at their proper side at Euston, for the up main line to cross, at the same level near Chalk Farm station, both the up and down slow lines to and from Euston; but this has now been entirely obviated. The slow lines from and to Euston descend between retaining walls and pass underneath the track of the incoming trains travelling on the up fast line.

The following brief details may be of interest as indicative of the work just completed:

The arrangement of the lines at Chalk Farm is made clear by the first diagram, while the second sketch illustrates the different levels of the 17 tracks, Nos. 3, 8, 13, and 16 being the electric ones. The whole of the work was carried out with scarcely any interruption to the normal operation of the system—an eloquent testimonial to the thoroughness of the organisation.

The up and down slow steam lines will, for a short distance between Euston and Chalk Farm, be used for both steam and electric trains, and have been altered so that, instead of running on the level, they pass through a cutting near Chalk Farm station, where the down slow line forks, the steam line portion continuing on its way to Primrose Hill tunnel, whilst the electric line deviates to the left and burrows underground, crossing at a lower level all up and down lines, and after passing through a new tube tunnel under Primrose Hill, emerges into the open at South Hampstead station. It then continues on the surface to a point north of Queen's Park station, where it joins the present electric line from the Elephant and Castle to Watford.

The up electric line to Euston is a continuation of the present electric line from Watford to Queen's Park station; it enters a new tube south of South Hampstead station, emerges into the open on the Euston side of Primrose Hill, joining the up slow steam line in the above-mentioned cutting near Chalk Farm, *i.e.*, almost immediately under the spot where the up fast trains cross by means of an overhead bridge.

An electric train service between Watford and Broad Street, via the Willesden high-level and the Hampstead junction lines, has been in operation for some time, but it was decided, when the Euston and Watford scheme was considered, to improve this by providing from the Queen's Park to Euston portion of the electric line a connection to Chalk Farm station, where it would, by a much shorter route, rejoin the electric line from Willesden to Broad Street. This has been effected by the provision of a stretch of up and down electrified lines which branch off at the south end of Primrose Hill tunnel and join, via Chalk Farm station, the present electric line to Broad Street. This has enabled a considerably augmented and accelerated service of trains to be run. It should be emphasised that every effort has been made to ensure punctual working by rendering each incoming and outgoing road independent of other lines, *i.e.*, all crossing at the same level is avoided; but similar facilities are necessary for engines and empty coaches to have a clear road into and out of the station, and considerable alterations to this end have been made between Euston and the Chalk Farm locomotive depôt, whilst for empty carriages a new tube steam railway has been tunnelled from a point north of Chalf Farm station. It passes under the Regent Canal, and all up and down lines, and emerges on the down side of the line some little distance outside Euston station. Thus, empty trains can be run from the Willesden sheds into Euston without crossing on the same level any of the passenger, &c., lines.

It is not intended to discontinue any of the existing fast steam services—they will be supplemented by the electric trains. The latter will maintain a three-coach, 30-minute service during the slack hours, whilst a six-coach 15-minute service will deal with the extra traffic during the peak hours.

The opening of these electric line extensions will render the North-Western suburban districts round London exceedingly easy of access, and taken in conjunction with the previous existing electric lines, it will place under the management of the L. & N.W. Railway a total route mileage of 78 miles of electrically equipped lines, the complete electric train services being as under:—

London (Broad Street) to Kew Bridge and Richmond, L. & S.W.; Willesden Junction to Earl's Court (Metropolitan District Railway); Broad Street to Watford; Euston to Watford; Elephant and Castle (Bakerloo Railway) to Watford; Liverpool (Exchange) and Southport (Chapel Street) and Crossens; Liverpool and Ormskirk; Manchester, Victoria and Bury; Bury and Holcombe Brook.

It will be remembered that by the amalgamation of the two railways the electrified portions of the L. & Y. Co. recently came under the control of the L. & N.W. Co. and on June 30th it was announced that the London & North-Western Railway Co. is to acquire the North London Railway, and the two undertakings will be amalgamated at the end of the year. It is proposed that the ordinary £100 shares in the North London Railway shall be exchanged for £80 ordinary of the London & North-Western Co. The North London Railway, which has its terminus at Broad Street, has a capital of £3,971,866, and last year paid a dividend of 6 per cent. on the consolidated stock.

The trains intended for the Euston and Watford service are similar to those used on the North London line, and

provide seating accommodation for 33 first-class and 130 third class passengers, carried in three vehicles—a motor car, a trailer, and a driving trailer car. The motor cars were built at the Birmingham works of the Metropolitan Carriage, Wagon and Finance Co., Ltd., and the trailer cars at the Wolverton works of the L. & N.W.R. Co., the electrical equipment being supplied by the Maschinenfabrik Oerlikon.

Each of the cars is 57 ft. long by 9 ft. wide at the waist, and is mounted on two four-wheeled bogies. The highest point of the roof is 11 ft. 11¾ in. above the rail level; the width over the stepboard is 9 ft. 6 in.

A 250-h.p. motor is fitted on each axle under the motor car, giving 1,000 h.p. for a three-coach unit.

Entrance to each car is through vestibules connected with each other by central passages and gangways. The body has been constructed in such a manner as to render it practically fireproof. All the cars are lighted with ceiling lamps enclosed in "Holophane" pineshaped globes. The lamps are fixed in rows about 2 ft. 7 in. from the centre line of the vehicles, and this allows the light to come over the passengers' shoulders to give a good light for reading. The compartments are heated with electric heaters supported on brackets under the seats. The ventilation of the cars is regulated by hemispherical ventilators controlled by "hit and miss" shades, and by small hinged windows over the large side windows arranged in such a manner as to control the ingress and egress of air.

The conduits in the interior of the coach are fixed in fireproofed wood, and in such a manner that, although hidden, they can be readily inspected. The conduits for the lighting cables of the car are fixed in a trough-shaped piece of wood fixed between the roof and the ceiling, while the conduits for the heating cables are fixed behind the skirting. At one end of the trailer and driving trailer cars and in the partitions dividing the compartments from the vestibules, casements enclosing the switchboards for the control of the heaters and lamps are fixed.

The driver's compartment of the motor car contains a master controller fitted with the usual deadman's-handle attachment, the main switchboard for the control of the supply of electricity to the power, heating, and lighting circuits, a hand brake wheel, apparatus for the control of the Westinghouse brake, gauges, and all other instruments necessary for the control of the locomotion of the train. In this compartment the whole of the contactors, circuit breakers, reversers, and other electrical equipment are fixed. Duplicates of as much as is required of this apparatus is enclosed in the driver's compartment of the driving trailer car.

The whole of the electricity needed to operate the company's electric lines in the London area is generated at the company's Stonebridge Park station (which also supplies outside consumers in bulk), and is distributed to 11 sub-stations, one of which is located in the generating station, that convert by means of rotary converters the 3-phase, 25-cycle a.c. energy from a pressure of 11,000 volts to d.c. at 630 volts, at which pressure it is supplied to the conductor rails.

All the water needed for the generating station is derived from two artesian wells, each 500 ft. deep, and approximately 24,000 gallons per hour has been extracted from each well on test. Cooling towers deal with the water after use and exhaust steam and flue gases are employed to heat the water to a temperature of 260 deg. F. before it enters the B. & W. land-type boilers, the normal rate of evaporation of each of which is 25,000 lb. per hour. The working steam pressure is 205 lb. per sq. in., and the steam is superheated 200 deg. F., its total temperature being 592 deg. F.

The coal-handling plant is of the B. & W. type. The coal is delivered into the coal store in hopper bottom wagons, and falls through valves on to tipping tray conveyors; gravity bucket conveyors being used to elevate and distribute the coal where required in the boiler house bunkers. The coal is then passed through measuring apparatus and down to the mechanically operated grates of the boilers.

The four Westinghouse-Siemens turbo-generator sets generate at 11,000 volts, 3-phase, 25 cycles. Separate excitation is used and also stand-by excitation is provided for use in emergency. The alternators are air cooled, and the air is filtered before passing into the alternator windings.

The main alternators are controlled by remote operated oil switches, the main switches being enclosed in stone cellwork. The system is divided into sections, feeders from the section bus bars being run to the various sub-stations through remote operated oil switches.

Transformers are provided for supplying the station auxiliaries. A 620-kW turbo-alternator is also provided for this purpose as a standby. The electrical system is protected by Mosicki condensers and Giles valves.

The main control switchboard is situated on a gallery from which a clear view of the main units can be obtained. Low-voltage direct current is used for operating the main extra-high-pressure switches.

A New Swiss Holding Company.—The Electrical Securities Co. has been formed at Glarus for the purpose of participating in industrial undertakings, particularly electrical, of all kinds.

LATIN AMERICAN ELECTRICAL NOTES.

Our special correspondent reports on recent developments as follows:—

"Permission has been granted to the Valparaiso Electric Tramways Co., Ltd., to construct a double-track electric line from the port of Valparaiso to the marine resort of Viña-del-Mar. While preliminary work has commenced, the necessary equipment has not yet been secured. British manufacturers of electric tramway equipment might, therefore, find it advantageous to communicate with the Secretary of the Valparaiso Electric Tramways Co., at Valparaiso, Chile.

It has been decided by the Barranquilla Railway and Pier Co., Ltd., of Barranquilla, Republic of Colombia, to introduce new lathes, with electric motors, for the railway shops, which are now being re-equipped.

Notwithstanding the shortage of funds, owing to the sugar crisis, the Cuban Government has been enabled to considerably develop its telephone services by the construction of additional lines. Encouragement has also been extended to private enterprise of a similar nature, the Cuban Telephone Co. having carried out a number of extensions under official supervision. Whereas in 1919 this company had 29,741 telephones in the whole of the Republic of Cuba, for which there were 59,290 miles of line laid, either above or below ground, the equipment has now been increased to 35,918 telephones, with over 84,000 miles of line. More than 90 per cent. of the instruments in use are automatically operated, and the service is considered an exceptionally good one. Complete telephone equipments are to be found in the larger cities, such as Habaña, Matanzas, Cienfuégos, Cardenas, Sagua, and Santiago-de-Cuba. The plant in the capital (Habaña) is described as the "largest automatic installation in the world under a single roof." Among other extensions carried out have been installations at Remédios, the industrial centre of one of the best sugar, tobacco and agricultural districts of the island; other installations of a similar character are about to be introduced, bringing the Republic into direct telephonic communication with the United States and the Dominion of Canada.

The new electric railway line between the towns of Matanzas and Hershey, Republic of Cuba, has been completed and opened to traffic. Within the course of a few weeks the line will have been extended so as to form direct connection with the electric tramway systems operating in Habaña.

The Government of the Dominican Republic, in conjunction with the Municipalities of three towns (San Pédro de Macorís, El Seibo, and Hato Mayor), will shortly be in telephonic communication, a plant having been practically completed between these centres.

In the Republic of Nicaragua progress is being made with the installation in various towns of electric installations, both for lighting and power purposes. A complete plant has recently been put into service in the town of Juigalpa, while others are approaching completion.

The Government has authorised the Tropical Radio Telegraph Co. to erect and operate wireless stations in or near the capital, Managua, as well as at the towns of Blue fields, Cape Gracias à Dios, and other places in the Republic. The Managua station will not be of less than 25 kW.

In the Republic of Uruguay a school has been established for instruction in mechanical-electric and electro-mechanical trades. The institution owes its creation to the enterprise of the Upper Council of Industrial Instruction, who have combined with a number of capitalists interested in electrical industries of the Republic. Elaborately-fitted machine-shops will be erected under the superintendence of the School for Apprentices in Electrical Work, which will be in addition to the State electrical shops already in operation, and which comprise some of the most modern electrical apparatus to be found in South America.

It is expected that immediately the new president of Venezuela (Señor Don Juan Vicente Gomez) has been officially installed, he will carry out his expressed intention of devoting such resources as the State can provide to the promotion of new hydroelectrical enterprises. It is not known whether these will be undertaken entirely by the State or partly by private individuals; but, in any case, the construction contracts will go to foreign electrical engineers. The existing electrical plants in Venezuela, of which three are run by water, have proved eminently successful. At the principal plant (situated at El Encantado, 16 kms. from Caracas) 400 h.p. is developed during the rainy season, but from December to April this is reduced to 100 h.p. or less, as in the dry months the water is used for irrigating adjoining lands. Additional electrical power, offering a continuous service, is sought for corn-mills, printing offices, coffee mills, &c., while it is also intended to considerably extend the lighting of the capital, Caracas. Additional electric plant will be required at an early date for Mérida and San Cristóbal, the former in the State of Mérida, and the latter in the State of Tachira. Other cities where electrical plant has already been introduced and extensions are contemplated are Maracaibo, Valencia, and Puerto Cabello. The Caracas Electric Tramways Co., a British concern, which has been established for some years, is a profitable undertaking, distributing dividends averaging 8 per cent.

The following information is contained in dispatches lately to hand from Reuter's Trade Service:—

A contract has been entered into between Señor Victor Manual Gallardo and the Municipality of San Pedro Nonualco, in the Department of Le Paz, El Salvador, for the establishment of an electric light installation in that town, which has approximately 7,000 inhabitants.

Electric freight-handling apparatus of the latest type will be required in connection with the important port prolongation works being undertaken at Rio de Janeiro, entrusted to a French company (La Société de Construction du port de Bahia). A similar installation has been decided upon for the free port now being constructed on Governor's Island. Other ports in the Republic which will require electrical installations in connection with improvements now being effected are Sao Luiz do Maranhao, Recifé (Pernambuco), and Fortaleza, in the State of Ceará, the contract for which is in the hands of a British company.

Active progress is being made with the work of electrifying the Central of Brazil Railway, upon which an expenditure of 60,000 contos of reis (approximately £2,900,000) has been authorised. Work has been commenced upon the first of the 53 miles of the section of the railway carrying the most traffic, and upon the construction and distribution of the signal systems for four sub-stations. Orders have been placed for 22 electrical locomotives and 150 motor carriages.

In connection with the Centennial Exposition, a hydro-electrical congress will be held at Rio de Janeiro under the presidency of Dr. Simoes Lopes, Minister of Agriculture of the Brazilian Government. The congress will discuss all questions pertaining to water-power developments which are about to engage the attention of the Federal Government, and also of several of the Provincial Governments, notably Minas Geraes and Sao Paulo. As a result of the congress and the known desire of the Federal Government to encourage the hydro-electrical industry in Brazil, it is expected that a large number of contracts for the utilisation of water-power will result. The potential power attributed to some of the Brazilian water-falls varies between 3,000,000 h.p. (Iguassú) and 50,000 h.p. (Itapura), and includes 1,000,000 h.p. (Paulo Affonso), 800,000 h.p. (Patos and Marimbondo), 400,000 h.p. (Dourado), 300,000 (Agua Vermelha), 220,000 h.p. (Onça), and 60,000 h.p. (Avanhandava).

Arrangements have been completed for the amalgamation of influential interests connected with the electrical industry of Argentina, with special reference to the provision of electrical plants and raw materials, including the production of power and light generating plants. A powerful company is being formed for the undertaking of operations throughout South America, by reason of which it is hoped that British materials and electrical plants will be considerably popularised. Special attention will be given to the supply of electric light and power in the form of small installations suitable for villages and private dwellings. Arrangements will be made with municipal councils to instal generating stations and to co-operate in financing the schemes.

A group of hydro-electrical engineers forming a British-American-Chilean combination have decided to take up the development of hydro-electric power in Chile on a wide commercial scale. They have chosen as a preliminary field for their operation the central region of Chile, and propose to utilise the waters of the rivers Maipo and Colorado, in the Province of Santiago. These are considered to afford the best possibilities for good commercial development. In connection with this enterprise a concession has been granted covering operations at Maitenes, where a plant will be erected consisting of, at first, three, and afterwards possibly four, similar generating units of about 10,000 h.p. each, each unit taking at full load 5,500 litres of water per second, the available head being 180 metres. In addition to the main plant, an auxiliary plant will be installed, containing pumps and water turbine-generators. Some 13,000 h.p. will be generated, making the Maitenes plant, together with its auxiliary, productive of 20,000 h.p. for base loads and 33,000 h.p. for peak loads.

The offer made some time ago by a well-known London firm of electrical engineers to invest the sum of £850,000 towards the development of electric power in Chile has been accepted by the Compañia Nacional Fuerza Eléctrica. With ample capital at its disposal, this enterprise will now proceed to carry out an ambitious programme. The plant to be erected will constitute one of the most modern systems in South America, destined to fill a much-felt want in supplying power at moderate rates to the industries of the Central Zone of Chile, and forming a nucleus for the development of many new industries in this part of the Republic.

In connection with the electrification of the Chilean State railways between Santiago and Valparaiso (116 miles), and the branch from Llai-Llai to Los Andes (28 miles), considerable progress upon construction is reported. By the terms of the contract, the work has to be completed by September 27th, 1923, but progress has been so satisfactory that it is expected that electric trains will be running over part of the line by the end of the current year.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Daysohms Safety Welding Device.

Although the voltage used in a.c. arc welding is comparatively low, the operator, who necessarily works with exposed live metal parts, is constantly liable to make contact with both poles and to receive a shock, and when he is working

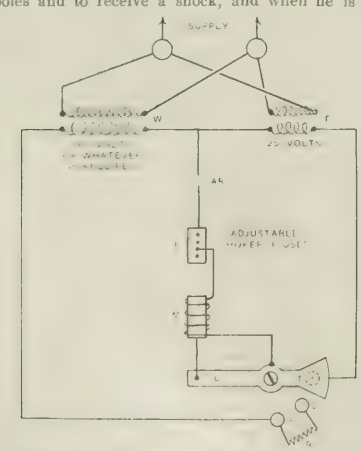


Fig. 1.—Diagram of Connections of the Daysohms Safety Welding Device.

on a scaffold, for instance, he may be startled into falling off it. More serious is the actual danger to life incurred when the welder is working on ships or in boilers, or in other places where the presence of metallic and large metal surfaces ensures his being in intimate contact with earth; under such conditions a pressure of 100 volts alternating would be likely to give a fatal shock. Hence, in a memorandum on electric arc welding by the Factory Department of the Home Office last year (Form 329, price 3d. net), it was recommended that all such work should be carried out with direct current only, and that if alternating current were used, the responsible persons should take special precautions. A footnote referred to the possibility of reducing the open-circuit pressure to a maximum of 25 volts, which would, of course, be harmless.

Obviously, a device effecting this object would remove the objection to a.c. welding; Messrs. Daysohms, Ltd., of 66, Southampton Row, W.C.1, applied themselves to the problem, and have produced a very simple and ingenious apparatus which is applicable to all systems of a.c. arc welding. Moreover, it is easily portable, and can be coupled up to the ordinary welding plant whenever work has to be undertaken under the "special risks" referred to in the memorandum.

The connections of the device are shown in fig. 1. It consists of a small transformer T, with a secondary pressure of 25 volts, an automatic switch S and a resistance coil R, all enclosed in a case fitted with a handle (fig. 2). The switch lever L is shown in the open-circuit position, in which it connects the terminal 1 of the transformer T to the welding electrode; if an adjustable choker is in use it is in circuit as shown at C, but it forms no part of the safety device. When the operator strikes the arc with the 25-volt current, the core of the electro-magnet M is pulled up, moving the switch arm into contact with the terminal 2 of the resistance R. For a moment the welding transformer W is in parallel with the auxiliary transformer T through the resistance, but the continued movement of the switch arm breaks contact with terminal 1 and makes contact with terminal 3, short-circuiting the resistance and connecting the main transformer W directly to the arc. Welding then proceeds normally, but should the arc be broken the switch S instantly returns under the action of a spring to its open-circuit position, reducing the difference of potential between the electrodes to 25 volts. The operation of the switch in either sense is practically instantaneous, and the arc circuit is never broken on the switch, so that injurious sparking is eliminated. We have

seen the device in operation, and its action appeared to be quite satisfactory; the parts are of substantial construction, and are designed with renewable butt contacts, fig. 1 being

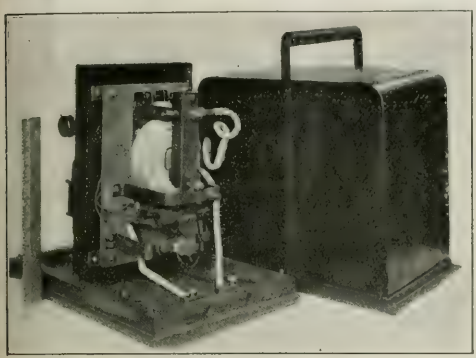


Fig. 2.—The Daysohms Safety Welding Device.

merely diagrammatic. By the adoption of this device the risk to life indicated by the Home Office, and the consequent liability of the employer, are obviated.

The " E. & D " Plug Adaptor.

The Davis Electrical Co., Ltd., 6, Warwick Court, High Holborn, W.C.1, has designed a novel and convenient form of plug adaptor by means of which the supply to an electrical appliance may be taken either from a wall " outlet " or from a lampholder. It is made in three parts. The top or plug portion consists of a disk provided with a stem. In this disk are two diametrically opposite holes into which the pins are fitted. The holes are elliptical in shape to allow the pins to be adjusted to non-standard sockets, and the pins are secured

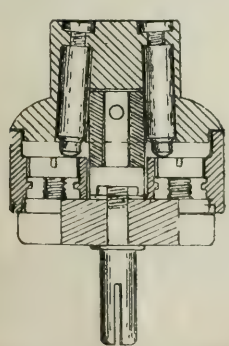


Fig. 3.—The " E. & D." Plug Adaptor.

on the bottom side of the disk by cheese-headed screws and washers. The stem has a locking pin through its base, and the disk is provided with a stop which limits the distance through which the central portion may travel. This central portion is a flat cylinder of insulating material closed at one end and having a hollow central portion. In the closed end are fitted two large-headed screws with washers, and the wires of the flex, connected to an electrical appliance are brought through two holes in the collar and clamped under the heads of the screws. The bottom portion is similar to the top of an electric lamp, but it also has two plungers projecting into the interior of the fitting. The contact terminals are formed by two large-headed screws. The assembly of the three portions is illustrated in fig. 3. When in use in conjunction with a wall outlet the pins are inserted, and the central portion is turned, so that the clamping screws are in contact with the bases of the pins. The plungers are then in contact with insulating material, and therefore out of action. To adapt the socket for a supply from a lampholder the central portion is pressed down and turned until the clamping screws make contact with the plungers; in this case the two pins are rendered ineffective, so that there is no danger of shock.

An Electrical Gas Lighter.

A simple form of gas-lighter has been put on the market by Mr. C. Mayfield, of 3, Duchess Road, Clifton, Bristol. It consists of an attachment to an ordinary pocket-lamp battery, the spring terminal of the latter being used as a switch; when the circuit is closed, a small spiral of wire is raised to a red heat, capable of igniting a gas flame. The device appears to be of German origin.

New Electric Cookers.

We have received particulars of two new designs of electric cookers. The first (fig. 4) shows one of the latest designs put on the market by Carron Company, Falkirk, N.B. This is constructed of cast iron and mild steel, double-cased and lagged. The oven is 16 in. wide, 16 in. deep, and 14 in. high, clear cooking space, with plain and grid shelves. The two elements are fitted at the sides of the oven; these are well protected and easily removable, they are of 1.5 kW each.



Fig. 4.—A New " Carron " Cooker.

The oven is surmounted by a boiling hob, which contains two 8-in. diameter, 1-kW hot plates controlled by three-heat switches. Between the oven and the boiling plates is a 8½ in. by 9 in. grilling chamber. The grill element is of 1.25 kW, and has one heat only controlled by a single pole rotary switch. Behind the grill is the wiring chamber, in which all the connections are made; it also contains fuses for the various cir-



Fig. 5.—The " Falco " No. 5280 Cooker.

cuits. Access is gained to the connections by lifting the hob which is hinged. The whole is mounted on four cast-iron legs.

The second design is that of the Falkirk Iron Co., Ltd., Craven House, Kingsway, W.C.2. The illustration (fig. 5) shows the completely-fitted cooker. It is provided with white enamelled skirting and plate rack, a large glass door to the oven, nickel-plated top, side fuses, and white enamelled feet. Every switch is plainly marked to indicate its function.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,135. [illegible] June 21st.

17,149. [illegible] pump." J. W. Flower. June 21st.

17,150. "Galvanic batteries." L. Fuller and Fuller's United Electric Works, Ltd. June 21st.

17,151. "Starting switches for motor-cars, &c." C. A. Vandervell and A. Vandervell & Co., Ltd. June 21st.

17,161. "Manufacture of metal filaments for electric incandescent lamps." General Electric Co., Ltd. June 21st. (Germany, July 13th, 1921.)

17,162. "Transformation of crystal structure of drawn wires of tungsten, &c." General Electric Co., Ltd. June 21st. (Germany, July 13th, 1921.)

17,163. "Manufacture of tungsten, &c." General Electric Co., Ltd. June 21st. (Germany, July 13th, 1921.)

17,164. "Wireless receiver." British Thomson-Houston Co., Ltd., and R. C. Clinker. June 21st.

17,165. "Methods of coating glass surfaces." British Thomson-Houston Co., Ltd. (General Electric Co.). June 21st.

17,166. "Electric ship propulsion systems." British Thomson-Houston Co., Ltd., and D. E. Jewitt. June 21st.

17,171. "Tables, &c., for supporting wireless telegraph, &c., installations." P. Hamardinquer. June 21st. (France, March 21st.)

17,181. "Electric switch." G. E. Morley. June 22nd.

17,189. "Commutators, &c., for motor vehicles, &c." F. S. Lomax, T. Moorcroft and G. H. Whitehead. June 22nd.

17,195. "Holding coils of wire for wireless telegraphy, &c." J. H. L. Bridge. June 22nd.

17,214. "Electric clocks." F. T. Reid. June 22nd.

17,224. "Advertising devices." Indicators, Ltd., and E. F. Perrin. June 22nd.

17,227. "Electrical photography." D. Charles. June 22nd.

17,232. "Thermionic valves." W. R. Bullimore. June 22nd.

17,233. "Thermionic valves." W. R. Bullimore. June 22nd.

17,236. "Switching apparatus for telephone exchange systems." Coventry Automatic Telephones, Ltd., and F. R. McBerty. June 22nd.

17,241. "Variable inductances." E. Mallett and R. Marx. June 22nd.

17,248. "Telephonic receivers for wireless telegraphy." K. Papoutchian and L. J. B. Verdier. June 22nd. (France, September 9th, 1921.)

17,252. "Advertising signs, &c." J. C. Round. June 22nd.

17,253. "Electric water heaters." A. H. Pullan. June 22nd.

17,265. "Thermionic valves, &c." S. G. Frost. June 22nd.

17,308. "System of winding inductance coils for wireless telegraphy, &c." A. Rothchild. June 23rd.

17,335. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). June 23rd.

17,337. "Oil-immersed electric switches, circuit breakers, &c." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. June 23rd.

17,352. "Couplings for electric ceiling fans." H. O. Burge and Crompton and Co., Ltd. June 23rd.

17,353. "Grip socket for electric conduits." F. Rawlings. June 23rd.

17,358. "Filaments for electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). June 23rd.

17,359. "Sealing in wires." British Thomson-Houston Co., Ltd. (General Electric Co.). June 23rd.

17,375. "Electric switches, circuit breakers, &c." Ferguson, Pailin, Ltd., and G. Pailin. June 23rd.

17,384. "Devices for protecting conductors of electric machines against losses due to eddy currents." T. Lehmann. June 23rd. (France, June 23rd, 1921.)

17,386. "Surface wiring systems." T. H. Martin-Harvey. June 23rd.

17,393. "Electrical apparatus." Radio Communication Co., Ltd., and J. Scott Taggart. June 23rd.

17,397. "Burglar alarm systems." H. E. Reynolds. June 23rd.

17,410. "Telephonic and telegraphic devices." A. R. Angus. June 24th.

17,414. "Sparking plugs." J. Grainger. June 24th.

17,418. "Containers for dry batteries." G. T. Challenor and Efandem Co., Ltd. June 24th.

17,427. "Induction systems of internal-combustion engines." S. L. Bailey. June 24th.

17,428. "Process for manufacture of coating of the dielectric of condensers." E. Pfiffner. June 24th. (Germany, July 5th, 1921.)

17,436. "Electrically-operated apparatus and advertising or display devices." C. M. Brown and H. G. Cocks. June 24th.

17,438. "Inductance coils." Igranic Electric Co., Ltd., and A. H. Mackley and W. S. Pyrah. June 24th.

17,452. "Lamps for motor-cars, &c." T. B. Jones. June 24th.

17,460. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 24th.

17,476. "Crystal detectors, &c., for wireless telegraphy and telephony." S. L. Forbes. June 24th.

17,491. "Intervalve and telephone transformers for wireless receiving apparatus." C. F. Elwell, Ltd., and B. E. G. Mittell. June 24th.

17,487. "Electric lampholders." W. A. Clark, A. A. Lines, and H. G. Longford. June 26th.

17,511. "Electric condensers." W. A. Brooke and W. A. McKillop. June 26th.

17,512. "Adjustable electric condensers." W. A. Brooke and W. A. McKillop. June 26th.

17,513. "Electric reactances." W. A. Brooke and W. A. McKillop. June 26th.

17,514. "Electric rheostats." W. A. Brooke and W. A. McKillop. June 26th.

17,526. "Controllers for wireless telegraphy, &c." H. Maynard and D. G. Morris. June 26th.

17,527. "Method of generating electricity." W. H. Cowley. June 26th.

17,534. "Wireless receivers, &c." E. Kerwin. June 26th.

17,562. "Radiometers." L. H. S. Clarke and S. Russ. June 26th.

17,565. "Wireless signalling systems." E. H. Armstrong. June 26th. (United States, June 27th, 1921.)

17,577. "Method of diminishing risk of back ignition in series-connected rectifiers." Akt. Ges. Brown, Boveri et Cie. June 26th. (Switzerland, July 2nd, 1921.)

17,588. "Resistance devices and welding wires." A. E. Waller. June 26th. (United States, July 6th, 1921.)

17,592. "Recording apparatus for radio-communication." A. Colleye. June 26th. (Belgium, August 30th, 1921.)

17,596. "Electro-mechanical controlling systems." Soc. des Etablissements Gaumont. June 26th. (France, July 22nd, 1921.)

17,647. "Trolleys for electric tramways." W. Lawrence. June 27th.

17,651. "Electric motors." M. Kawarada and T. Yamamoto. June 27th. (Japan, July 4th, 1921.)

17,661. "Electric apparatus for recording sound." A. F. Sykes. June 27th.

17,667. "Apparatus for converting a uniform energy flux into a wave-form energy flux." H. Baron (Signal Ges.). June 27th.

17,668. "Electro-magnetic vibrators, telephones, &c." Signal Ges. June 27th. (Germany, August 1st, 1921.)

17,677. "Control of electric motors for traction." T. Ferguson and Metropolitan-Vickers Electrical Co., Ltd. June 27th.

17,678. "Alternating-current motor." E. Weissberg. June 27th. (Germany, July 1st, 1921.)

17,683. "[illegible] for connecting electric [illegible] A. [illegible] June 27th.

17,684. "[illegible] A. S. [illegible] June 27th.

17,695. "Apparatus for applying curative treatment with a radio-active substance." A. Muguet. June 27th. (France, June 29th, 1921.)

17,698. "Telephone systems and apparatus." Western Electric Co., Ltd. June 27th. (United States, July 21st, 1921.)

17,703. "Electric variable condensers." A. E. Chapman. June 27th.

17,724. "Vacuum tubes or valves of the Audion type." J. P. Prangnell. June 27th.

17,734. "Galvanic batteries." G. Oldham and J. Oldham. June 27th.

17,736. "Automatic spring switch for electric circuits." F. Burr. June 28th.

17,758. "Contact breakers." R. Bosch Akt. Ges. June 28th. (Germany, February 11th.)

17,788. "Electric arc welding." A. E. McCarthy, H. Martin, and L. J. Steele. June 28th.

17,800. "Electro-magnetic remote-control apparatus." W. B. Dale, R. A. Hopkinson, and J. Hopkinson & Co., Ltd. June 28th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

34,316. "Signalling systems, especially radio communication." J. Scott Taggart. December 4th, 1920. (181,400.)

34,918. "Electric heating apparatus." C. G. Nobbs, Junr. December 10th, 1920. (181,405.)

35,618. "Signs and advertising devices." T. Sapp. December 18th, 1920. (181,409.)

1921.

987. "Submarine cables for telegraph or telephone purposes." Siemens Schuckertwerke Ges. February 1st, 1918. (Patent of addition not granted.) (157,121.)

988. "Cables with uniform gradation of voltage drop." Siemens Schuckertwerke Ges. September 6th, 1919. (Patent of addition not granted.) (157,122.)

1,080. "Radio-dynamic receiving systems." J. H. Hammond, Junr. July 31st, 1917. (157,208.)

4,410. "Electric rotary converter, with variable tension." R. Bruynde. February 5th, 1920. (158,894.)

4,578. "Change-over or switch mechanism suitable for revolution direction indicators and like purposes." Siemens Bros. & Co., Ltd., and F. Turner. February 9th, 1921. (181,417.)

5,944. "Terminal pieces for electric conductors." H. B. Cornish. February 15th, 1921. (181,428.)

7,013. "Electrically-propelled vehicles." J. P. Kemp. March 3rd, 1921. (181,432.)

7,205. "Distributing brush-holder for magnetos." Soc. des Moteurs Salmson (Systeme Canton Unne). March 27th, 1920. (161,162.)

7,551. "Telephone exchange system." Western Electric Co., Ltd. (Western Electric Co., Inc.). March 9th, 1921. (181,454.)

7,571. "Loud-speaking telephone." Siemens and Halske Akt. Ges. March 9th, 1920. (159,897.)

7,574. "Supporting machines and other structures." W. Eccles, H. L. Guy, and Metropolitan-Vickers Electrical Co., Ltd. March 9th, 1921. (181,457.)

7,698. "Loud-speaking telephones." Siemens and Halske Akt. Ges. March 10th, 1920. (Addition to 159,897.) (159,904.)

7,778. "Electric current regulators." W. Langdon Davies and A. Soames. March 11th, 1921. (181,470.)

7,819. "Providing electric cables with distinguishable wrappings for the various leads." H. Sefton-Jones (Deutsche Kable Industrie Ges.). March 11th, 1921. (181,473.)

7,882. "Cooling arrangements for electric machines." A. Arutunoff. March 12th, 1921. (181,477.)

7,933. "Electric motors." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. March 14th, 1921. (Addition to 154,286.) (181,478.)

8,011. "Guiding means for the push buttons in telephone push-button boards." W. Stott and Telephone Manufacturing Co. (1920), Ltd. March 14th, 1921. (181,480.)

8,012. "Tires of tramway and railway wheels." Vickers, Ltd., and C. L. Sumpter. March 14th, 1921. (181,481.)

8,021. "Telephone systems with high-frequency oscillations." H. A. Gill (Deutsche Telephonwerke Ges.). March 14th, 1921. (181,483.)

8,140. "High-frequency multiplex telegraphy." H. A. Gill (Deutsche Telephonwerke Ges.). March 15th, 1921. (181,489.)

8,197. "Electrically-actuated automatic starting gear for internal-combustion engines." F. Sweeney and W. B. Bond. March 16th, 1921. (181,493.)

8,399. "Electric rheostats." British Thomson-Houston Co., Ltd. (Soc. d'Electricité et de Mécanique). March 17th, 1921. (181,504.)

9,133. "High-frequency cable telegraphy." H. A. Gill (Deutsche Telephonwerke Ges.). March 24th, 1921. (181,514.)

9,146. "Electric regulating systems." British Thomson-Houston Co., Ltd. (General Electric Co.). March 24th, 1921. (181,515.)

9,920. "High-resistance conductors for electrical machinery." British Thomson-Houston Co., Ltd., and H. W. Taylor. April 4th, 1921. (181,530.)

10,140. "Dynamo for magnetising permanent magnets and for other purposes." A. T. Scorey. April 6th, 1921. (181,534.)

10,274. "Telephones." Siemens Bros. & Co., Ltd., and E. A. Laidlaw. April 7th, 1921. (Addition to 113,565.) (181,539.)

10,341. "Holders or adaptors for electric lamps, plugs, or the like." H. J. Dean Osgood. April 8th, 1921. (181,540.)

10,365. "Electric tumbler switches." G. H. Webb and W. H. Wood. April 8th, 1921. (181,542.)

11,483. "Tramway rails having removable treads." F. Adams. April 21st, 1921. (181,554.)

12,609. "Electric lighters for cigars and the like." A. Zecchini. April 26th, 1921. (162,296.)

12,381. "Induction train control systems." J. B. Regan. April 29th, 1921. (181,566.)

12,630. "Signalling devices for use in connection with telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. June 1st, 1920. (164,313.)

16,894. "Electric radiators." J. Y. Fletcher and R. J. H. Hill. June 20th, 1921. (181,614.)

17,941. "Electric drives for paper machines and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). July 1st, 1921. (181,619.)

20,059. "Storage-battery electrolyte." F. de W. Cheney. July 26th, 1921. (181,630.)

23,317. "Electrically-controlled sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (181,639.)

25,029. "Couplings for sparking plug or like terminals." J. I. D. Stevenson and K. D. Stevenson. April 11th, 1921. (Divided application on 170,045.) (181,644.)

28,963. "Bracket arm hangers used for supporting trolley or other wires conveying electric current." S. T. Quilliam and A. T. Craston. November 1st, 1921. (181,649.)

1922.

65. "Electric motor controllers." British Thomson-Houston Co., Ltd. (General Electric Co.) January 3rd, 1922. (181,658.)

5,398. "Arrangement for the recovery of energy in electrical railway systems employing series-connected direct-current motors." E. Santuari. October 12th, 1920. (Divided application on 159,873.) (Addition to 159,873.) (175,992.)

6,756. "Regulating devices for electric installations." Etablissements de Dion Bouton Soc. Anon. April 14th, 1921. 178,415.)

THE

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ELECTRICAL REVIEW.

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COMPULSORY WIRING RULES.

A CORRESPONDENT draws attention in this issue to a question raised at the recent I.M.E.A. Convention—whether supply authorities should be given power to compel the observance of wiring rules, such as those formulated by the Institution of Electrical Engineers. This is a very important matter, on which conflicting views are held amongst the supply authorities themselves; as Mr. Purse pointed out, the power companies are rigidly opposed to compulsory rules, and many municipal authorities side with them, but the I.M.E.A. voted in favour of compulsion. At present, with certain exceptions, the supply authorities are not entitled to impose any rules at all upon contractors or consumers; if an installation complies with the simple conditions prescribed in the Electric Lighting Acts, the supplier is compelled by law to connect it to the mains. Subject to the exceptions referred to above, local rules are enforced only by bluffing on the part of the authority, and the I.E.E. rules similarly are in no sense compulsory, except when they are specified by the owner of the installation himself. These and other points were fully explained by Mr. Charles A. Baker, electrical engineer to the London County Council, in a forceful article which we published in our issues of April 18th and 25th, 1919.

We are strongly in favour of the adoption of one standard set of wiring rules; local conditions of climate, &c., are practically uniform throughout the country, so far as indoor wiring is concerned, and there is no justification for the use of differing sets of rules. There are, however, important considerations to be taken into account when the question of compulsion is raised.

In the first place, compulsion implies inspection; to set up obligatory rules without appointing inspectors to see that they are carried into effect would be futile. Are the supply authorities prepared to undertake the duties of inspection whilst work is in progress? If so, will they seek powers to charge fees for such inspection?—they possess no such powers at present. If the verdict of the inspector is adverse, presumably the installation will not be connected to the mains, and the owner will have to compel the contractor to rectify the defects. Where the supply authority has a wiring department, there will be a suspicion that the inspector treats its work more leniently than that of the rival outside contractors—complaints are already common enough that the wiring department's installations are connected without demur, whilst the scales are heavily weighted against the contractors'.

By fees, rectifications, and delays, obstacles may thus be placed in the way of the development of the domestic load, which is of the first importance to-day and goodness knows, there are quite enough obstacles to its development already. In our issue of April 25th, 1919, we emphasised the urgent necessity of facilitating connection to the mains: "A new phase in the history of electricity supply is opening before us. Let us cast away all hampering, unnecessary restrictions, and *welcome* the new consumer: make his path easy, and abandon the tradition which requires that he shall fight his way through the wire entanglements and pitfalls which have embarrassed him up to now. The supply undertakers are the servants of the public, not their masters."

Another important matter is the tenor of the wiring rules themselves. The adoption of compulsory rules at once calls for a material reduction in their rigour; optional rules may be formulated in accordance with ideals, but compulsory rules must conform with practical possibilities and be simple and elastic. Commenting on the article by Mr. C. H. Wordingham in our issue of September 17th, 1920, we expressed the view that the standard of wiring set up by the I.E.E. rules, admirable as they were, was far in excess of reasonable requirements—thousands of installations which broke the rules in all directions had given satisfaction for long periods of years, and still gave satisfaction. Mr. Wordingham held that the rules should be graded—those extant aimed at securing the very highest class of work, and were well enough for important installations, but they were far too stiff for the small house; hence he proposed that rules should be drawn up for grades "rising from that which is just safe and the plainest of the plain, to that which is the best and most elaborate that money can buy." If compulsion is adopted, the only set of rules that can be imposed upon all and sundry is necessarily that relating to the lowest grade. The wiring rules of the I.E.E. are now in course of revision, and it will be interesting to see whether the new edition complies with this condition.

Finally, we must harp again upon the familiar string—that the electricity supply industry must cater for the middle-class and industrial-class house to the utmost possible extent. Shoddy wiring is an evil which cannot be condoned; but any step which tends to impose new and unnecessary restrictions upon the development of the industry, or to place obstacles in the way of the prospective consumer, must be strenuously resisted.

Electricity in Factories.

The chief feature of the annual report of H.M. Chief Inspector of Factories and Workshops for 1921, to which further reference is made elsewhere in this issue, is its brevity; only short summaries embodying some of the more important points in the interesting and valuable reports from the inspectors throughout the country have been included in it this year, a procedure that is to be regretted.

The chapter on the generation and use of electricity occupies 4½ pages only, but it is satisfactory to note that H.M. Senior Electrical Inspector, Mr. G. Scott Ram, confirms the impression that, in general, the quality of new work on factory premises continues to improve, and that electrical manufacturers have done much to improve apparatus and accessories from the safety point of view. Attention is drawn, however, to cases where the occupier, not possessing technical knowledge, relies entirely on a contractor who secures the order on price considerations only, and sometimes being incompetent or unscrupulous, carries out the work in an inferior and often dangerous manner. It should be remembered that the occupier, being responsible under the Factory Acts, should be careful to make it a condition of his order that the work shall be done in accordance with the requirements of the regulations.

Again, apparatus is not infrequently described as "complying with the Factory Acts' requirements," which in reality has never been submitted for the approval of the authorities concerned, and not only does not comply with the requirements, but is wrongly constructed in essential particulars.

The number of accidents due to electricity recorded during the year covered by the report shows a reduction of 20 per cent. on the total and 50 per cent. on the fatal cases, as compared with each of the two preceding years. The reduction in the total is doubtless partly due to the higher standard of electrical work generally, but it may have been to some extent influenced by slackness in trade, many undertakings having been inactive during part of the year under review. The reduction in the relative proportion of fatal cases is also satisfactory, but cannot be regarded as a permanent improvement, as so much depends upon the chance circumstances of the accident.

The reduction in the fatalities is entirely in respect of the low-pressure shock cases; the majority of the h.p. accidents occurred in public electricity supply stations, and the report points out that the employment of labourers or other unskilled persons on dangerous work in such stations, and without proper supervision, is still far too prevalent. An actual test by a suitable instrument to prove that the conductors have been isolated and made dead before work is commenced thereon is obviously the safest course to adopt. Instruments specially designed for that purpose have already been in use long enough to prove their usefulness, more than one serious accident having been known to have been prevented thereby.

Rubber.

The position of rubber has been most unsatisfactory from almost every point of view since the end of the war, and values have declined to unprecedentedly low levels. This, of course, was the inevitable outcome of the great expansion in the production of plantation rubber, accentuated by an abnormal depression in the general trading conditions of the world. The natural result was the creation of an enormous accumulation of surplus stock, the quantities in London alone at the beginning of this month totalling well over 71,000 tons, compared with about 69,000 tons a year ago, and about 23,000 tons two years ago. In addition to the stocks in this country, large stocks are believed still to exist in America. The obvious corrective to this position would, of course, be to restrict production, but although untiring efforts have been expended in order to secure concerted action towards that end, the obstacles to be overcome have up to the present prevented any tangible result. Plantations with a low producing cost, which could sell rubber without loss at or about current market figures, see little to be gained by restricting output for the benefit of those less favourably placed, which might be forced out of action altogether if economic forces were permitted to have free play. Another and probably greater difficulty, however, has been that of bringing the producing interests in the Dutch East Indies into line with those in British possessions. Latterly, the Dutch planters have shown decidedly more willingness to co-operate, and this has led to a considerably more hopeful feeling in rubber trading circles. So far, the low price does not seem to have done much to stimulate consumption, but no doubt the generally adverse conditions of trade in every description of goods, and the chaotic condition of Europe, are partly to be blamed for this. America is, of course, the largest consumer, and the excellent demand in evidence in the motor industry there ought to mean a good consumption for tires. Efforts have been made to discover and encourage new uses for the commodity, and as the economic and commercial conditions of the world stabilise themselves, the market should gradually feel the benefit, more especially if the proposals for curtailment of production are carried into effect. There is, however, a lot of rubber to be absorbed before the position can be regarded as healthy.

Legislation on Industrial Lighting.

The appearance of the third report of the Departmental (Home Office) Committee on Lighting in Factories and Workshops, an abstract of which will be found elsewhere in this issue, marks a new stage in progress toward legislation on industrial lighting. The Committee has already recommended that the omission of any requirement on this point in the Factory Acts should be rectified by the insertion of statutory provisions requiring "adequate and suitable lighting" in general terms. It has also specified minimum values of illumination necessary in the interests of safety, and has dealt with such matters as glare, flicker, and troublesome shadows in

general terms. It has recently had under consideration the more complex question of defining the conditions of illumination necessary for the actual carrying-on of work. Briefly, the conclusion arrived at is that much more experience is needed before legal minima for this purpose can be laid down. Instead of that, the Committee prefers merely to make recommendations, indicating good modern practice, for a very comprehensive list of industrial processes, prior to more detailed investigations being made in which the industries concerned should share. There is little doubt that all the recommendations of the Committee, based as they are on actual tests in many factories, will prove easy to comply with, and the moderate course it has adopted is justified by the fact that industrial lighting has improved very greatly since its work was commenced. In order to avoid hardship, legal minima for working illumination would presumably have to be fixed on the low side; they might, therefore, actually have the effect of impeding further progress. The educational propaganda of the Illuminating Engineering Society has created a general belief in the practical value of good lighting, and managers of factories and workers should readily accept recommendations made in their interest. What is chiefly needed in the future is further educational work so that the fundamental principles of good lighting may be more clearly understood.

Railway Goods Rates.

As the result of an agreement between the Federation of British Industries and the English and Welsh railway companies regarding reductions in the rates for the carriage of goods on railways, there will now be no need for the promised inquiry by the Railway Rates Advisory Committee into the application of the Federation for a 50 per cent. reduction in the increase over the pre-war rates. Both parties are to be congratulated on the arrangement that has been come to, which, in the circumstances, must be regarded as a fair compromise. The arrangement is a general reduction, to come into force on August 1st, 1922, on merchandise traffic by goods train, so that the rates will be 75 per cent. above the rates in operation on January 14th, 1920, in place of 100 per cent. as at present, this to apply to both class and exceptional rates. Any concessions already made which bring the rate below 75 per cent. above the corresponding rate in 1920 will remain unaffected by this settlement. The flat rate increases are to be reduced as follows: 1s. to 6d.; 9d. to 4d.; and 6d. to 3d., the remaining 3d. rate being unaffected. The rate for smalls will be reduced from 150 per cent. to 100 per cent. over the 1920 rate.

The parties to this arrangement agree not to make application for a general alteration to come into operation before July 31st, 1923, and this will give the railway companies ample opportunities to test the wisdom of reducing rates with a view, not only to stimulating trade generally, but also to increase their own traffics. There is little doubt that trade in this country is severely handicapped by high railway freights, and anyone in doubt of that statement need only refer to the proceedings before the Railway Rates Advisory Committee when the new classification was being investigated. That particular inquiry did not include the fixing of actual rates, which was a matter to be dealt with thereafter. The compromise now made merely improves the present position which it must be confessed the railway companies have shown considerable reluctance to modify, having got their increases when the railways were under Government control. Since then, however, there have been considerable reductions in wages and raw materials without any corresponding advantage to the trader. It used to be regarded almost as a joke that goods could come from many hundreds and even thousands of miles from overseas more cheaply than they could be transported a few miles within the confines of Great Britain, but the fact is that to-day there are innumerable such cases, and it is high time that the railway companies were brought into a little more intimate relationship with the real needs of the trade of the country. In America, there is that close relationship already, and there are instances in which the rates from the Atlantic to the Pacific border have been reduced considerably in order to enable industries to meet competition, particularly in the matter of export trade. After all, dullness in trade is reflected in the railway revenue, and the railways cannot be regarded in any other light than as an integral part of the whole industrial fabric which is the foundation of national life. Although there are almost continuous complaints of bureaucratic control, it is pleasing to note that there are two outstanding instances of official control which can be claimed to have justified themselves. The one is the appointment of the Electricity Commissioners, and the other the organisation set up under the Railways Act, for we are convinced that but for the fair and impartial manner in which the Railway Rates Advisory Committee has carried out its duties, we should not have found the railway companies quite so get-at-able as they have been lately. The happenings since the passing of the Railway Act have done much to bring the railways and industry into closer touch, and this should go a long way toward removing the anomalous state of affairs which too often exists in which the cost of freight within our own shores bears an altogether disproportionate relationship to the value of the article, quite apart from the considerations applying to export trade or competition at home with imported goods. As we have already mentioned, the present modification affects the charges now being made, but in connection with the new classification, which is almost complete, there is to be a new schedule of charges, the object of which, together with the classification, is to sweep away so many exceptional rates. It was the original intention to get rid of these altogether, but it was soon found to be impracticable, and when the new schedule of charges is published, it will be found that there are still some exceptional rates. This new schedule, however, will not come into operation for some time, as is evidenced by the agreement now made embodying an undertaking that no application shall be made for a general modification to come into force before July 31st, 1923.

A Call to Labour.

In the speech which Mr. H. Hirst delivered at the annual meeting of the General Electric Co., Ltd., on Tuesday, he was careful to dwell upon the important fact that the ill-effects of an industrial dispute are felt long after it has been settled between the parties immediately interested. The moulders' strike still exercises its baneful influence, as do also the coal trade disturbances, while the engineering lock-out has left consequences in its trail which will take some time to overcome. In this respect the speech is a great call to Labour to do its utmost to wipe out the consequences of our industrial disagreements. However efficient sales organisations may be, they cannot succeed if the productive side of the business is at a standstill or is going slow, or if purchasers are unable to place orders. There are many other reasons why manufacturing companies have not been able during the past year to give the same volume of employment, or distribute the same amount of profit, as formerly. We commend the speech to the careful attention of all our readers. The speaker, like other industrial leaders, does not anticipate a very rapid revival in the general trade in everything electrical, but he is, as he always was, an optimist in regard to the future of the electrical engineering industry, especially if the nation can be induced to see the necessity for supporting home industries.

THE NERVES OF THE NATIONS.

The Romance of the Submarine Cable.

By ROLAND BELFORT.

The forthcoming celebration of the Eastern Telegraph Companies' Jubilee has brought into sudden and well-merited prominence the world's submarine cable system. Never yet has the general public quite realised the universal scope and vital importance of what many eminent authorities consider the greatest scientific achievement of the nineteenth century. The conception of the cable will surely rank in the world's history with the discovery of gravitation, the discovery of America, the circumnavigation of the globe, and other epoch-making developments that have marked the world's progress.

The Cable as Federator.—From the Imperial standpoint, the cable has proved of fundamental importance. Certainly it has been a dominating factor in that problem of Imperial federation which, once a nebulous aspiration, became, during the Great War, a living manifestation of the unity and strength of the British Empire. Future historians will probably comment upon the curious fact that this framework of federation was mainly due to the first Sir John Pender, who happened to be a Manchester man, a Free Trader, and a prominent and active figure in those industrial and social circles where Imperial expansion was regarded with a certain suspicion.

There is no need to dilate upon the services rendered to the Press by the cable. Again, diplomatic and financial crises may now be generated with greater suddenness than formerly, but they are often averted with greater ease, thanks to the possibilities of instant cable intercommunication. As Lord Dufferin once remarked to me: "The cable has transformed the most distinguished Ambassadors into mere Foreign Office clerks, charged with the execution of the Foreign Secretary's orders." Problems that involved months for their solution are now solved in a few days. More than once the cable has averted the imminent danger of war between this country and certain others.

Famous Cable Pioneers.—While the cable has been developed by many brainy, farsighted men, British and foreign, it is generally agreed that the founders of the first Atlantic cable and, later on, the Eastern Telegraph combination's world-wide system, must be credited with the premier position among these hardy pioneers. For Sir John Pender and his associates persisted when others weakened; by their success they provided the British Empire and the world generally with a vital nervous system without which federation could not have come into being and so rapidly developed into the mighty instrument of civilisation which to-day excites the admiration—sometimes the envy—of the world. History is there to prove the unique services rendered by our universal cable system during the Great War, in rapidly rallying our scattered naval forces; transmitting our secret diplomatic instructions; facilitating the movements of British and Colonial troops; protecting our financial and commercial interests and everywhere maintaining British prestige and puissance throughout this mighty struggle.

The Cable's Influence on Finance.—Long before the war, the cable had revolutionised the world's commerce, reducing, in international dealings, the elements of uncertainty and risk; simplifying the complicated problems of international marketing; evolving world prices and the system of forward contracts. New markets were created and developed which, without the cable, would not to-day exist. The cable completely metamorphosed the Stock Exchanges of London and New York, creating in the former a distinctly American market, with a big volume of business. The Atlantic companies gave the arbitragists a five-minute service, as compared with the Government's one-hour service between London and Paris. Generally speaking, the finances of the world have been beneficially influenced by the cable; prices and values have been regulated with a precision and a delicacy never before known; London has been further strengthened in its position as the world's unchallenged financial centre. As for industrial and commercial affairs, the cable has facilitated and expedited these transactions—now conducted with a rapidity and a secrecy which have created new values and standards.

What a calamity for the world should certain omnipotent cable magnates suddenly decree the universal severance of this spinal cord of civilisation!

British Cable Supremacy.—Certainly, France, Germany and America have made, during the past twenty years, commendable efforts to exploit submarine cables on a limited scale, and they have also furnished some brilliant financial, diplomatic and administrative talent in cable enterprise. But it still remains true that, despite this laudable ambition and cordial co-operation, they have been compelled to depend mainly upon the British for their cables, repairing ships, scientific and mechanical equipment, and even for many super-smart operators. Thus the British may fairly claim that by their bull-dog pluck, capacity for "hanging on" against all odds, their inventive genius and financial daring they have contributed the lion's share towards the development of these nerves of the nations.

While the sun never sets on the British Empire, never can it rise without illuminating the ruddy, cheerful features of the ubiquitous cable expert—manager, electrician, or operator. "Follow the flag" is their motto. That means, of course, the tour of the world. In no profession is there greater need for personal devotion and initiative—qualities which have never been rare among our cablists. I have seen proofs of this in many countries, among the chiefs, the managers, the scientific staff, the men of the cable-laying and repairing ships, and also the general body of operators. "Carry on!" whatever the difficulty or danger. No riots, native risings, earthquakes, or cyclones; no cold, heat, or fever have ever been allowed to divert the cablist from his duty. In this attractive service, rich in romance, a resourceful mind, a capacity for prompt action, personal courage, and an unflinching devotion to duty are the commonplaces of a profession in which are brought into play the finest qualities. There is no occasion to look elsewhere for the source of the success enjoyed by the cable since its inception.

The Men that Never Sleep.—For over fifty years the recorder "slip" has almost solved the problem of perpetual motion—countless thousands of miles of "slip" have been used in tracing the millions of messages flashed beneath the mysterious depths. Our sentinels of Empire

> ". . . . . unsleeping,
> While Earth rolls onward into Light,
> Through all the world their watch are keeping,
> And rest not now by day or night."

As a former cablist, now operating in another sphere, I record with pleasure that if the staff has developed this admirable loyalty and zeal it is largely due to the fact that the great captains of the cable have ever been constant in their solicitude for the welfare, comfort, and even the personal enjoyment of their men, wherever stationed. And, the more isolated or dreary the station, the greater their solicitude: generous salaries, ample leave, pension at 65, luxurious quarters, and every facility for rest, study, and recreation.

The young man fortunate enough to secure a cable appointment—not an easy feat, so attractive is the ser-

vice—and going abroad, may make sure of a hearty welcome everywhere. He always finds pleasant companionship, a fine mess, reading rooms, billiard rooms, cricket, golf, and tennis grounds, facilities for boating, and often a concert hall or theatre. Never is he really isolated. He gets the latest news from all parts of the world red-hot—often before his friends in England.

The Perfect Globe-Trotter.—Cablists explore the remotest corners of the earth in the practice of their profession. Every globe-trotter knows them; the more isolated the station the more hospitable its hosts. The cablist plays football or cricket in Cornwall, haunts the gay boulevards of Havre, Brest, and Marseilles, bathes in the Red Sea, and drinks of the waters of the Nile. He can go further East to Aden, Bombay, Zanzibar, Mozambique, or Madras; or to the Far East, anywhere between Colombo and New Zealand. Many placidly pursue the even tenor of their career in London, Penzance, Waterville, Valentia, or even Weston-super-Mare. Others are buried away in isolated spots like St. Pierre Miquelon, where they are popularly supposed to get nine months' winter and three months' fog, varied by a glimpse of the sun every blue moon! Some drag out a weary existence among the snows of Kamschatka or the reeking jungles of the Malaysian Islands. There are torrid stations in the Red Sea where it rains about once a year, and damp spots like Hong-Kong, where fungi grow in your boots during the night. Along the coasts of Africa and South America may be found horrible fever traps where the white man lives, as the Scotsman is alleged to joke, with exceeding difficulty. In the Far East there are also some very trying stations, planted on savage coasts and lonely islands far from the track of civilisation.

The Cablist Afloat.—One of the most attractive branches of the cable service is certainly that connected with the making, laying, and repairing of these precious links of civilisation. In no department of human effort is there anything more fascinating than the processes by which a big ocean cable is made, laid, and repaired. Such operations connote scientific and mechanical skill of no mean order; a gift for organisation and a talent for the management of men working under abnormal and even dangerous conditions. British pluck, resource, and ingenuity bordering on genius have seldom been developed and displayed to greater advantage than during these operations. In cable-repairing our men have always enjoyed undisputed supremacy. I have known several foreign experts who attempted this work, but their record was not brilliant. One not only failed to repair his own cable, but broke one belonging to another company. A certain foreign cable remained unrepaired for quite a year, because the company's ship could not raise it. On the other hand, British cable captains have scored some legendary successes. Although immense progress has been made in electrical science, cable-repairing still remains complicated, uncertain, dangerous work. The ship itself costs about £100,000; its maintenance in constant readiness for sea is expensive; then there is the element of luck. A steamer may leave harbour in brilliant weather; hook the broken ends of a cable, and effect a speedy repair. Or she may steam out of port in a howling storm or thick fog; fail to locate the cable; wearily drag the ocean for weeks without getting a "bite." Even if the cable be hooked, it may rise almost to the surface, suddenly snap and "swish" into the sea with a thud which sickens both technicians and navigators. The "Anglo" Co. once spent about £95,000 and quite a year in repairing one of its cables. Atlantic cables are broken by ships' anchors, icebergs, whales. Four cables were once broken simultaneously by a terrible "seaquake."

When it is considered that repairing operations involving the most intricate navigating manœuvres, mechanical feats and delicate electrical experiments are conducted in mid-ocean, during stormy, foggy weather, right in the track of ocean flyers or icebergs, its dangers can be readily understood. Yet accidents are not frequent; repairs are usually promptly effected; all hands work zealously by day and by night. One cable engineer, seeing the cable fouled by the propeller, jumped into the sea and cleared it, although sharks were cruising around. Such incidents are fairly common. This holy zeal explains the success of cable-repairing despite tremendous difficulties, disasters, and disappointments.

Foreigners as Cable Experts.—Foreigners envy us this universal cable system, which makes of London a vast gramophone, registering and announcing almost simultaneously every important event as it occurs. To us must the world look for the latest news, for we usually get it first, and act as a sort of news clearing house for all other nations, especially in shipping, Lloyds having a wonderful service from all parts of the world. Thus, not only does Britannia rule the waves, but she also controls the ocean depths.

Men of many nationalities are engaged in cabling, but only in limited numbers, and they rarely equal British operators in either speed or accuracy. Even American cable companies usually employ British operators, their telegraphists, although extremely clever, never having quite caught up with us in cable telegraphy. My experience is that the foreigner, apart from the American, fails to appreciate the immense importance of *speed* and concentration in a profession wherein "rush" is the essence of the contract. "To-morrow will do." However, in this respect, they are now making considerable progress, stimulated by the example of the British, in cable-making, laying, and working.

Evolution of the Cable.—When, in 1851, Brett submerged his first 25 miles of cable beneath the waters of the Straits of Dover his audacity was regarded as more than the freakish exploit of a madman—the scheme was described as a veritable swindle, engineered by some greedy London promoter. That cable pioneer never dreamed that this "swindle" would develop into a vast, universal industry with about 330,000 miles of cable; an army of 25,000 men; a fleet of over forty ships, vast establishments and valuable real estate all over the world. Brett, who experienced such difficulty in raising his modest capital, would have marvelled at the £60,000,000 now invested in cable enterprise, and the imposing array of financial, scientific, and administrative talent now engaged in maintaining and developing this magic "girdle round about the earth."

The Pluck of the Pioneers.—No estimate of the cable position can be practical or equitable unless special consideration be accorded to the fact that the world's cables have been financed, manufactured, laid, repaired, and worked by brainy, resolute, resourceful capitalists and scientists, notably the Penders and their associates in all departments. They firmly believed in the potentialities of submarine cables from the outset, when sceptics were in the majority. Generally speaking, this grand work has been done without much British Governmental support. In the early days no Government would have undertaken such risky, uncertain, novel work. When the pioneers stepped in where our State mandarins feared to tread, the general public rather scoffed at them as visionary enthusiasts, "eager to throw their money into the sea." Disraeli nicknamed Pender "John Spender." For, when irretrievable failure threatened the second Atlantic cable, and other capitalists were sick and weary even of the word "cable," John Pender pluckily saved the situation by his personal guarantee of £250,000. Such superb confidence naturally inspired hope and emulation and stamped John Pender as a leader of men—a financier of exceptional daring.

(To be concluded.)

Light Without Heat.—Demonstrations of a device for the production of "cold light," which were recently given before a group of international scientists by Mr. M. J. Bitterath, a Los Angeles inventor, have aroused great interest in the American kinema world. "Cold light" is claimed to be pure white and so free from heat that even highly inflammable films can be subjected to it for hours without fear of burning.—*Evening News.*

CALCULATING CURRENTS IN A MESH-CONNECTED THREE-PHASE CIRCUIT.

By ALFRED STILL.
Professor of Electrical Design, Purdue University, Indiana, U.S.A.

ALTHOUGH the following graphic solution of a three-phase problem is remarkably simple, the writer has no knowledge of its having been published.

Problem.—Given the magnitude and phase relations of the three line currents supplying a three-phase mesh, calculate the magnitude and phase relations of the currents in the mesh.

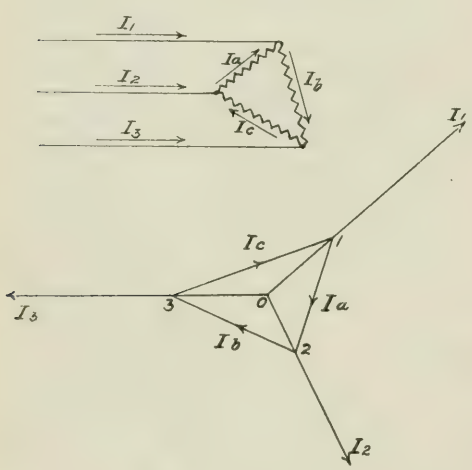
Graphic Solution.—Draw the vectors $o1_1$, $o1_2$ and $o1_3$ to represent in magnitude and phase the three line currents shown in the diagram of connections. Locate the points 1, 2, and 3 on these lines, so that—

$$\begin{aligned} o1 &= \tfrac{1}{3}\, o1_1 \\ o2 &= \tfrac{1}{3}\, o1_2 \\ o3 &= \tfrac{1}{3}\, o1_3 \end{aligned}$$

and draw the triangle 1, 2, 3. Then—

$$\begin{aligned} 1, 2 &= I_a \\ 2, 3 &= I_b \\ 3, 1 &= I_c \end{aligned}$$

where I_a, I_b and I_c are the currents in the three branches of the mesh, as indicated on the diagram of connections.



Proof.—Since the vectorial addition of the three currents in the mesh must be zero, we have—

$$\dot{I}_a + \dot{I}_b + \dot{I}_c = 0 \quad \ldots \quad \ldots \quad (1)$$

From the diagram of connections it is seen that—

$$\dot{I}_2 = \dot{I}_a - \dot{I}_c \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

and

$$\dot{I}_1 = \dot{I}_b - \dot{I}_a \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Subtracting (3) from (2), we have—

$$\dot{I}_2 - \dot{I}_1 = 2\,\dot{I}_a - (\dot{I}_b + \dot{I}_c),$$

but it is seen from equation (1) that—

$$\dot{I}_b + \dot{I}_c = -\dot{I}_a,$$

whence

$$\dot{I}_2 - \dot{I}_1 = 3\,\dot{I}_a,$$

and

$$\dot{I}_a = \frac{\dot{I}_2}{3} - \frac{\dot{I}_1}{3}.$$

It is obvious that similar expressions will be obtained for the currents I_b and I_c.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

THE ANNUAL CONVENTION AT WOLVERHAMPTON.

Sub-station Equipment including Automatic Control.

By R. A. CHATTOCK,
City Electrical Engineer, Birmingham. (*Abstract.*)

(*Concluded from page* 64.)

AUTOMATIC OPERATION OF SUB-STATIONS.

The apparatus should be designed to automatically control the starting and stopping of the sub-station plant, as required by the demands of the system. For a single unit feeding into a network the control is effected by the pressure of supply on the line. When this falls to a pre-determined figure owing to the increased demand, a relay is operated which starts the sequence of operations which start up the unit of plant.

For a number of units feeding into a network it would appear that the control would be better determined by the amount of current that is being supplied from the group, individual units being cut in when this rises to a pre-determined amount and cut out again as it falls.

In each case it is advisable to allow a time lag of about five minutes before the control actually operates, in order to allow for temporary variations which can be satisfactorily met by the plant on circuit for short periods. This applies especially to automatic sub-station plant used for traction purposes.

For the rotary converter the controls are numerous and complicated. In the case of an induction motor-generator a number of these devices can be dispensed with. In the case of the mercury arc rectifier, some of the protective devices, such as heated bearing control, field regulating control, &c., could be still further dispensed with and the automatic arrangements simplified in consequence.

Since July, 1921, the Birmingham electric supply department has had a trial mercury arc rectifier running at the Harborne sub-station, and has developed an automatic system of control which has been in operation for some months with entire satisfaction. The rectifier is run as a single unit in parallel with the storage battery, and is left in circuit day and night. Should a serious overload or external short circuit occur, the apparatus automatically cuts out, and the automatic starting mechanism comes into operation, first closing the a.c. oil switch, then striking the mercury arc in the cylinder, and closing the direct-current switch. Should the external trouble still be on, it trips out again, and this is repeated three times in all, after which the apparatus is cut out permanently.

The load on this sub-station does not require more than one set at a time in parallel with the battery, so that it has not yet been necessary to develop the starting and stopping arrangements controlled by the total load going out from the sub-station. These can, however, be added when required.

The apparatus is left on circuit and the attendants are withdrawn from the sub-station at night time and at week-ends, the station being run as a two-shift station.

The automatic apparatus was thoroughly tried out for a considerable time on external resistance load, and was found so satisfactory that it was put on circuit and the staff eventually cut down.

The remainder of the paper is devoted mainly to typical sub-station lay-outs.

The cost of a sub-station containing rotary converter plant of 4,000 kW capacity, with a battery, is given as £79,732, and with an annual converted output of 9,200,000 kWh the working cost per kWh sent out is 0.356d. A static transformer sub-station of 50 to 100 kW costs £6 per kW.

For power-factor correction, on a 25-cycle circuit, the cost of condensers is £9 9s. per kVA. and of Kapp vibrators £3 12s. per kVA.

DISCUSSION.

Mr. S. J. WATSON (Bury) said that a speed of 500 r.p.m. was sound practice a few years ago, but now 1,000-kW rotaries were running at 1,000 r.p.m., consequently costing less, and having a slightly higher efficiency. Prices generally had fallen rapidly since the date given in the paper, and today a complete rotary equipment cost less than £4 per kW. Self-synchronising rotaries had advantages; they could be run up and put on load within half a minute. They were also far less sensitive to short-circuits on the high-pressure side, which threw rotary converters out of synchronism. With regard to the comparison between a.c. and d.c. distribution, Mr. Watson thought the former far the better: the only advantages of d.c. were the use of batteries and the facility for regulating the speed of motors.

Mr. S. E. FEDDEN (Sheffield) said it was quite impossible to give a cheap and abundant supply of electricity on a large scale on the systems advocated in the paper; the capital outlay was very large. A cheap supply could be given only by the static transformer system, which also overcame the difficulty of voltage regulation. In Sheffield they used concrete for sub-station buildings and ironclad switchgear; the whole building cost only £150. No kiosks were used, the same construction being suitable on a small scale, and 11,000

volts could be handled without difficulty. A 1,400 kW a.c. sub-station cost only £2 or £3 per kW. Batteries were out of the running. In Sheffield the power factor was poor at slack times, but when the town got busy it improved at once. Individual cases of low power factor were dealt with separately.

Mr. W. H. Alabaster (Melbourne) expressed his pleasure at attending the Convention, and remarked that the corresponding association in Australia was smaller in number, but the members had ten times as far to travel. He gave particulars of the sub-station practice of Melbourne, being in general agreement with the author of the paper. In an area of 2,000 by 1,250 yards the d.c. load amounted to 12,000 kW; he was installing a new sub-station with three 2,000-kW rotary converter sets, but without a battery. He thought that 0.356d. per kWh was an appalling cost; perhaps it was partly due to the use of a battery. He was using a 5,000-kW frequency changer, 50 to 25 cycles, for railway supply, and a 12,000-kW set was on order for the Victorian Government.

Mr. R. B. Mitchell (Glasgow) agreed with the first two speakers, and regretted the necessity of supplying direct current. He thought that batteries in sub-stations were not justified, on account of the cost. A 1,500-kW mercury arc rectifier with three cylinders had been installed at Glasgow; difficulties had been met with, but would be overcome by the makers in time. They were using 25-cycle current for lighting in spite of the flicker. He approved of power-factor correction, and had found Kapp vibrators satisfactory.

Mr. R. L. Morrison (Brown, Boveri & Co.) said that his firm had produced satisfactory rotary converters to work at 1,500 volts, 50 cycles. Seven designed for the Midi Railway were to have a continuous output of 750 kW, but in view of their overload capacities they were really normal 1,200-kW machines. The two-hour rating was 1,125 kW, and the five-minute rating 2,250 kW; the no-load pressure had to be 1,650 volts, and the speed was 750 r.p.m. The no-load losses, on the 1,200-kW basis, were 2.75 per cent. The specification required the machines to withstand five consecutive short-circuits at one-minute intervals; in fact, 60 short-circuits were applied to the first machine at that rate, and the set stood up to the test perfectly, 150 short-circuits being applied in all. Flashing was almost absent, and no flash-barriers were used. On the 1,200-kW basis the efficiency was 95 per cent. at full load, 93 per cent. at half-load, and 89 per cent. at quarter-load.

At this point the discussion was cut short, and Mr. R. A. Chattock, in reply, said that reliability was of supreme importance, even at greatly increased cost. That was a guiding principle in Birmingham—hence the use of batteries, which were a necessity for maintaining continuity of supply. They were rated at 20 to 30 per cent. of the capacity of the plant in a sub-station and carried on while the plant was restarted after a mishap. In Birmingham the power factor was gradually falling; the tariff was on the kW basis, and it was difficult to change to the kVA one, so that they would have to face power-factor correction themselves. For a certain small section of the area a 1,500-kW frequency-changer was being installed. The cost stated for the battery sub-station did not include that of the building. Their one-cylinder 250-kW mercury arc rectifier gave no trouble, working in parallel with other plant, and offering no difficulty in regulation.

Mr. R. L. Morrison, who was asked to forward his remarks for publication in the *Proceedings*, informs us that below half-load the rectifier shows to advantage, because its quarter-load efficiency is usually within 1 or 2 per cent. of that obtained at half-load. Moreover, the efficiency improves in course of time. The smallest rectifier manufactured is a 300-amp. size, which, at the basic pressure assumed by Mr. Chattock, would give 150 kW. This is an extremely satisfactory size; one is installed at Ipswich, and several hundred are at work on the Continent. With regard to rectifier prices, full allowance should in fairness be made for the saving effected as regards attendance. Where new sub-stations have to be erected a light corrugated iron structure or an existing building can be utilised, and if this is done the figure indicated for automatically operated sub-stations complete will be below that of similar rotary converter sub-stations. It is admitted that Mr. Mitchell has had some trouble with one of his three cylinders; the other two are working quite satisfactorily, and have been taken over by his department. These troubles are "diseases of infancy," and only occur in a small percentage of cases, and then almost without exception during the first few weeks of operation until the anodes are "formed."

Of sixteen sets in hand for the Midi Railway each has a continuous output of 1,200 kW at 1,575 volts d.c., and has to fulfil the same conditions as the seven rotary converters referred to above. Recently a standard high-pressure rectifier was operated for 70 consecutive hours at 3,500 volts d.c. with a load of 250 amps. So satisfactory were the results that the d.c. pressure was raised to 5,400 volts, and a further continuous run was maintained for 24 hours with the same current. The rectifier functioned perfectly, there being no tendency whatever to internal flashing-over. To prove the suitability of the rectifier for extra-high-pressure d.c. traction conditions it is proposed to install a trial equipment on one of the Italian railways at 4,000 volts d.c.

Some nine months ago Messrs. Brown, Boveri, at their own expense, put into operation a trial equipment operating at 1,500-1,700 volts on the Bernese Overland Railway. The rating of the set at this pressure is about 850 kW, while the load is of an extremely variable nature. Throughout this period it has worked without a hitch, and having completed their trials the makers were desirous of removing the equipment, but the railway authorities would not hear of this, and have agreed to purchase it outright. One very important advantage for high-pressure d.c. electrification is that whereas rotary converters must be placed in fairly large sizes in sub-stations located a fair distance apart, with the rectifier it is possible to utilise much smaller automatically-operated sets in cheap sub-stations at short intervals along the line. The saving that will be effected in copper alone is considerable.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Where are the Wiremen?

I have had the greatest difficulty in getting a young man suitable for general work in a small supply station in the south. The duties consist of small wiring jobs, overhead line work, and making himself useful generally in the station and outside. I have had nearly 200 applications on each occasion I have advertised, and so far I have not been able to get a man who can wire a job of a few lights without getting it all mixed up and necessitating my testing out and correcting it myself.

With so many out of work one would think it was an easy matter to find a suitable man, but I have not found it to be so, and I shall be glad if any of your readers who know of such a man can personally recommend him to me.

I may add that I have an excellent staff, and it is getting this one extra man that seems so difficult. I may also add that mine being a small station I am naturally not offering some of the extraordinary wages asked by some of the applicants; at the same time I am offering a very good figure for a constant job for a handy man.

Engineer.

July 12th, 1922.

The I.E.E.'s Outlook.

I agree with Mr. E. Kilburn Scott's contention, as expressed in your issue of May 26th, that the Institution would gain if the oversea dominions were represented on the Council. The chairmen of Local Centres abroad are *ex-officio* members, but they are seldom in London to attend a meeting and are completely unknown to the majority both of the members and of the Council; *ex-officio* membership, in fact, is merely a rather empty honour to the man, and of no use whatever to the Institution. Overseas trade is of vital importance to electrical engineers professionally, but the great majority of the members of the Council are and always have been distinguished engineers connected for most of their lives with some one undertaking or business in the United Kingdom. The fact remains that if any of us unknown returned wanderers were put up for election to the Council we should not get a score of votes.

J. W. Meares.

Simla, India, *June 19th*, 1922.

The I.E.E. Wiring Rules.

It was pleasing to notice that, according to the report contained in your last issue, the question whether powers should be sought to enable electricity supply authorities to make the observance of wiring rules compulsory to contractors was raised at the I.M.E.A. Convention.

The carrying of a motion to bring the matter to the notice of the Electricity Commissioners makes it clear that this Association recognises the importance, not only of securing a greater margin of safety for the community, but also of placing the future of domestic wiring on a sound footing.

The development of such a step would, it is ventured to suggest, greatly help to raise the status of this branch of the industry, and the problem should, therefore, receive the very careful attention of all those whose calling connects them with it.

The present position is far from satisfactory. Whilst it is true that most undertakings have framed certain rules and regulations for the guidance of local wiring contractors, to which the latter are expected to adhere, much controversy exists in some quarters as to whether the suppliers concerned are entitled to enforce them either wholly or partially (with the possible exception of those few who hold special statutory powers), and to those whose business it is to test and connect installations, and to adjudicate upon matters arising therefrom, the introduction of a definite ruling would be welcome.

The general acceptance and adoption of the I.E.E. rules would, undoubtedly, tend to raise the standard of domestic wiring in no small degree, and should result in mutual benefit to both suppliers and contractors alike, inasmuch as the former would be saved a deal of anxiety and annoyance, and the latter would have the advantage of being in a position to uphold their reputation for good work without fear of being undercut in price by a less conscientious competitor.

Again, for a contractor carrying out work up and down the country, the matter of making himself acquainted with the particular requirements of a certain undertaking may have been overlooked, with the result that, unless it happens that an official of the latter happens to come on the job during erection, nothing is known until the installation is ready for connection, and this fact often leads to delay in completing the work.

It is not suggested that it is possible to lay down hard-and-fast rules which would be adaptable in every instance, as many factors are entirely dependent upon local conditions, but it is maintained that many clauses could be so compiled as to eliminate much uncertainty. The writer has experienced instances where failure on the part of outside wiring contractors to make themselves familiar with the particular requirements of the local undertaking has resulted in considerable inconvenience to all concerned.

In point of fact, it is well to bear in mind that, strictly speaking, the suppliers have no dealings with the contractors at all; *their business is to supply electrical energy to the consumer*, and, in consequence, they must approach him direct on all matters relative to work being carried out on his premises, and this only makes the position more complex.

It would be interesting to have the views of others on this subject.

J. R. Willingham.

Llanelly, *July 11th*, 1922.

Where are the Young Men of the I.E.E.?

The experiences of "Younger Member" apparently have been unfortunate.

Such experiences are, I am convinced, very rare. Certainly the students and graduates attached to the Scottish Centre cannot complain of "the lack of recognition and encouragement by senior members of the Institution." My own experience is that Scottish members do their utmost to encourage the younger members, and that they rigidly exclude any atmosphere of stiffness from their meetings.

At the recent summer meeting in Scotland the honorary secretary and the Committee of the Scottish Centre were untiring in their efforts to make the younger members, especially those who were strangers to Scotland, feel at home and among friends.

The friendly spirit of the seniors towards the juniors is, to my mind, an outstanding attribute of the Institution, and I feel sure I am not alone in that opinion.

In conclusion, may I suggest that junior members who feel that they are out in the cold should help to solve their own difficulties by going to the meetings with an open mind unhampered by the belief that they are going to be treated in a "superior" manner.

Duncan J. McKellar.

Glasgow, *July 11th*, 1922.

Careful perusal of some of the letters concerning the above question from certain of your correspondents seem to convey clearly that they have entirely overlooked the objects of the I.E.E.

Such associations as the A.M.E.E., the S.T.E., and the E.P.E.A. are doing their utmost to set a "first-class profession" upon a first-class basis, as far as salaries and status are concerned.

The I.E.E. is essentially not a "wage wrangling" body, and it is particularly desirable, in the interests of all classes, that it should not be so.

It is quite possible that some members can prove certain isolated instances, such as those mentioned by one or two of your correspondents, but I feel sure that these matters could have been soon rectified, had the proper channels been explored.

The question of securing better positions leads to the matter of applications, and I was particularly interested in a leading article in *Engineering* on June 2nd, 1922, entitled "The First Step," as I consider that some home truths were very vividly brought out therein.

The writer of that article, amongst other things, stated that "the task of the advertiser is not so much that of selecting one candidate as of finding reasons for rejecting one hundred and ninety-nine. By the time he has thrown aside all the illegible letters, the misspelt letters, the undated letters, and the ill-constructed discursive letters, often covering several pages which do not read consecutively; the letters which do not give the age of the applicant, or which fail to state how he acquired the experience which he claims; those which do not say when he could take up his duties, if appointed; those which say the candidate would like to have more particulars of the job before he can state the salary he would ask, and all the other letters which for various reasons are unattractive or hopeless, the remainder, destined for serious consideration, will usually be very few in number. A man who scribbles or misspells in a letter of application is likely to be equally illegible and perfunctory in actual work. Those who do not trouble to put a date on their letters are rejected not so much because they have omitted a date, as because they are the sort of people who omit dates on records; again, a man who cannot state his own qualifications clearly, fully and concisely, shows himself deficient in the art of clear thinking and the orderly marshalling of facts in his mind."

It is unfair to expect any chief to "push" a man on just because he has one qualification; the desirable chiefs are those who consider *all* qualifications, and judge accordingly. Many young men would do much better if they considered some of the above remarks of those who deal with applications.

Kenneth Pittaway.

London, *July 15th*, 1922.

Proposed Emigration—New Zealand.

I have just read Mr. Allan's advice to "Inquirer" to proceed at once to New Zealand, in the Electrical Review of February 24th. It would seem that Mr. Allan has not first-hand knowledge of this country, yet is most enthusiastic in its praise. Well, I really believe it to be a better place to live in than England, although the 70 in. rainfall is rather a drawback, but things are so bad here that I would advise "Inquirer" to wait awhile. Perhaps in 100 years New Zealand may be a rival to England as a manufacturing centre; just now it is that much behind. We have a trifling debt of nearly 200 millions, and I notice Mr. Allan thinks "able finance" would help us. Personally, I think finance is just a little bit too able sometimes. However, to come to the point, a man wants to be really keen on hard work to do any good in New Zealand. If he is a real "top notcher" let him stay away. There are more openings in England for such men. If Mr. Allan, however, means by "skilled worker" an artisan who knows his work, there are plenty here already, and lots looking for jobs just now. That fact need not prevent "Inquirer" coming, as doubtless the country districts will presently need such men with the coming of hydro-electricity. This is slow, and the large scheme that is to supply Auckland is to be in operation in five years, perhaps. That is contingent upon this magic "finance."

By the way, "Inquirer" must be prepared to do a job of navvying if required, or lend a hand jacking logs, or shovelling coal. The writer 14 years ago loaded limestone into railway trucks, and once sawed off 16 in. square piles below water well off shore in a northern harbour. Such trifles as putting new boards into the bottom of water races three miles into the bush at 2 a.m. in a gale, with 4 ft. of water running, must not daunt "Inquirer." If he has pluck enough to do these jobs he will be better in New Zealand, but if he can earn a living easier where he is, let him stick to it.

Ex-Londoner.

Auckland, N.Z.

REVIEWS.

Artificial Light. By M. Luckiesh. Pp. x + 366; 42 illustrations. London: University of London Press. Price 12s. 6d. net.

At the outset it must be stated that the author has endeavoured to provide for the general reader and not for the technician; nevertheless, the book is comprehensive and one is enabled to follow closely the march of civilisation through the ages on account of the assistance given to educative and creative work by the gradually improving lighting conditions. The development of the various materials and apparatus used for the production of illumination is fully covered, so that the specialist in any of the particular branches of the art is able to obtain a wide outlook and at the same time can appreciate the great fields covered in other directions by his brother specialists.

After a chapter dealing with the subject in a summary and abstract form, the writer turns to the art of making fire as carried out by primitive man, showing the progress made up to the present time; this leads to the consideration of the early light sources, the multiplicity of devices used is striking, and one is reminded that there are to-day many peoples who are still dependent upon light sources similar to those used by our forefathers. The pages devoted to the ceremonial use of light indicate the close connection between religion and our subject in both Christian and pagan rites.

We then proceed to the more modern units, the oil lamps of the nineteenth century being first dealt with, when more technical matters begin to appear and assist one in making interesting comparisons. Early gas lighting follows and one can appreciate the difficulties encountered by the pioneers. Before modern apparatus and means are arrived at the

author treats us to a chapter on the science of light production, and introduces the non-technical reader to scientific terms and definitions; from the reading thereof he should be able to estimate the relative efficiencies and possibilities of the various sources available. The chapter on modern gas lighting impresses one with the rapid advancements made during the past hundred years, but still more striking is the history of electric lighting, covered by the next two chapters. Naturally enough, the writer treats of the progress on the American side probably more fully than the European, and items with which he has been in close contact are mentioned at length, although in this country they may not have met with any success whatever. Interesting figures indicate the increase in the standard of lighting during the last decade. The embryo inventor can glean much from the next pages directing attention to the future, which completes the story from the production point of view.

The purposes to which light is put occupy the remainder of the book; again we are led through the historical sequence so that we may better understand the why and the wherefore of present day practice. Street lighting, lighthouses, the use of artificial light in warfare, and signalling are the headings of consecutive chapters, and the matter is sure to be of interest even to the specialist. In these days of economy the pages dealing with the cost of light should prove a source of thought, though to the English reader the American values and costs may be misleading, owing to the very different conditions prevailing in the latter country. Somewhat similar remarks apply also to "Light and Safety" and "The Cost of Living." The chapters on "Artificial Light and Chemistry," and "Light and Health," contain much that may be novel to many readers, but it is noteworthy that the author passes quickly over the latter subject, calling attention only to those applications of proved merit.

"Modifying Artificial Light" naturally leads one to spectacular lighting, and to English readers the employment of light for decorative purposes as carried out in the States will come as a revelation. The abstract is covered by the title "The Expressiveness of Light"; church lighting is here touched upon, as is also stage lighting. To those who may have been surprised at recent exhibitions on the London stage, it may not be out of place to point out that Mr. Luckiesh himself claims credit for suggesting such methods a number of years ago.

After useful hints relative to home lighting, the book closes with a plea that lighting should be considered as a fine art, a plea, which in our opinion, is justified, though we much regret that in this country conditions are, as yet, much behind those to be found across the Atlantic.

Handy reading references are given and there is a good index, the illustrations are well selected, and should prove educative to the average reader. We are well satisfied that a thorough reading of the work amply repays one, and we trust that it will meet with the success it deserves.

The Electro-Deposition of Copper and Its Industrial Applications. By Claude W. Denny, A.M.I.E.E. Pp. xii + 105, figs. 29. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

This is one of the volumes in that excellent series "Pitman's Technical Primers," and, like some of its companions which we have read, is characterised by the author's skill in compressing an astonishingly large amount of useful, practical information into an exceedingly small compass.

Before the war, industrial applications of electrolytic copper deposition, apart from electro refining, were practically confined to the production of electrotypes for printing blocks and plates and, to a less extent, of art metal work. Now, however, there are many uses of deposited copper which are of considerable interest to the ordinary engineer, and the author of this book deserves our thanks for having drawn attention to them. One such use is in reinforced steel sheets where copper is deposited on and into perforated steel. Reinforced copper tubes are also now made, and many applications of these materials are suggested or will occur to the reader. Electro-deposited, jointless radiators for internal combustion engines are also now made, and they offer an obvious advantage over the built-up radiator, with its multiplicity of joints. Another interesting application of copper deposition is for the production of gramaphone records, and we wish the author could have found space to give more details of this art. An application which appears to have been overlooked is the case of certain aero engine details where copper has been deposited successfully as a protection against carburisation in parts adjacent to those requiring case-hardening, as a means of improving heat conductivity and for building up definite constructional details. Capt. Thain read a paper on this subject last year at Sheffield at a joint meeting of the Institute of Metals and the Faraday Society.

Apart from describing the above and other applications of copper deposition, the book includes some well-written, if highly-condensed, chapters on the process of deposition, including very useful sections on the testing of solutions and the lay-out of plant. Attention is rightly drawn to the necessity of circulating the solution in most, if not all, cases of deposition. It would have been well to add a warning as to the harmful effect of accumulated impurities—and especially those of an organic character—on solutions which have been used for long periods without purification, mechanical and chemical, more particularly where copper of high tensile strength is required.

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XC. of the Electrical Review, which is now being printed, will be supplied only to those who through the post specially apply for it. To them it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—Joseph R. T. Norris, trading as Acme Electrical Co. and residing in Warley Road, Blackpool.—At Blackpool County Court on July 12th a receiving order was made. Judgment had been obtained in the High Court by Millo Co., Oldham. Liquidator: Mr. A. C. Hanson, of Oldham.

Bell, J. B., electrical engineer, 21, North Bar Within, Beverley.—Trustee (Mr. E. P. Dutton), released, March 17th, 1922.

Leslie Brown, The Street, Frensham, Surrey, electrician.—The following are creditors herein:—

	£		£
Fairbank, Dr.	70	Robertson, A. M.	60
Ayling, W.	30	Johnson & Phillips	25
Haskell, J.	25	Berridge, F. W.	40
Milsum, W. S.	38	Wright, A. E.	70
Mackenzie, Miss	72		

Phillip Marsden Rogers, trading as the Longbridge Engineering Co., Great Darkgate Street, Aberystwyth, electrical engineer.—The following are creditors herein:—

	£		£
Clarke, George	14	Nico, Ltd.	12
Ewins, Ltd.	15	Gwen, Richard	26
Hart Accumulator Co., Ltd. ...	14	Swinburne, T. H. M.	23
Jenkins, Edward E.	22	Snelling, George	95
Jenkins, D. Lloyd	20	Wolsley Sheep Shearing Machine	
Bankers	60	Co.	36
Mealand, E. H.	200		

T. R. W. Wyness (Wyness & Bale, electrical engineers), 13, Commercial Street, Brighouse.—Trustee, Mr. C. H. Baker, 1, Albion Street, Leeds, appointed July 12th.

A. J. Wilcox, motor and electrical engineer, The Garage, Farnham Common, Bucks.—Last day for proofs for dividend July 29th. Trustee: Mr. F. W. Davis, 28, Theobald's Road, Bedford Row, London, W.C.1.

Company Liquidations.—Electrical Industries, Ltd., 9-10, Pancras Lane, London, E.C.—July 31st is the last day for receipt of proofs for dividend by the liquidator, Mr. H. E. Burgess, 33, Carey Street, London, W.C.2.

Special Productions, Ltd.—Meeting August 17th at 22, Cooper Street, Manchester, to hear an account of the winding-up from the liquidator.

Beta Batteries, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Cameron. Meeting August 16th at 5, New Court, Lincoln's Inn, W.C.2, to hear an account of the winding-up.

Planet Electric Co., Ltd.—Meeting, August 25th, at 67, Broad Street Avenue, London, E.C.2, to hear an account of the winding-up from the liquidator, Mr. S. H. Swallow.

Scheme of Arrangement.—Westminster Engineering Co., Ltd., Victoria Road, Willesden Junction.—Meetings of the different classes of shareholders are to be held, by order of the Court, on July 27th to consider a scheme of arrangement between the company and themselves.

Dissolutions of Partnership.—Meadowcroft & Whittaker, consulting engineers and merchants, King Street, Manchester.—Messrs. S. Meadowcroft and J. B. Whittaker have dissolved partnership.

J. L. Electric Co., electricians, 30, Church Street, Birmingham.—Messrs. L. C. Hickson and A. Quaife have dissolved partnership.

C. Galloway Taylor & Co., electrical engineers, Bright Street, Leicester.—Messrs. G. Adcock, H. Shipley and C. Galloway Taylor have dissolved partnership.

Trade Announcements.—Mr. W. Graham, late of the Edison Swan Electric Co., Ltd., has been appointed resident engineer and local manager of the Malacca Electric Lighting Co., Ltd., which is opening a new contracting branch in connection with its supply business. He desires to receive catalogues, price information and samples. These should be addressed to the company at Kabu Road, Malacca, Straits Settlements.

Mr. Graham M. Stevenson, M.I.E.E., M.I.Mech.E., of 136, Yardley Wood Road, Moseley, Birmingham, has been appointed sole representative in Birmingham and district for Messrs.

T. W. Broadbent, Ltd., of Victoria Electrical Works, Huddersfield, manufacturers of generators and motors, switchboards, &c. Mr. Stevenson will devote himself more particularly to the application of electric driving to rolling mills. He was personally responsible for work of this nature at the Redbrook Tinplate Works, near Newport, Mon.

Catalogues and Lists.—Messrs. W. H. A. Robertson and Co., Ltd., Lynton Works, Bedford.—An illustrated catalogue of air compressors, vacuum pumps, compressed-air reservoirs, and dessicating sets.

Messrs. H. P. Boothroyd, Ltd., Bootle, Liverpool.—Stock list of d.c. motors and generators.

Messrs. Buck & Hickman, Ltd., 2, 4, & 6, Whitechapel Road, E.1.—An illustrated brochure dealing with automobile gears manufactured by E. N. V. Motors, Ltd., an associated firm.

Electrical Installations, Ltd., 27, Martin Lane, Cannon Street, E.C.4.—A well-produced brochure illustrating examples of the firm's work, and including views of factories of various types, country houses, churches, and other large buildings.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publication No. 324, a priced and illustrated leaflet advertising the Sterling "No 1" crystal w.t. receiving set.

Messrs. Thompson & Co., 48, Watling Street, E.C.4 (agents for the Société Industrielle pour la Fabrication d'Appareils de Mesure, Paris).—A well-illustrated descriptive catalogue of switchboard instruments, including voltmeters, ammeters, synchroscopes, p.f. meters, frequency meters, &c.

Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list of d.c. motors, &c.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—List No. A/23, a comprehensive catalogue of electrical goods, including wireless apparatus, electro-medical sets, X-ray equipment, instruments, telephones, switches, lighting fittings, &c. Fully priced and illustrated.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—List No. 952, giving particulars, illustrations, and prices of the new pattern "Diaduct" distribution boards.

Messrs. W. H. Sugden & Co., Ltd., Glenny Road, Barking.—Stock list of electric motors, d.c. and a.c., of various makes.

Messrs. Hardy & Padmore, Ltd., Worcester Foundry, Worcester.—An illustrated catalogue of cast-iron work, including feeder pillars, transformer kiosks, lamp standards, frames and covers, &c.

"Underground" Advertising.—The "Underground" combine continues to publish fresh pictorial posters advertising its system and adding to the appearance of its stations, &c. We have received a copy of the latest of these posters depicting a highly-coloured animal, which we understand to be a *Cercopithecus Mona*—the object being to entice travellers to go to the "Zoo" by the electric railways.

The Empire Exhibition at Wembley Park.—We are not yet provided with much information respecting the progress made with the arrangements for the electrical exhibition which is to take place at Wembley Park in 1924. More activity is apparent with regard to the shipbuilding, marine, mechanical, and general engineering sections, the organisation of which is in the hands of the British Engineers' Association. On Thursday last week the president of the B.E.A., Mr. N. G. Gwynne, and the Council of the Association paid a visit to Wembley Park to inspect the progress that is being made in the preparation of the site and the erection of the Exhibition buildings. Not unnaturally, this gives rise to comment on the part of some who have the general engineering invitation before them, but who wish to know the electrical details before they lodge their space inquiries with either committee. We hope to be in a position to publish something official on the subject before long, but in the meantime perhaps our readers can glean some information from the following quotation from the *Electrical Contractor* for July:—

"The year 1924 seems a long way off, but it is going to be such a busy time for the electrical industry that plans cannot be prepared too soon. The Institution of Electrical Engineers contemplates a National Electrical Convention in that year. 1924 was first thought of, but the postponement of the British Empire Exhibition induced the I.E.E. Council to choose the later year for the first big all-Association gathering. The contractors will have their part to play in that enterprise; and they will also, we hope, have some function to perform in the display which the electrical industry will make at Wembley. The British Electrical and Allied Manufacturers' Association has ambitious proposals for the letting of £100,000 worth of space, but it is doubtful whether contractors will find it worth while to occupy corners in that vast and heavy display of technical products. Had the B.E.A.M.A. schemed for some popular display which would boost the demand for electricity, contractors might have co-operated; but the authorities at Kern House appear to be confining their attention to the letting of space for "serious" exhibits and to the organisation of the First World Power Conference. The object of this Conference is 'to consider how the industrial and scientific sources of power may be adjusted nationally and industrially.' Delegates from all parts of the Empire will attend to talk about power resources, power production, research, technical education, and so on. It is magnificent, but is it business? There may be some deep commercial purpose behind this orgy of technical talk, but we fail to discern it. With all respect to our friends the manufacturers, could they not use their energies in some more direct way of stimulating the growth of British electrical industry?"

Austrian Imports and Exports.—Detailed statistics have been issued respecting the foreign trade of Austria in electrical manufactures in the first half of 1921. The figures are as follows, those for the corresponding period of 1920 being given for the purpose of comparison:—

	First half of 1920. Metric tons.	First half of 1921. Metric tons.
Imports—		
Dynamos and electric motors (except automobile motors)	247	459
Meters, &c.	20	66
Switches, contacts, &c.	86	131
Electric bulbs, &c.	66	173
Other electrical apparatus	143	177
Cables and insulated wires	23	29
Carbons for electrotechnical purposes	45	28
Other classes not specified	2	3
Total	634	1,070
Exports—		
Dynamos, electric motors (except automobile motors), and transformers	868	2,283
Telephones and microphones	21	189
Meters	50	93
Switches and contacts, &c.	68	144
Electric bulbs, &c.	352	674
Other electrical apparatus	385	1,053
Cables and insulated wires	230	541
Accumulators, with lead plates, and plates alone	293	366
Carbons for electrotechnical purposes	64	83
Total	2,317	5,430

The imports of electrical machinery and apparatus in the nine months ended with September, 1921, of which details are lacking, amounted to 1,545 metric tons, most of which was supplied by Germany and Czecho-Slovakia. On the other hand, the exports reached 7,996 metric tons, and were chiefly forwarded to Cezcho-Slovakia, Poland, and Jugo-Slavia.

The Scandinavian Market for Electrical Goods.—Mr. Norman D. Johnston, Canadian Trade Commissioner at Rotterdam, recently sent to the Department of Trade and Commerce at Ottawa a report on the market for electrical apparatus in Scandinavia. After briefly reviewing the situation in Denmark, Sweden, and Norway, he makes the following general observations:—

In general, it may be said that among those products in demand in Scandinavia are electrical motor accessories, household electrical articles such as irons, toasters, &c.; heating apparatus, electrical machinery of various kinds; material for the Government railways and power plants; equipment for the municipal light, heat and power plants; as well as all kinds of electric fittings and cables. Heating apparatus is coming largely from the United States and Switzerland, while Germany supplies most of the imported light fittings. In most of the electrical products it is very difficult to compete with the low German prices which are quoted on account of the low exchange value of the mark. A similar factor also applies in the case of those products manufactured in Norway and Sweden, where the currency is depreciated. It may, therefore, be said that until conditions become more normal, a large proportion of the trade which is not done by Scandinavian firms themselves will go to Germany. At the present time business in electrical products is not very good on account of the slump in trade, but it is very likely that there will be a large trade done in the future as there are uncompleted power, heating, and lighting schemes which will mean a demand for transformers, motors, and all kinds of machinery and cables, as well as lighting, cooking, and heating apparatus. Electricity is being used extensively, and the trade in all electrical products is likely to increase with the probable still greater use of electrical energy for domestic and production purposes.

Electrical Contractors' Associations.—At the annual meeting of the E.C.A. (Inc.), the N.E.C.T.A. and the N.F.E.A. held on June 21st, it was stated that the membership of these three associations continued to make progress, and was, at May 1st, as under:—

E.C.A.: Full members, 672; second members, 71. Total, 743.

N.E.C.T.A.: Full members, 532; second members, 61. Total, 593.

N.F.E.A.: Full members, 667; second members, 76. Total, 743.

Osram Delivery Service.—The General Electric Co., Ltd., has recently installed a fleet of motor lorries at its Osram G.E.C. Lamp Works, Brook Green, Hammersmith, in order to render its delivery as efficient and up to date as possible. These vehicles, which were built by the Associated Equipment Co., are used for collecting raw materials from the docks, and crates of lamp bulbs made at the Leamington Glass Works from the railway terminus; but their main employment is in delivering consignments of Osram lamps

direct from the works to customers' premises in the London area and to railway stations and docks in the case of country and export orders. Large stocks of all standard lamps are held at Hammersmith, and, with the new lorry service, the prompt delivery of orders will be assured.

Copper and Lead Prices.—Messrs. James & Shakespeare report, July 19th: Copper bars (best selected), sheet and rod, no change; English pig lead, £26 15s. (£1 decrease).

The Austrian Electrical Industry.—The report of the Austrian Siemens-Schuckert Co. of Vienna states that, notwithstanding the economic crisis, it was possible to provide adequate occupation for the works and also obtain orders through the cultivation of new connections. Thus, for instance, the company participated in the formation of a Jugo-Slav company which has branches in Belgrade, Zagreb, Laibach, and Serajevo, and has already received noteworthy orders. In addition, the electrification of some lines of the Austrian State railways was asserting itself. As to the present year, the report states that the early months were quiet, but the sudden fall in the German mark rendered it difficult to compete. The costs of production in Austria, owing to the general inland costliness, have in part considerably exceeded the German sale prices, but there are no signs of a crisis in production or sales. It is hoped to receive orders from the State and others in connection with the erection of public hydro-electric works, although these will be unable fully to occupy the works. In every case a serious price contest with German competitors is impending, as the sale prices of the latter only slowly follow the depreciation of the mark. The net profits are returned at 40,800,000 crowns for 1921, permitting of the payment of a dividend at the rate of 20 per cent.

Poland as a Field for Enterprise.—A memorial has been published by the Union of Polish Electrical Works stating that the electrification of the country will be impossible under existing conditions without having recourse to the co-operation of foreign capital. Apart from Upper Silesia, the number of supply works in Poland proper is 350, but only about fourteen can be considered as large works, as, for instance, those at Warsaw, Lodz, Sosnovice, and Cracova. Most of the works are in the hands of private companies working under municipal concessions. The average annual consumption per head of the population is stated to be merely 10 kWh, as compared with 170 in Germany, 240 in Switzerland, and 380 kWh in the United States. As the existing electrical manufacturing works have not reached a high stage of development, most of the machinery and plant has to be procured from other countries, which is now a very difficult matter owing to the very low level of Polish exchange.

The country possesses adequate resources for the production of electrical energy. These include pit coal in the districts of Dombrowa, Cracova and Upper Silesia; water power in the Carpathians capable of yielding 3,000,000,000 kWh per annum; petroleum, natural gas, lignite, and peat. It is calculated that a capital of 39,000,000 dollars would be required to defray the cost of the construction of works adequate to meet present requirements, including tramways, the absence of which is keenly felt in many towns; and 60 per cent. of the expenditure would apply to machinery and accessories. In conclusion, the Union complains that the Government has not yet taken any steps to make known in the West the great sphere of activity which Poland offers to private initiative.

Annual Outings.—Messrs. Robson & Coleman, of Newcastle-upon-Tyne, held their annual excursion on Saturday, July 8th, the staff and employés and friends, to the number of 75, proceeding by train to Corbridge, where lunch and tea were served at the Angel Hotel. The weather was not favourable, but the premises of the local rowing club were available. Vocal and instrumental selections were given by Messrs. Mitchell, Turpin, Chambers, and Aitchison. Between the showers, sports were indulged in, comprising skipping and potato races for the ladies and tug-of-war and quoits for the men. After tea Mrs. Robson presented the prizes.

The staff of the South Wales Electrical Power Distribution Co.'s station at Upper Boat, Treforest, held its annual outing on Saturday last to Weston-super-Mare. Mr. W. A. Chamen, managing director of the company, and Mrs. Chamen accompanied the party. Mr. Chamen presided at the luncheon, and several of the staff testified to the mutual good feeling maintained by the company and its staff.

E.D.A. Activities.—The Association, in continuation of its electric fan "campaign"—which the weather is not at present aiding—has published a short history of the fan from the earliest days of mankind (E.D.A. 284), through Egypt, China, and Babylonia and mediæval times, culminating in the development of the electric fan, which does its work without inconvenience to someone else. The pamphlet is artistically produced and includes two illustrations.

The Association has also issued a poster (E.D.A. 278) bearing the heading "Use Electric Power and Your Costs Will Fall," and showing the collapse of a chimney stack—symbolising the end of waste.

Wages in the Plymouth Electricity Department.—The note on this subject in our last issue (p. 52) ended with the words "proposed amendment." The last word was used in the sense of "reform," and did not imply an amendment to the resolution previously mentioned, which, couriously enough, embodies the "amendment" in question.

German Reparations in Kind.—The following resolution passed by the Executive Committee of the F.B.I. at its meeting in London on July 12th was forwarded to the Prime Minister by Col. O. C. Armstrong, D.S.O., the president of the Federation of British Industries:—"In view of the present position respecting the questions of reparations and German exchange, the Federation of British Industries desires to reiterate the request submitted to the Prime Minister on December 19th, 1921, that H.M. Government should not commit themselves to any step for modification or revision of the existing arrangements until industry, which is more vitally affected than any other section of the community by the reactions of these problems upon the world's economic system, has been given an opportunity of expressing its views. The Federation is especially concerned that the credit of the country shall not be definitely pledged for the purpose of rendering financial assistance to Germany until such consultation shall have taken place."

We read in the F.B.I. *Bulletin* that this resolution was put to the committee on the proposal of Sir Peter Rylands.

A Six Months' Review.—The *Board of Trade Journal*, in the course of an industrial survey of the first half of 1922, refers as follows to the engineering and hardware trades:—"The long drawn out dispute in the engineering trades came to an end on June 13th, after 13 weeks' stoppage. The trade outlook is still bad for some branches, but others have substantial accumulations of orders to start on. The outlook is very poor for those sections connected with shipbuilding. The electric and motor industries are said to have good prospects, while the textile machinery trades are booked up with orders for months ahead. The extensions of the London Electric Railway, the decision of several other railway companies to make substantial additions to their locomotives and rolling stock, and the Indian Railway programme, should materially benefit important sections of the industry. It is not, however, expected that the revival of trade will be rapid or that unemployment for some time to come will be other than severe. There will probably have to be some further reduction of costs before confidence in present values is assured. In this connection it is to be noted that engineering employers are now pressing for a reduction of the bonus of 26s. 6d. per week. Until this question is settled there is bound to be some hesitation in placing orders. Hardware manufacturers have been passing through an unhappy time but, with the liquidation of stocks, the outlook is said to be improving. While the machine-tool trade has suffered from the disposal of Government stocks, the demand for small and hand tools has improved. Rustless iron and steel products and stain-resisting nickel goods are in good demand. The cutlery trades on the whole are slack, and the pen and pocket-knife branches continue to find German competition difficult to meet."

Our Foreign Trade.—June Figures.—The following were the values of imports and exports of electrical goods and machinery during June, 1922:—

	June, 1922.	Inc. or dec.	Inc. or dec. 6 months, 1922.
Imports—	£	£	£
Electrical goods and apparatus ...	89,784	−101,675	623,630
Machinery ...	664,747	−118,617	2,080,840
Exports—			
Electrical goods and apparatus	519,911	337,279	3,961,120
Machinery	2,321,902	2,063,228	15,146,710
Re-exports—			
Electrical goods and apparatus	7,731	− 6,354	38,668
Machinery ...	75,400	26,682	−101,118

The Engineering War Bonus.—As the result of further discussion on Tuesday between the Engineering Employers' Federation and the Unions, the representatives of the latter decided to submit the proposals for bonus reductions in three instalments of 5s. 6d. each to a ballot of their members, to be returnable by July 28th.

Lamp Contracts. The English Electric & Siemens Supplies, Ltd., has received a contract for the supply of Siemens Britannia metal-filament lamps for six months to the Booth Steamship Co. The Great Northern Railway Co. has accepted a tender for the supply of Siemens Britannia lamps for train lighting.

The Woman's Exhibition.—The exhibition organised by the *Daily Express* opened at Olympia on July 12th and will continue until the 29th. Several electrical firms have exhibits, and we propose to give some details of these in our next issue.

British Industries Fair (Birmingham).—We have received from the General Manager of the Birmingham section of the British Industries Fair an advance prospectus of the arrangements for the next display which will be held from February 19th to March 2nd, 1923. This indicates that the exhibition will follow closely the lines of this year's show, there being eleven groups: Brassfoundry, hardware, and ironmongery; metals; construction, building, and decoration; power, lighting, heating, cooking, and ventilating; engineering; agriculture; mining; motors, motor-cycles, &c.; guns, saddlery, harness, &c.; brewing, distilling, and catering; and services (*i.e.*, journals, trade organisations, &c.). The registered office is at the Chamber of Commerce, 95, New Street, Birmingham.

Falco-Hotpoint Co-operation.—The annual meeting of the Falkirk Iron Co. was held last week, when a dividend of 10 per cent., less income tax, was approved. The chairman (Mr. R. W. Kennard), in his speech, stated that the accounts showed satisfactory trading, with a reasonable profit and a strengthening of their already sound financial position. In alluding to the electric heating and cooking side of the business, the speaker said the situation in this country was such that before manufacturers could expect a demand that would make it worth while developing manufacture along the lines upon which it should be developed, a great deal of expensive propaganda must be undertaken to bring home to the public the advantages arising from the domestic applications of electricity. The company had just concluded arrangements with the Hotpoint Electric Appliance Co., London, under which the Falkirk Co. would be free to concentrate their energies on the manufacturing side, leading the Hotpoint Co. to apply its selling organisation and propaganda to the distribution of both "Falco" and "Hotpoint" specialities. This combination of effort (to which brief reference was made in our last issue) would be of much benefit to both the trade and the public; the Falkirk manufacturing facilities and development work, together with the Hotpoint experience and power to sell, would enable them to put the British-made article on the market at lower prices than the smaller outputs in the past would permit; this should result in increased sales, and there was no question that many of the largest distributors, appreciating the necessity for domestic electric apparatus being absolutely reliable, had refrained from adopting apparatus whose only claim was that of low price. Exhaustive experiments had been carried out by their electrical department, and they hoped shortly to place on the market a cooker which would revolutionise present methods of cooking by electricity, both for domestic and restaurant work.

The A.E.U.—The membership of the Amalgamated Engineering Union has dropped from 440,000 to 394,000 during the last 12 months, and there has been a shrinkage of between 7,000 and 8,000 members alone during the past month.—*Birmingham Post.*

The Trade Position.—In a speech recently delivered at Newcastle, Mr. Stanley Baldwin, President of the Board of Trade, said that the position of Europe to-day was very grave, and the position of Germany was very grave. With regard to our own position he was more hopeful to-day than he had been the last three years, and for this reason—that he believed that all classes of the community realised as never before the need for peace and for common working together. They had also to-day a slow but steady and real improvement in the trade of the country. That did not mean that many industries were not suffering badly, but, taking the country as a whole, things were better and were slowly getting better, but we had yet a long lane before us, and it would require all our courage, doggedness and perseverance to carry us through to the prosperity we hoped to attain.

Engineering Trade in Australia: A Serious Situation.—*The Industrial Australian*, in a recent issue, refers to the serious position of engineering trade in New South Wales as follows:—"Many of the engineering firms throughout New South Wales during the past few months have been compelled to close down their works owing to the slackness of trade. In consequence, there is considerable unemployment in the industry. A conference was held recently between representatives of the Metal Trades Employers' Association and the Amalgamated Society of Engineers, for the purpose of discussing the position, and, if possible, arriving at some scheme that would materially reduce the number of unemployed, and which would also enable the employers to carry on their businesses. The conference sat until a late hour, and at the conclusion of the proceedings it was stated that an agreement had been reached between the parties. The employers contend that there is an urgent need for a simplification of the industrial arbitration procedure. At the conference the union's representative put forward a proposal to the effect that an increased tariff on imported goods would enable local industry to be carried on, provided that the employers would be satisfied with reduced profits. However, the union delegates were opposed to any scheme that would mean a reduction in wages or an increase in hours."

Annual Sports.—The Sports and Athletic Club of Messrs. J. H. Tucker & Co., Ltd., of King's Road, Tyseley, Birmingham, announces that the annual sports meeting will be held on Saturday, July 29th. In addition to the usual contests for the cups presented by the directors, there will be a number of open events, and a cordial invitation is extended to all friends who can find it possible to attend. The meeting will be held in the sports ground at the rear of the factory in King's Road.

Model Electric Bakery.—It was reported at a meeting of the Swansea Master Bakers' Exhibition on July 14th that certain of the members had been acting in an advisory capacity to Mr. J. W. Burr, the borough electrical engineer, in the setting up of a complete model electric bakery at the electrical exhibition at Swansea in October next. It was the intention to put down a complete electrical plant, and offers had already been received from manufacturing firms for its supply.

Holidays.—The works of the London Electric Firm, Brighton Road, Croydon, will be closed from August 4th to 14th for the annual holidays. A small staff will be present to attend to urgent business.

For Sale.—By direction of the Disposal Board, Messrs. Bradshaw, Brown & Co. will sell by auction at Woolwich Dockyard, on August 15 and following days, wireless material and electrical equipment. 100-200 electric lamp standards are being disposed of by the Corporation of Edinburgh. (See our advertisement pages to-day.)

Book Notices.—The *Journal* of the Junior Institution of Engineers, Vol. xxxii, Part 10, July, 1922. London: Percival Marshall and Co. Price 2s. net.—The Gustav Canet lecture on "The Railway Act, 1921," by Sir Eric Geddes, G.C.B., &c., is reproduced in this issue; and "Notes on Hardness Testing," by R. K. Innes, also appear. Other proceedings recorded are "lecturettes" on "Engineering Business in China" and "Gold Casting under Steam Pressure," as well as visits to works, &c, and reviews of recent publications.

"M. & C. Machine Mining," July. Glasgow: Messrs. Mavor & Coulson, Ltd. Price 6d.—This issue contains several articles of value to those who have to deal with mechanical and electrical coal-cutting machines. Arrangements have been made for the binding of the first volume which this number completes.

"National Physical Laboratory: Collected Researches." Vol. XVI, 1921. Pp. 359; diagrams and illustrations 318. London: H.M. Stationery Office. Price £1 net.—An excellently-produced collection of 21 papers describing research work carried out at the N.P.L. All the papers are reprinted from the journals of various scientific societies, and most of them are descriptive of work carried out in connection with metals and alloys. Three of them, however, deal with experimental work on ships and in connection with submarine warfare, while four of the papers are of an electrical nature. The last are entitled "The Study of Thermal Electromotive Force as an Aid to the Investigation of the Constitution of Alloy Systems, with an Appendix on the Peltier and Other 'Effects'"; "A High Temperature Electric Resistance Furnace"; "The Measurement of Electrical Conductivity in Metals and Alloys at High Temperature"; and "Time-Lag in Spark Discharge" respectively.

Technical publication (Ref. A/s1) of the British Electrical and Allied Industries Research Association, being "Directions for the Study of Electrical Insulating Papers (Untreated) for Purposes other than the Manufacture of Cables." Pp. 12; 11 illustrations. London: B. E. A. I. R. A. Price 7s. 6d.—Technical publication (Ref. B/s1), being "Directions for the Study of Hard Composite Dielectrics (Insulating Materials)." Pp. 11; 19 figs. Price 6s.—The contents of both the above publications are clearly indicated by their respective titles.

"Tests on Ranges and Cooking Appliances." By A. H. Barker, Wh. Sc., &c. (Fuel Research Board, Special Report No. 4). Pp. 55+17 figs. London: H.M. Stationery Office. Price 2s. 6d. net.—This report gives copious details of tests upon coal fires and ranges, together with comparisons with gas appliances. Electric cooking is not touched upon, but the results obtained may be useful to manufacturers of electrical cooking appliances as standards of comparison.

"Wireless for Australia."—Amalgamated Wireless (Australasia), Ltd., has issued a well-produced illustrated booklet in which an account is given of the extraordinary general meeting that was held at Sydney, N.S.W., on April 24th last, for the purpose of putting into operation the agreement which has been arrived at recently with the Commonwealth Government for the establishment of direct wireless communication between Australia and England. A general outline of the steps leading up to the agreement, a brief statement of what it consists of, and the company's immediate programme, are also included amongst other information.

"Engineering Abstracts from Current Periodical Literature." New series, No. 12. July, 1922. (228 pp.). London: The Institution of Civil Engineers.

LIGHTING AND POWER NOTES.

Aberdare.—Extension of Supply.—The Urban District Council has under consideration a scheme for extending the supply of electricity to Cwmdore, Hirwain, and Llydcoed. A detailed estimate of the cost of the undertaking is to be considered by a special committee.

Accrington.—Year's Working.—The accounts of the municipal electricity undertaking for the year ended March 31st, 1922, show a total revenue of £80,225, as compared with £76,776 in the previous year. Working expenses amounted to £45,548, as against £71,967, leaving a gross profit of £34,677 (£4,809). After payment of capital charges the net result was a profit of £13,790, comparing very favourably with a net deficit of £9,109 in 1920-21. The capital expenditure during the year was £29,397, the bulk of which (£26,872) was spent on account of a new turbine, boilers, condensing plant, converters, transformers, switchgear, &c. The total number of units sold fell from 8,962,083 to 7,946,852. The capacity of the station was increased from 6,000 to 7,000 kW.

Barnstaple.—Proposed Purchase of Undertaking.—The Lighting Committee has considered the offer of a syndicate to purchase the municipal electricity works, and it was agreed to open negotiations.

Burton-on-Trent.—Extension of Supply.—The Electricity Commissioners have sanctioned the Council's application to supply electricity to Brethy Colliery and to the Heathcote Pottery Co., Ltd., outside the area of supply of the Electric Lighting Order, 1890.

Ceylon.—Hydro-Electric Scheme.—According to *Indian Engineering*, a hydro-electric scheme is to be commenced in September this year. The centre of distribution is within 42 miles of Colombo and 150 miles from the furthest point in the island. The scheme will be divided into four stages. In the first stage, a basin will be constructed which will provide nearly 30,000 h.p. and will cost about Rs.15 millions. The second part will increase the power available to 10,000 h.p., and a fresh source will be tapped in the third stage, giving an additional 50,000 h.p. In the last stage an artificial lake will be constructed which will bring the output to 250,000 h.p. The estimated total cost of the scheme is Rs.70 millions.

Chesterfield.—Price Reduction.—The Town Council has reduced the price of electricity for lighting from 85 per cent. to 60 per cent. above pre-war charges, and for power and heating from 100 per cent. to 75 per cent.

Continental.—Esthonia.—A scheme is being promoted for the utilisation of the fall of the Narova river, which is expected to yield 70,000 h.p. According to a plan prepared by the Narwa Hüdro-Elektrijaama Projekteerimiscrüroo, it is proposed gradually to install six Francis turbines, each of 12,000 h.p., which will operate 6,000-V a.c. generators. It is intended to transmit about 55,000,000 kWh per annum to Reval at 110,000 V, the distance being 136 miles. The estimated outlay on the works will amount to 1,000,000,000 Esthonian marks, with an addition of 330,000,000 marks for the transmission line. The scheme is to be undertaken gradually, and a sum of 800,000,000 marks is required for the first instalment.

Darlington.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £31,731 to cover expenditure on plant, mains, &c.

Renfrewshire.—Extension of Supply.—The Strathclyde Electricity Supply Co. proposes to apply to the Electricity Commissioners for a Special Order authorising the company to supply electricity in parts of the parishes of Paisey, Eastwood, and Neilston.

Rochdale.—Interruption of Supply.—A complete interruption of not only the local, but also the general South-east Lancashire supply of electricity was caused by a rat at Passmonds, Rochdale, about 10 p.m. on July 11th. At that time a heavy short circuit occurred in one of the feeders of the supply station at Messrs. S. A. Heywood & Sons' works, Passmonds, which are supplied with power at 6,000 volts. On investigation it was found that a rat had gained access to an e.h.p. switch, causing a short circuit across the terminals. This resulted in the destruction of the switch and the consequent interruption of the supply. As under existing arrangements the Rochdale undertaking is linked up with the Lancashire Electric Power Co.'s supply system at Outwood, Radcliffe, the effect of the disturbance was felt immediately both there and in many of the South-east Lancashire towns, even, in fact, as far as Wigan. The supply was quickly restored.

Special Electricity Orders.—Confirmations.—The Minister of Transport has confirmed the following Special Orders made by the Electricity Commissioners:—Kilmarnock (extension); Kirkintilloch and district; Preston; Renfrew and district; Alderley and Wilmslow; Isle of Wight; Atherstone and district; Cookham; St. Mellons and district.

Surbiton.—Plant Extensions.—Messrs. Callenders are about to make extensions to their central generating station, and propose to take a bulk supply of electricity, which will involve a change from direct to alternating current. New plant is to be installed at an approximate cost of £20,000.

Thrapston.—Electricity Supply.—The Urban Council has referred to a committee the question of establishing electricity works for the town.

Urban Electric Supply Co., Ltd.—Special Order.—The Electricity Commissioners have granted a Special Order to the company, which so amends a number of local Orders as to provide that the company, the local authority concerned, or not less than twenty consumers, may, every three years from the date of the Special Order, ask for an inquiry by the Minister of Transport with a view to the alteration of the prices charged.

Wakefield.—Price Reduction.—The Electricity Committee has recommended that the charge for electricity to ordinary power consumers be reduced by taking 20 per cent. off the war increase.

Extension of Supply.—The Council has decided to extend its electricity supply to Alverthorpe, and Sandal, and application is to be made to the Electricity Commissioners for sanction to the borrowing of £5,000 for mains.

Weymouth.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £1,000 for mains extensions.

Whitehaven.—Loans.—The Town Council has applied for loans of £1,000 for mains and services, and £980 for public lighting.

Wolverhampton.—Price Reduction.—The Town Council has reduced the charge for electricity for lighting, power, and general supplies, other than flat-rate lighting supplies, from 115 per cent. to 90 per cent. above pre-war charges.

TRAMWAY AND RAILWAY NOTES.

Continental.—Spain.—A new electric railway has recently been completed and put in operation between La Coruna and Sada, a distance of about 12½ miles.

Croydon.—Year's Working.—The report upon the tramway undertaking (manager: Mr. T. B. Goodyer) for the year ended March 31st last records a total revenue of £181,737, as compared with £178,772 in the previous year. Working expenses totalled £163,715, as against £183,387, leaving a credit balance of £18,022; in 1920-21 there was a gross deficit of £4,615. Capital charges absorbed £14,767, and the net result was a profit of £3,255, carried to reserve. The sum of £2,891 was spent from reserve on a new feeder cable, leaving a balance of £364. The net deficit in the previous year was £19,611. There was a decrease of 11 per cent. in the number of car-miles run, the figure being 2,340,093, and the passengers carried (24,976,440) decreased by 7 per cent. A table of comparisons given in the report shows that the gross expenditure per car-mile was 16.79d. in 1921-22, as against 7.404d. in 1913-14. The revenue per car-mile has increased in a greater ratio, the figures being 7.52d. in 1913-14 and 18.63d. in 1921-22. The number of car-miles run in the past year was considerably below the pre-war figure.

Heywood.—Year's Working.—The annual report on the working of the tramway undertaking (manager: Mr. H. C. Day) for the past year shows a total income of £23,457, as compared with £25,901 in the previous year. Working expenses amounted to £21,959 (£22,125), leaving a gross profit of £1,497 (£3,775). After deduction of capital charges there was a net loss of £2,431. In the previous year there was a loss of £311.

London.—Moor Lane Fire Inquiry.—The inquiry concerning the recent fire at the electric sub-station of the Metropolitan Railway Co., at Moor Lane, City, was concluded before Dr. Waldo, the City Coroner, on July 18th, when the jury returned a verdict that the fire was caused by an electrical fault in a transformer. They added a rider that the spread of the fire was due to the absence of sand or other fire extinguisher, and that the fire brigade should have been summoned very much earlier than was done. In summing up, the Coroner said that 45 minutes of valuable time had been wasted before the fire brigade was called. When a police constable first suggested that the brigade should be called an official told him "it was more than he dare do."—*Morning Post.*

Northampton.—Year's Working.—The results of working of the Corporation tramways for the year ended March 31st last were as follows, the previous year's equivalents being given in parenthesis:—Total revenue, £72,519 (£75,058); working expenses, £56,312 (£71,155); gross profit, £16,177 (£3,903); net result, £5,792 profit (£5,232 deficit). Car-miles run, 749,268 (797,207); number of passengers carried, 10,534,713 (11,375,160).

Pontypridd.—Sunday Services.—The Rhondda Tramways Co. has come to an agreement with the Council, whereby the company will run its cars over the Council's track between Treforest and Pontypridd on Sundays. £500 per annum is to be paid to the Council for the use of the track.

Sunderland.—Year's Working.—The report of the general manager of the Corporation tramways (Mr. A. R. Dayson) records a total revenue of £138,821, as compared with £158,165 in the previous year. Working expenses decreased to about the same extent, from £136,668 to £118,156, leaving a gross balance of £20,665 (£21,497). The balance of net revenue carried to appropriation account was £8,757 (£8,017). This extinguished the 1920-21 deficit brought forward, and the balance was used for loan repayment and renewals fund. The number of car-miles run decreased from 1,647,618 to 1,481,755.

Wolverhampton.—Year's Working.—The annual report of the general manager and engineer of the municipal tramway department (Mr. C. Owen Silvers) for the year ended March 31st last shows a total income from all sources of £121,096, comparing with £126,294 in the previous year. The working expenditure was £94,417, as against £107,458, leaving a gross balance of £26,679 (£18,836). Decreases were shown in the cost of power, wages, and maintenance costs. Interest and other capital charges absorbed £21,685, and there was a credit of £1,124, giving a net result of £6,118 profit, as against £2,954 in 1920-21. The motor-omnibus accounts recorded a net profit of £1,181. The number of passengers carried on the tramways showed a considerable reduction from 19,370,676 to 15,691,440, although the car-mileage remained at about the same level.

TELEGRAPH AND TELEPHONE NOTES.

Austria.—Wireless Telegraphy.—The Chief Committee of the Austrian National Council, on July 13th, approved the decision of the Cabinet to grant to Marconi's Wireless Telegraph Co., of London, a concession for a wireless service between Austria and foreign countries. An Austrian joint stock company must be formed within six months by the Marconi Co., whereupon the concession will be automatically transferred to the former company, says the *Morning Post*.

The Austrian Government, says the *Financial Times*, will participate to the extent of 30 per cent. of the capital, and a group of Austrian banks will co-operate with the Marconi Co. in founding the Austrian Co. This concession was obtained against very strong competition on the part of the Berlin Telefunken Co.

The London Marconi Co. will subscribe more than half the capital, says the *Daily Mail*, and will erect two transmitting stations and three receiving stations near Vienna and one control station in the centre of Vienna, and hand them over ready for use to the Austrian Marconi Co. The concession confers the exclusive right of conducting public wireless services between Austria and all other countries for a minimum period of thirty years.

The Marconi Co. will take over the Austrian Government's existing wireless stations at Deutschaltenburg and Laaerberg, and will modernise them so that they will be capable of handling 150 words per minute. The rates for messages will be the same as those charged for telegrams by wire.—*Reuter*.

Australia.—Wireless Telegraphy.—The Federal Government's life hung in the balance for a few minutes in the House of Representatives on July 14th. The agreement with the Amalgamated Wireless Co. to provide direct wireless communication with Great Britain was challenged by the Labour Party over the appointment of Sir Thomas Hughes, formerly Lord Mayor of Sydney, to the Joint Board. The company and the Government have each three directors. They were unable to agree on the seventh, and the arbitrator, under the agreement, selected Sir Thomas Hughes, chairman of the Amalgamated Wireless Co., thus giving the company a majority on the directorate, though the Government holds the controlling interest. The Labour Party forced the Government to decline to accept the appointment, and then asked for the adjournment of the debate. Mr. Greene, who is in charge of the House in the absence of the Prime Minister through illness, saw that resistance was perilous, and gave way.—*The Times*.

Senator Pearce outlined in the Senate, on July 11th, the Government's new proposals for assisting the development of the Northern Territory of Australia. The Commonwealth Government is convinced that the Territory must be treated as pastoral, but that the isolation must be broken down by the establishment of prompt and effective communication. Negotiations have been opened with the Australian Amalgamated Wireless Co. to install wireless telephones with a central station capable of communicating with the different holdings. —*The Times*.

Government Manufacture of Telephones. The Commonwealth Government proposes to utilise a section of its Lithgow small arms factory for the manufacture of telephones.—*Reuter's Trade Service*.

Germany. Telephone Extensions. The Inter-Allied Commission has had to make strong representations to the German Government against a scheme which it found was being undertaken for the transformation of the German trunk telephone system from overhead to underground lines. The Germans pleaded that this was a necessary outlay, because it would so much improve the efficiency of the service. To this the Inter-Allied Guarantee Commission has replied that until Germany has paid her foreign debts such a lavish outlay on her part would be totally unjustified, says the *Daily Mail*.

The French Press draws attention to the vast public works now being carried out, or about to be carried out, in Germany. In the German Budget for 1921-22 no fewer than 2,320,000,000 marks are provided for new construction, says the *Lyonnay Neues*, of which 1,116,000,000 marks are for the extension of the telephone system, with an additional 600,000,000 for underground cables.

Holland. New Telephone Cable.—The long-awaited telephone cable between Britain and the Netherlands has been laid. It was landed by a British cable ship near Dornburg, on the Dutch coast, on July 8th, after considerable difficulty, owing to bad weather. The cable is 100 miles long, and was laid by the Eastern Telegraph Co.

Japan.—Wireless Telegraphy.—Representatives of some ten leading shipping and business houses are planning the promotion of a wireless company with a capital of 200,000,000 yen for the improvement of transpacific communication. The preliminaries are now being negotiated with the Government. —*Reuter's Trade Service* (Tokio).

It is learned in New York financial circles that the company is to be an American-Japanese one, says the *Financial Times*.

South Africa.—Wireless Broadcasting.—The Union Government has approved of the Post Office receiving applications for the establishment of broadcasting wireless telephone services. The circulation of advertising matter and commercial traffic is, however, not to be permitted, says *The Times*.

Wireless Telegraphy.—The Marconi Co. has submitted a scheme providing for the formation of a South African wireless company, with a capital of £500,000, four-fifths to be subscribed in London and the remainder in South Africa. The company undertakes to construct and work a station out of range of gunfire from the sea, capable of communicating direct with England, India, China, Australia, the United States, and South America.—*The Times*.

According to the *Morning Post* it is proposed that the Government shall have the right to purchase the new undertaking after 10 years, and that in the case of an emergency, the Government will take control of the new station. The proposed rates are to be 6d. per word for a full-rate message; 8d. per word for deferred and Government traffic, and the Press rate to be 2½d. per word. The Marconi Co. is to arrange for a suitable corresponding station in the United Kingdom, to place at the disposal of the S.A. Co. all patents, &c., and to guarantee a 10 per cent. improvement in the daily service over the Australian guarantee, which is for an uninterrupted service for 300 days yearly, with a minimum of 12 hours per day. It is reported that the South African Government's technical adviser has reported favourably on the scheme, which is independent of the proposed Imperial P.O. chain of stations.

Mr. C. F. Elwell, of London, who arrived at Capetown on July 18th, is submitting to the Union Government a scheme which the *Morning Post* describes as an alternative to Marconi's offer. He states that his firm is willing to furnish, erect, and hand over in complete working order, within twelve months from the date of receipt of the order to proceed, a high-power station, including 820-ft. masts and Poulsen arc generators sufficiently powerful to guarantee a service of twenty-five words per minute for not less than twelve hours a day, and for not less than 350 days in the year, for a sum not exceeding £150,000. A more powerful station could, if necessary, be built, comprising twice as many towers and more powerful arc generators, for a sum not exceeding £200,000.

The Telegraph Service.—Underground Cables in Scotland. —On July 17th, in the House of Commons, the Postmaster-General was asked whether, in view of the delays to business occasioned in Scotland, north of Edinburgh and Glasgow, by breakdown through storm in the overhead telegraph trunk system, he would now proceed to have the system put underground with the view of remedying this defect at an early date, and at the same time providing work for the unemployed.

Mr. Pike Pease (Assistant Postmaster-General) said that the provision of underground cables between Edinburgh or Glasgow and the North of Scotland would involve heavy expenditure, and could not be undertaken at present. He fully appreciated, however, the importance of electrical communication to the fishing and other industries in the north of Scotland, and he had under consideration the questions of specially strengthening one of the overhead routes, and of providing a wireless service between Stonehaven and a station in the south for use in emergency.

Wireless Telegraphy.—Imperial Chain.—In the House of Commons, on July 13th, in reply to a question, the Postmaster-General said the Government had further considered the question of the Imperial Wireless Chain, and had decided to erect in England a station of the ultimate power (240 kW) contemplated by the Expert Commission, instead of the smaller power (120 kW) which it proposed should be used in the first instance. This station would provide especially direct commercial communication with India, South Africa, and Australia. In India the Imperial Government would erect and the Indian Government would work a station also capable of direct communication with England, South Africa and Australia. As a corollary of this decision the proposed second station in Egypt and the station in East Africa would be deferred, and the erecting of stations at Singapore and Hong Kong would be reconsidered. Experts of the Canadian Government were expected to reach England very shortly in order to discuss the participation of Canada in the scheme, says *The Times*.

Communication is proceeding with the Union Government as to the station in South Africa, and the *Daily Express* points out that the decision to make the "steps" of the chain 4,000 instead of 2,000 miles, as originally suggested, represents the end of a prolonged controversy regarding the ownership of means of Imperial communication between the mother country and British territory overseas, it having been decided that they shall be State-owned and State-operated. The daily Press reports that surprise is expressed in India at Mr. Kellaway's statement concerning the proposed Indian station, as it has been understood that the Imperial chain would consist of "steps" of 2,000 miles, and not 4,000, as now announced, while the Indian Government, for financial reasons, has been inclined to give the concession to private enterprise and an Indian company has undertaken to carry out the work on condition that it secures full Government control.

Developments.—When addressing the cadets at the Royal Military Academy, Woolwich, recently, Lord Cavan, Chief of the Imperial General Staff, referred to the heavy casualties among men burying telephone wires during the war, and said that the Army Council had decided that in future wars there would be no telephone wires from "division" to the front line; therefore officers should obtain a knowledge of wireless.

An interesting new type of aerial has been satisfactorily tested for the reception of long-distance wireless, which is nothing more than two pairs of wires suspended from telegraph poles by means of ordinary porcelain insulators. The aerial is eight miles in length, and is stated to give better results than one previously suspended between 320-ft. and 100-ft. towers. A similar aerial, just over a mile in length, is being used for reception at ship stations.

An advance in technique may be looked for as the result of a new type of microphone. The drum of the microphone is fitted with a coil which vibrates in sympathy with it, and being placed in a strong magnetic field, the vibrations create electrical impulses, which are carried by wireless in the usual way. The voice currents are stated to be remarkably true, and the reproduction of music highly successful.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Melbourne.—October 17th. Postmaster-General's Department. Automatic c.b. telephone equipment, with all associated equipment, including material for use at subscribers' premises. (Sched. 39 and 40.) (July 7th.)

September 27th. Telephone apparatus and parts. (Sched. 561.) (July 14th.)

Brisbane.—September 20th. Postmaster-General's Department. Supply and delivery of switchboard apparatus and parts. (Sched. No. 559.)*

Belgium.—July 27th. Municipal authorities of Schaerbeek, Brussels. 550 electricity meters for single-phase l.p. mains and 10 meters for h.p.

Suarlee (Province of Namur).—The municipal authorities are inviting tenders until July 29th for the establishment of a system of electricity distribution in the town.

Bishop's Castle.—August 5th. Installation of electric lighting in the Parish Church. (See this issue).

Brigham, Cockermouth.—July 25th. Electric light installation at the parish church. The Vicar.

Dublin.—July 25th. Electric and Public Lighting Committee. (a) Supply to Pigeon House Works of one Edwards air pump, with accessories and pipework; (b) supply and installation of one 210 h.p. 3-phase motor; (c) rewinding the stator of existing 210-h.p. 3-phase motor. Particulars and forms of tender from City Electrical Engineer, Fleet Street, Dublin.

August 1st. Corporation. Two sets electrically-driven sewage pumps for the Ringsend pumping station. Chief engineer, Castle Street.

France.—Paris.—August 2nd. Two electrically-driven travelling bridges for the sub-station of St. Germain-en-Laye and Chatou. Service Electrique, 43, Rue de Rome, Paris.

Horsham.—July 31st. Urban District Council. 1,000 yd. of l.p. 3-core .007 sq. in. paper-insulated, lead-sheathed, steel tape-armoured cable suitable for 660 V working pressure. 1,000 or 1,500 yd. of 2 core .007 sq. in. cable as above. The Electrical Engineer, Stanley Street, Horsham. (See this issue.)

India.—July 28th. High Commissioner's Department. Telephone switchboards and desk and wall sets. (July 7th.)

Liverpool.—July 24th. West Derby Union. Electricity supplies. G. W. Coster, clerk to Guardians, Union Offices, Brougham Terrace, Liverpool.

Manchester. — August 8th. Tramways Department. Supply of permanent-way special track work. Specifications and forms of tender from Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester. (Deposit £1 1s., returnable.)

Oxford.—August 15th. Oxford Electric Co., Ltd. One 1,000-kW turbo-alternator and condensing plant; and one 500-kW conversion plant (3,000 V, 3-phase, to 1,100 V, d.c.), complete with switchgear. (See this issue.)

Plymouth.—August 4th. Electricity Department. Transporter runway travelling trolley hoist. (July 14th.)

South Africa.—Grahamstown.—September 1st. Electric lighting plant and equipment, comprising steel poles, overhead wiring, house services, fuses, transformer switches, meters, street lamps, &c. Consulting engineer: Prof. W. Buchanan, 75, Louis Botha Avenue, Houghton Estate, Johannesburg.*

Tasmania.—Hobart. October 2nd. City Council. Tenders for 750-kW rotary converter and transformer and 550 volt, d.c. switchboard panel. Tenders are returnable at Hobart on October 2nd next, and particulars, which have been posted, are due to arrive at the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2, about the middle of August.

Warrington.—July 24th. Electricity and Tramways Committee. (a) Cast-iron circulating pipes; (b) steam pipes, feed tank, &c. Mr. F. V. L. Mathias, borough electrical and tramway engineer, Howley, Warrington.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Barnes.—Urban District Council. Accepted:—
Feeder cable (£3,490) Siemens Bros. & Co., Ltd.

China.—Peking Tramways. (Prices in gold dollars):—
Boilers (109,000).—Babcock & Wilcox.
Engines and generators (109,000).—Brown, Boveri.
Transformers (24,000) and overhead equipment.—Siemens-Schuckert.
Rails (295,000) and cars (55,000).—A French company, through the Anglo-French Corporation.—(Abstracted from *Electrical Engineering*.)

Faversham.—Town Council.
Underground cables (£555 10s.).—Pirelli-General Cable Works, Ltd.

India.—Karachi Electric Supply Corporation, Ltd. Accepted:—
Two 500-kW Diesel-driven flywheel alternators to the specification of Messrs. Handcock & Dykes:—
Engines (crosshead type).—Mirrlees, Bickerton & Day, Ltd.
Alternators.—Electric Construction Co., Ltd.
Contract price for the two sets, f.o.b. English port, £34,950.

Salop.—Education Committee.
Installation of electric lighting at Bishop's Castle secondary schools (£77 10s.).—Smallwood & Co., Shrewsbury.

Sunderland.—Town Council. Accepted:—
Temperature recording and indicating instrument for turbine.—Cambridge Scientific Instrument Co.
Tube cleaner.—Babcock & Wilcox.
Cable.—British Insulated & Helsby Cables, Ltd., and Pirelli-General Cable Works, Ltd.

Weymouth.—Town Council.
Electric lighting on the housing estate at Westham £188 10s. W. Smith & Son.

FORTHCOMING EVENT.

Eastern Associated Telegraph Companies. Monday, July 24th. At the Royal Botanic Society's Gardens, Regent's Park. Banquet, &c., and reception in celebration of the 50th anniversary of the incorporation of the companies.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week, we need the names of manufacturers or suppliers of:—

Victor switches.
Electropoise Birmingham refills.
Bracket switches resembling gas taps.

NOTES.

The Proposed Visit to Gennevilliers.—Great interest is being shown in our proposed excursion to the Gennevilliers power station, of which further particulars are given in this issue; provisional applications are flowing in at a gratifying rate, and in many cases are accompanied by interesting suggestions with regard to the programme. In addition to the charabanc tour through part of the "devastated area" proposed by Major Rich in our last issue, it has been suggested that the party should visit the new power station of the Usine Centrale d'Energie Electrique du Nord de la France at Comines, a super-power station which is nearing completion at Beuvry, and the large extension of the 80,000-kW power station at St. Ouen of the Compagnie Parisienne de Distribution d'Electricité; and one enterprising correspondent wishes to know whether arrangements can be made to fly to Paris. The visit is, certainly, in one sense, "in the air" as yet, though every day's mail strengthens the support that is being given to the scheme; it may be possible for some members of the party to adopt the aerial route, but we anticipate that the majority will prefer the more prosaic modes of transport.

The original proposal in our issue of July 7th, p. 2, was to leave London on Friday, September 22nd, with the Gennevilliers 200,000-kW power station as the main objective, and to return on Monday night, September 25th; those who could spare the time might extend the tour to include other new steam power stations, and the hydro-electric works at Grenoble. These are merely the tentative outlines of the programme; as shown above, other proposals are coming in, and

we shall be glad to receive further suggestions and comments from readers who are interested in the scheme, as well as provisional notices of intention to take part in the visit, which will, of course, in no way commit the writers to participation if for any reason they are unable to join the party.

The sooner we know how many are likely to go to Paris, the sooner we shall be able to submit a definite programme for their approval.

The Engineers' Club (London).—The first year of existence of the Engineers' Club is now approaching completion, and it is possible to survey its record over a sufficient period to warrant an opinion thereon. The club was opened on September 1st, 1921, at 39, Coventry Street, London, W.1, as the result of some nine months' efforts on the part of the promoters; a provisional committee was formed in January last year, and early in February it met and appointed an executive committee, which set to work with vigour, under the guidance of Mr. E. L. Hill as hon. secretary—without whose stimulating enthusiasm and untiring energy the project would never have been brought to fruition. At a general meeting of the supporters of the club on June 2nd, 1921, the proposals of the Executive Committee were unanimously endorsed. Mr. E. Manville being elected the first president. At that time the number of applications received from prospective members was over 1,700; not all of these, of course, matured, but nevertheless the membership is now double that figure, and is steadily increasing—the Committee hopes to reach a membership of 4,000 by the end of this year.

The Club is situated in a central position, close to Trafalgar



Photo. by [*Hames.*

Mr. Edmund L. Hill, M.I.Mech.E., M.I.E.E.
Hon. Secretary, The Engineers' Club (London).

Square, and is handsomely appointed in every respect; including the annexe, which was completely redecorated and refurnished in April last, it contains 74 bedrooms available for members, and the dining rooms can accommodate over 300 simultaneously; the latter have been in great demand for dinners and smoking concerts, the catering being recognised as unexceptionable. In connection with the Club, a golf circle, a chess circle, and a Masonic lodge have been organised; the golf circle has held four successful meetings, the Captain's prize (a silver cup presented by Mr. S. F. Corby) being won at Epsom on June 22nd by Mr. H. G. Ogden; while the President's prize (a silver cup presented by Mr. E. Manville, M.P.) will be played for in the autumn. A general meeting of all members—the first since the Club was opened—will be held early in October.

The office of President being held for one year only, Mr. Manville retires on August 31st, and the Committee, whilst gratefully acknowledging the indebtedness of the Club to him, announces that Sir Robert A. Hadfield, Bart., D.Sc., D.Met., F.R.S., M.Inst.C.E., has consented to take office. Members elected after June 30th will enjoy all the privileges of membership until August 31st, 1923.

There is no doubt that the Club has fulfilled its purpose, and has been a boon to engineers in London—including visitors from the provinces and overseas, who find it a haven of rest and a convenient rendezvous; moreover, it has been financially successful from the first, and may now be regarded as firmly established.

We have pleasure in publishing a portrait of the hon. secretary, Mr. Edmund L. Hill, M.I.Mech.E., the *genius loci*, to whom in very great measure the Club owes its existence. Mr. Hill is the youngest son of Dr. G. Birkbeck Hill, and therefore is a member of a very distinguished family, his brothers, Sir Norman Hill, Bart., and Sir Maurice Hill, G.C.B., having attained high distinction in the law as solicitor and judge respectively. He was educated at Haileybury, and received his engineering training in the L.B. & S.C. locomotive works at Brighton. His temperament has been described as "very dynamical," and accordingly after passing through the shops he transferred his energies to electrical engineering, founding the firm of Hill, Upton & Co., electrical engineers, at Oxford, which is still in existence under its original style. The next phase of his career was developed with the South Wales Electrical Power Distribution Co., where his literary talents had free play. Afterwards he became Messrs. Siemens's branch manager at Manchester, a post which he occupied for 10 years, and it was during this period that the Manchester Engineers' Club was successfully started. Mr. Hill was one of the founders, and for some years hon. secretary of this institution, which was the prototype of the London Club. In 1917 he became general secretary of the Federation of British Industries, and during his tenure of that office the membership of the Federation was increased from 400 to 1,200, a fact which bears testimony both to his personal charm and to the driving force of his character. In that capacity he greatly extended his already wide circle of friends—indeed, there are few men in the engineering industry who can lay claim to greater popularity, and certainly there is not one more admirably fitted for the post which he occupies. We print an effusion from one of his admirers, a strong supporter of both the Engineers' Clubs, which affords some indication of the esteem in which he is held.

The Pusher.—

There are some men who can't keep still,
And one of these is Edmund Hill.
His hobby, in the last few years,
Is making clubs for engineers.
In Manchester he tried his hand,
And the result is simply grand.
In London next they dragged him in,
And Edmund scored another win.
The British Trade Ship's now his toy,
So all his pals shout "Ship ahoy!"
In short, whate'er new stunt he tries,
It lives, the opposition dies.
So here's a tip for politicians,
Wee Frees, Die Hards and Coalitions.
Cut out Lloyd George and start anew,
Let Edmund pull the Nation through.

J. H. C. B.

London's New "County Hall."—The London County Council's new building, known as "The County Hall," has been growing since 1912, when the King laid the foundation stone, and was formally opened by His Majesty on Monday last, the 17th instant. It is within the area of supply of the London Electric Supply Corporation, and will be fitted with a 10,000-volt transformer sub-station having a capacity of 750 kW, connected with two extra-high-pressure feeders from Deptford; this will deal with the main lighting supply, which is distributed throughout the building on the three-wire system at 210/420 volts. There is a stand-by supply connected to the mains of the Westminster Electric Supply Corporation (with which a booster is put in circuit); the Council Chamber and main corridors will have some lamps connected to this supply. There is also a d.c. power supply (L.E.S.) at 460 volts, from which the lifts, ventilating fans, pumps, and other motors are worked.

The installation generally has been carried out by the builders, Messrs. Holland, Hannen & Cubitts, Ltd., through whom sub-contracts were entered into as follows:—For mains, cables and wires, Messrs. Pirelli-General Cable Works, Ltd., and Messrs. Hoopers; switches, Ediswan; lamps, Siemens; switchboards, Dorman & Smith; fittings, Faraday & Son, Osler, Galsworthy, Broomsgrove Guild, Davis-Cash, Best & Lloyd, General Electric Co.; lightning conductors, W. J. Furse & Co.; lifts, the Express Lift Co. and Messrs. Waygood-Otis; annunciators, The Express Telegraph Co.; electric clocks (of which 700 will be fitted), Messrs. Gillet & Johnston, Croydon; electric motors, Messrs. Crompton and Co.; whilst the Sterling Telephone Co. has supplied a specially designed system of electric bells for calling "divisions."

In a subsequent article some details will be given of the various items included in this brief summary; the installation represents thoroughly up-to-date practice in the electrical equipment of an important building.

(*Continued on page 94.*)

THE SUPPLY OF ELECTRICITY TO PARIS.

THE UNION D'ÉLECTRICITÉ AND THE POWER STATION OF GENNEVILLIERS.

Our highly-esteemed contemporary, *La Revue Industrielle*, has published, under the title "L'Union d'Electricité et la Centrale de Gennevilliers," a work by M. Ernest Mercier, general manager of L'Union Electricité, describing the circumstances in which the new power station was projected, the plant installed therein, and the methods adopted for supplying electricity to the metropolitan area. We have already, with the assistance of the journal above named and of the Union, described the generating plant, and the general arrangement of the power station (Electrical Review, April 14th, 1922), and we are now enabled by the courtesy of our confrères of *La Revue Industrielle* to reproduce a number of photographs and to give additional particulars regarding the undertaking.



Fig. 1.—The Power Station of Gennevilliers.

During the war, in France as in Great Britain, the imperative demands of the fighting forces for supplies of munitions necessitated an immense effort on the part of manufacturers which could only be sustained by the aid of electric power in unlimited amount; there, too, the war revealed the importance of electricity to industry as well as the defects of the existing organisation, which, in Paris as in London, was heterogeneous and to a high degree uncoordinated. Consequently, in 1918, the Ministry of Public Works set on foot a national scheme for the reorganisation of electricity supply, with a standard frequency of 50 cycles per second, and a vast network of mains interconnecting the principal generating stations.

There were at that time eight companies supplying electricity to Paris and its suburbs, besides two municipal refuse destructors leased to companies; the total capacity of the generating plant, in eleven power stations, was 426,000 kW (exclusive of the destructors), all two-phase or three-phase.

Early in 1919 the Union Française d'Electricité was formed to embrace all these undertakings and ultimately to arrive at a uniform standard three-phase supply, besides relieving them of the generation of electricity

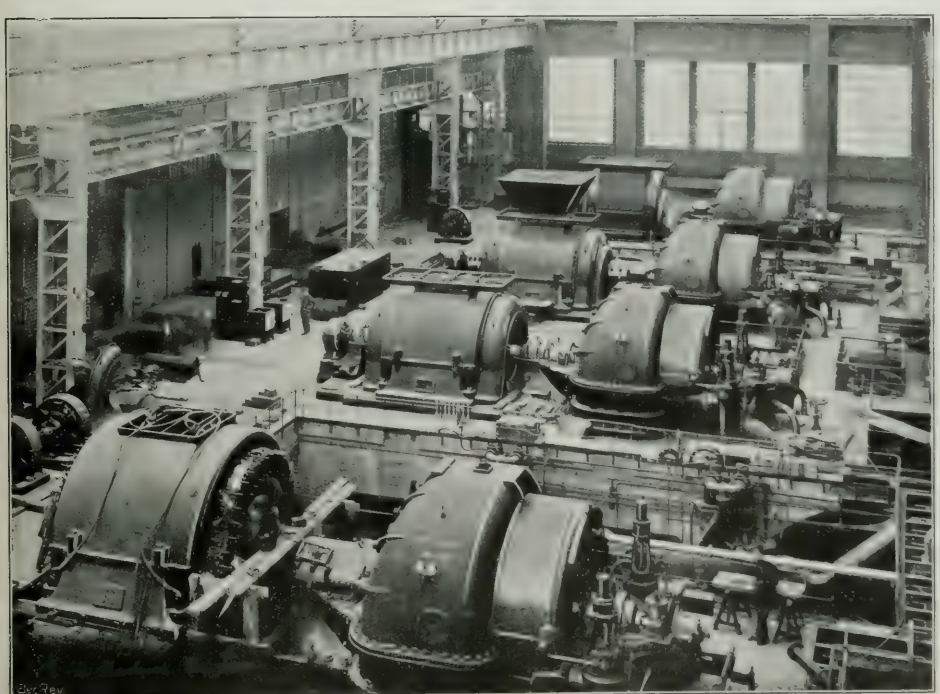


Fig. 2.—Interior of Turbine-Room

and paving the way to the future introduction of hydro-electric power. With the exception of the Compagnie

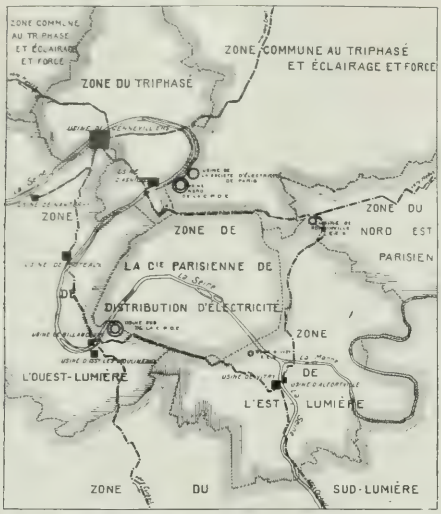


FIG. 3.—PLAN OF THE METROPOLITAN AREA.
The boundaries of the Secteurs are indicated by shade lines, the principal power stations by squares (Union) and circles (non-Union), and the routes of the 60,000-V mains by chain-dotted lines.

Parisienne de Distribution d'Electricité, which holds a concession from the City of Paris, and the Société d'Electricité de Paris, which supplies energy mainly to electric railways and tramways, and to the former concern, all the undertakings lent their support to the new programme. In the course of the year 1919 the Union Française amalgamated with, absorbed, or concluded agreements with the six companies, and, under the style of Union d'Electricité, assumed ownership of their power stations, shown as black squares on the accompanying plan (fig. 3), which also indicates in chain dots the 60,000-V network. Work was commenced on the new power station in the summer of 1920, and the first set was under test 18 months later, whilst extensions undertaken in the existing power stations resulted in the installation of more than 100,000 kW of turbo-alternators of the most modern type, to meet the increased demand for electricity. The distribution network, which is in course of construction, will be fed by the power stations of Gennevilliers (200,000 kW), Vitry (80,000 kW), Nanterre (20,000 kW), Issy-les-Moulineaux (31,000 kW), and Eguzon (40,000 kW, hydro-electric, in course of construction), whilst those at Alfortville, Asnières, Billancourt, and Puteaux, aggregating 152,000 kW, will be shut down as the new supply becomes available.

Overhead lines being impracticable, except in the outer districts, and the radius of distribution being 50 km., it was thought necessary to adopt the highest pressure for which underground cables could be made, namely, 60,000 V, which was chosen after most careful investigations had been carried on over a period of two years. Single-core cables were found to be safer and cheaper than three-core, and had the advantage that the actual pressure between core and earth was $60{,}000/\sqrt{3} = 35{,}000$ V, at which pressure thousands of kilometres of cable are operating satisfactorily. The three cables composing each feeder are laid together in contact, as shown in the section of the reinforced concrete trough (fig. 5). Joints are enclosed in lead sleeves filled with compound. The Merz-Price system of protection has been adopted, and the neutral point is earthed; telephone lines enclosed in the pilot cables connect the various sub-stations with the load dispatcher's office. The total length of the 60,000-V ring-main round Paris will be 125 km. The feeders have a uniform cross section of 150 mm.² per core, and carry a normal load of 30,000 kVA. The loss due to eddy currents in the lead sheathing is less than one-sixth of the corresponding loss in the copper, and the loss in the dielectric is about 900 W per km. of three-phase feeder.

The overhead mains are to radiate to Creil (55 km.), Mantes (45 km), Orléans (110 km.), and Meaux (40 km.), the total length being 250 km. The Paris-Creil line, illustrated in fig. 7 is complete; it consists of two 60,000-V three-phase lines carried on reinforced concrete poles, the conductors being of aluminium, of 150 mm.² cross-section. The Paris-Corbeil-Orléans line will form part of an extra-high-pressure system in connection with the hydro-electric works of Eguzon, on the Creuse, which will cost 38 million francs. Throughout, the ultimate supply of electricity from the Rhône, the Rhine, or the Massif Central, has been kept in view.

A general account of the power station of Gennevilliers having been given in our previous article, we need only supplement it with particulars not there included.

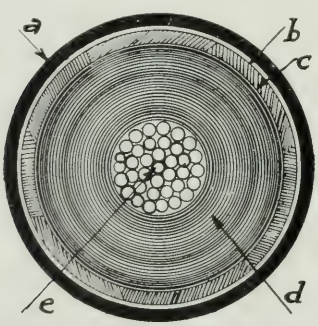


FIG. 4.—SECTION OF CABLE (ACTUAL SIZE).
a compounded hemp; *b*, tarred serving; *c* lead sheath; *d*, insulation; *e*, conductor.

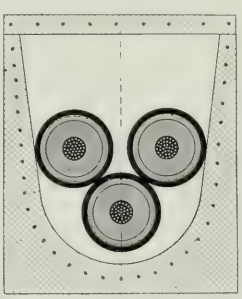


FIG. 5.—SECTION OF CONCRETE TROUGH AND THREE-PHASE FEEDER.

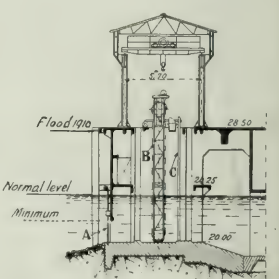


FIG. 6.—VERTICAL SECTION OF INTAKE.
A, coarse screen;
B, revolving screen;
C, safety screen.



FIG. 7.—PARIS-CREIL TRANSMISSION LINE, AT 60,000 VOLTS.

The site, comprised between the State railway from Paris to Rouen and the River Seine, is admirably situated for the supply of coal and water; barges of 1,000 tons can be berthed at the wharf, which is 160 m. in length, and can be extended to 400 m. The coal store is parallel with the river bank, measures 40 m. × 300 m., and can accommodate 60,000 tons of fuel, part of which can be submerged. The works can be extended in any direction, and a clear space of three hectares (7½ acres) has been reserved for the future terminal of the pro-

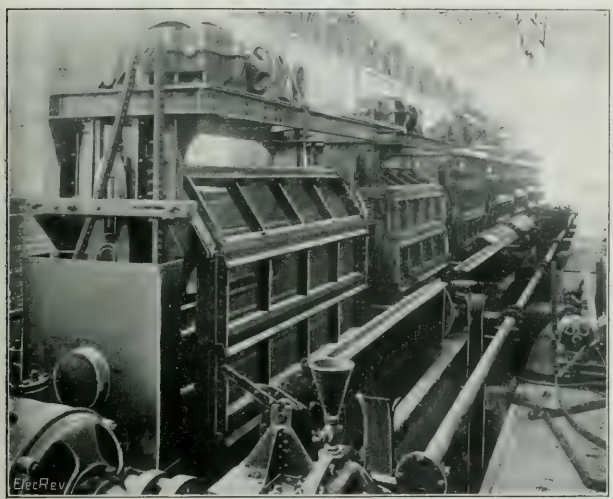


Fig. 8.—Revolving Screens.

jected 150,000-V lines from hydro-electric generating stations. The intake for circulating water is situated 130 m. up-stream from the discharge; the river is here 150 m. wide, and the quantity of water is sufficient to enable the works to run at full load (250,000 kW) for three hours without raising the temperature of the water more than 4 deg. C., even if the river were to stop flowing. At the intake mechanical screens are provided, as shown in fig. 6, in section, and in fig. 8, consisting of seven compartments provided with coarse movable gratings, revolving screens which are cleaned with water jets, and stationary screens which come into use when the revolving screens are being overhauled. The screens are driven by motors, and are housed in a building furnished with a travelling crane.

In designing the power station the engineers aimed at securing the maximum efficiency attainable without excessive complications, and the lowest cost without sacrificing reliability. The normal annual output within a few years will be 600 million kWh, and with coal at 60 francs a ton, a saving of 1 per cent. represents about 400,000 francs. With these considerations in view, the working steam pressure of 25 kg./cm.² (356 lb. per sq. in.) was chosen as the most advantageous for steam turbines, the thermodynamic gain due to higher pressures being counterbalanced by mechanical losses; the turbines, however, can give their full output with a pressure of 284 lb. The temperature of superheat was limited to 400 deg. C. by the properties of the materials used, and to provide a margin of safety the temperature at the stop valve was fixed between 350 and 375 degrees, which had been found quite satisfactory with cast-iron turbine casings at the Asnières works during several years.

For the turbo-generators the rating of 40,000 kW was suitable for the service conditions, especially the night load, and was considered the maximum consistent with reliability for single-cylinder turbines, running at 1,500 r.p.m. This output was found the best in point of economy, running cost, and initial outlay. The alternators generate at 6,000 V, but switchgear at that pressure was out of the question, and it was decided to couple each alternator directly to a transformer raising the pressure to 60,000 V. Consequently all the switchgear operates at that pressure, and presented no special difficulties of construction.

In order to cope with a wide range of fuel, a mixed boiler equipment was adopted—half the boilers of the Stirling type with Riley stokers, and half of the Babcock and Wilcox type with B. & W. stokers.

For the thermal scheme the Union surveyed minutely the various known arrangements, and adopted what appeared to be the best compromise between them in view of the requirements of economy, reliability, and simplicity. For this reason the auxiliaries are driven by electric motors fed from the main switchboard, but an adequate reserve of apparatus driven by separate steam turbines has been provided, and, in addition, two auxiliary turbo-generators of 3,000 kW each have been installed, either of which can supply sufficient power to maintain in operation the auxiliaries which are essential to continuity of service, or the whole of the auxiliaries required for the night load, when only one main generating set will be running.

The main turbines are bled at two stages, the steam extracted being used in auxiliary condensers to heat the

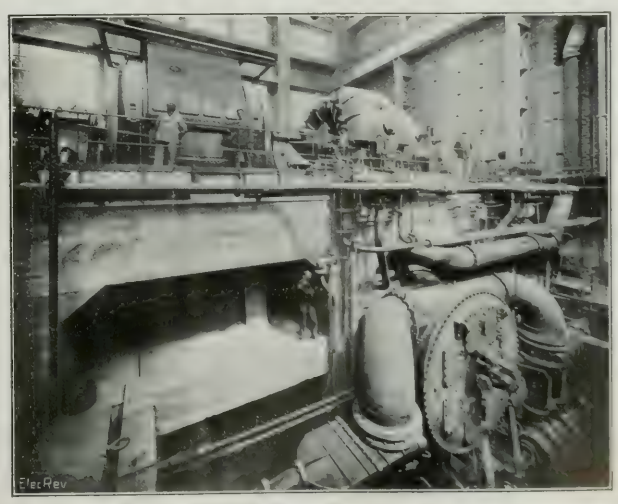


Fig. 9.—Condensing Plant.

condensate, and raising the temperature of the latter to 85 deg. C. at full load or 70 deg. at half load. The exhaust steam from some steam feed pumps, constantly

in operation, further raises the feed temperature to 100 deg., but special regulating devices ensure that this temperature is not exceeded, to prevent loss of heat. Entering the economisers at 100 deg., the feed water leaves them at about 160 deg., the heating surface being increased to suit this temperature range. Under these conditions the temperature of the gases leaving the economiser will be 220 deg., which is too high a value for enomomy; hence an air heater is installed at the economiser outlet, raising the temperature of the air for the furnaces to 90 deg., and lowering that of the waste gases to 150 deg.

No attempt was made to reduce the capital cost by parsimony of material or apparatus; but the concentration of power in large sets has led to notable savings in the civil engineering works, the pipe-work, the losses in piping, and the cost of its maintenance; in the same way the losses by radiation and the cost of upkeep of the economisers have been minimised by designing them so as to reduce their volume, and by erecting them above the boilers. Similarly the circulating water channels, which in a station of this magnitude reach large

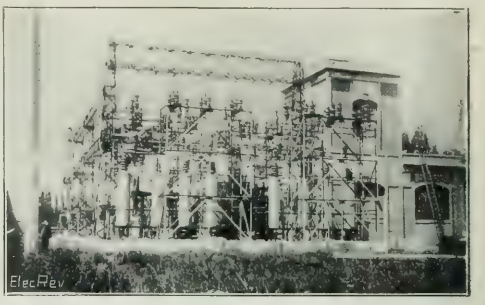


Fig. 12.—General View of Creil Switchgear and Sub-station.

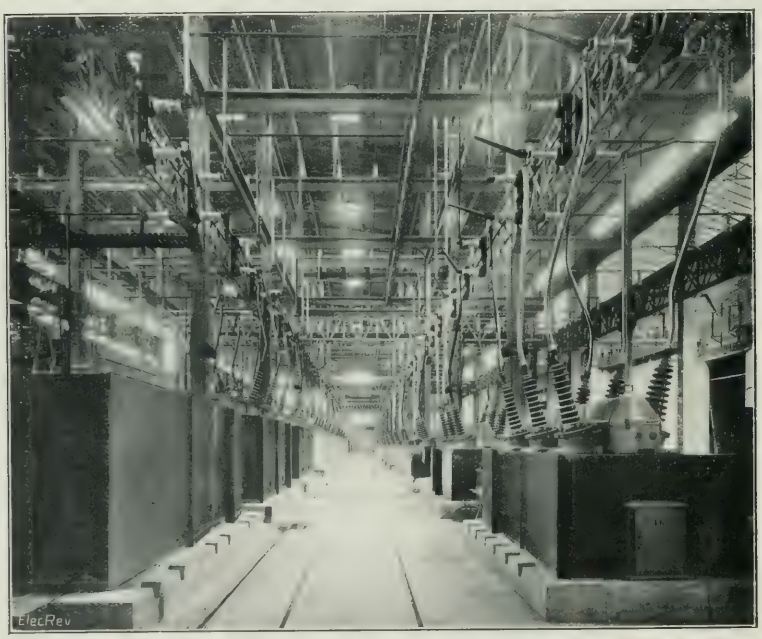


Fig. 10.—Interior of 60,000-volt Switch-house.

dimensions, have been reduced to the minimum. Naturally, the buildings and other works are devoid of useless ornamentation; but architectural amenities have been preserved in the general outlines and ensemble of the structures.

All the details of construction have been worked out by the company's own staff, and each item of plant has been separately ordered in the most favourable market; moreover, a large workshop, covering 2,000 m.², has been built on the site, in which a great part of the boiler work and pipe work, structural steel work, &c., has been accomplished, with a material saving of time and of supplementary expenses.

We have already illustrated the turbines and alternators, and given vertical sections of the power station; the accompanying illustrations show the turbine room and switchgear. Briefly recapitulating, all the five sets, though made by three firms, are identical in design, the turbines being of the Zoelly type. Space is provided for a sixth set, and the lay-out provides for the addition of two more. The guaranteed consumption of steam per kWh, without bleeding, is 4.37 kg. (9.6 lb.) at full load, 4.3 at $\frac{3}{4}$, 4.5 at $\frac{1}{2}$, and 5 at $\frac{1}{4}$ load. With bleeding, the coal consumption is reduced by 4 per cent. The condensers have each a cooling surface of 3,500 m.² (37,670 sq. ft.) and the two circulating pumps each supply 6,750 tons of water per hour. Each pump is driven by an induction motor, but one in each group is also provided with a steam turbine



Fig. 11.—Outdoor Switchgear at Creil, showing Transformers.

as stand-by. The extraction pumps are in duplicate, motor driven, each rated at 200 m.³ of water per hour, and air is extracted by two steam ejectors, with a special starting ejector. The guaranteed vacuum with water at 15 deg. C. is 96.5 per cent. The air for cooling the alternators flows in a closed circuit, and is cooled by the condensate in a tubular cooler; fresh air can also be used, one filter being provided capable of supplying four sets simultaneously. Two turbo-alternators of 3,000 kW each, running at 3,000 r.p.m., 3,000 V, are installed to supply power to the auxiliaries in case of need.

All motors above 50 kW are fed from the 3,000-V circuit, smaller a.c. motors being supplied with energy at 220 V. The motors driving the screens, fans, and cranes, &c., are d.c., supplied at 500 V. Normally, the power for the auxiliaries is derived from the mains, through step-down transformers, rotary converters and a storage battery being provided for the d.c. supply. Stand-by excitation is furnished by the battery or by independent exciters.

The main steam pipes are of weldless steel, 254 mm. in diameter; each boiler is connected directly to a steam separator, to which are coupled two 254-mm. pipes feeding the corresponding turbine, and two longitudinal pipes of the same size. The whole of the piping and valves are installed on a special floor between the stoking floor and the basement, and the valves are controlled from the stoking floor, so that in case of accident to the piping the valves can be actuated without danger from escaping steam.

The condensate from the turbines passes through the alternator air coolers, then through an oil cooler, and through heaters supplied with steam bled from the main turbines, thus attaining a temperature of 90 deg. at full load, 75 deg. at half load. It then passes into one of three hot-wells of 123 m.³ capacity, which receive the exhaust from the steam feed pumps, the auxiliary reserve turbines, and steam bled from the 3,000-kW turbines, reaching a final temperature of 100 degrees. Six degassing apparatus are provided (four of 200 tons and two of 50 tons) in which the hot water is deprived of all dissolved oxygen and carbon dioxide before it is pumped into the economisers. There are nine feed pumps, of which six are driven by 420-h.p. motors and three by steam engines, the output of each being 225 tons per hour. Special water services are provided for fire extinction and for cleansing, the condensers being furnished with a device patented by the Société Alsacienne, which enables the interior of the tubes to be cleaned with water jets without stopping the operation of the condenser. A vacuum cleaning system pervades the whole of the works, and the oil store and oil cleaning plant is served by a complete system of piping and pumps.

The plant is electrically divided into as many sections as there are generating sets, each section being controlled by one main circuit-breaker, three selector switches, six feeder circuit-breakers (two to each feeder), three 60,000-V reactance coils, and one sectioning circuit-breaker. All the breakers (except the selectors) are alike, their normal rupturing capacity being 600,000 kW. The alternator circuit-breakers are automatic, but do not operate on overload, the generators being able to carry their short-circuit current with full excitation; the circuit is interrupted only in case of internal injury to the alternator or transformer. Each circuit-breaker is mounted on a pedestal which contains a vat capable of holding the oil from all three tanks, the whole being enclosed in a casing of sheet iron 8 mm. thick. The reactance coils are immersed in oil in copper tanks with bronze bottoms and covers, the windings being held in place with bronze bolts and spring washers. The whole of the switchgear is of the outdoor type, but is covered with a light structure of reinforced concrete, a gallery affording ready access to the conductors and insulators.

The low-pressure switchgear is housed in a large building between the turbine-room and the high-pressure switchgear; here also is situated the "load dispatcher's" office or control room.

The step-up transformers are contained in a range of cubicles running the length of the turbine-room; each cubicle is provided with an outlet for smoke in case of fire, and a reservoir beneath it capable of containing the whole of the oil in the transformer tank.

Mechanical, chemical, and electrical laboratories are provided, the last being furnished with a rotary converter of 6,000-kVA, and a transformer for testing cables at double the normal pressure.

In the well-equipped mechanical workshop there is an electrically heated oven for repairing electrical apparatus, capable of receiving the complete rotor of an alternator; a smaller oven is also to be installed.

The turbine-room is served by two cranes, of 100 and 20 tons respectively, and the transformer gallery by one of 40 tons.

The coal-handling plant is naturally planned on a large scale; it provides for the reception of 400 tons per hour from barges, which can be put into store or sent direct to the boiler-house bunkers, which have a capacity of 3,800 tons, and for the delivery of coal by rail. Soot is collected from the boilers, economisers, and air-heaters by a pneumatic system, and ashes are removed by battery-driven trucks each of 40 tons capacity, for dispatch by rail or by water.

Very special attention has been given to the welfare of the personnel; cloak-rooms, baths, a first-aid room, and a canteen are provided, as well as dwellings for the staff, and the whole of these are equipped exclusively with electric cooking and heating apparatus.

The buildings were erected on piles of reinforced concrete, over 2,000 in number; the turbine-room is steel-framed, and the boiler-house and switchgear house are of reinforced concrete. By the liberal use of exceptionally powerful machinery, and a large staff of men, numbering 1,300 for some months, the work of erection was carried out in a remarkably short time.

The total cost of the power station, equipped with plant of 200,000 kW, will be less than 600 francs per kW, and when the capacity is increased to 280,000 kW the cost per kW will be reduced to 530 francs. These figures respectively correspond to £11.2 and £10 at the present rate of exchange, but it should be borne in mind that the international exchange does not truly represent the value of money raised and spent in France.

In conclusion, in the course of two or three years the Union d'Electricité will have available in the four power stations (Gennevilliers, Vitry, Nanterre, and Issy-les-Moulineaux) plant of an aggregate capacity exceeding 400,000 kW. It has demonstrated the advantages of centralisation of plant, and has shown how, in a country too often assumed to be saturated with individualism, the spirit of co-operation has developed and the most diversified interests have been quickly and effectively organised for joint action. M. Ernest Mercier, Administrateur-Délégué of the Union, accords well-earned thanks to M. Gustave Mercier, civil engineer, M. A. de Casanova, chief engineer, and M. Couffon, chief electrical engineer, as well as to other members of the engineering staff, for the loyalty and devotion which they have displayed in carrying out this great undertaking.

The British Cast-Iron Research Association. During the past month investigations of a varied character have been carried out on behalf of the members of the Association. The larger research works which are being carried out by the director are being pushed forward, and very valuable data collected. A special committee has been appointed to carry out a thorough investigation in connection with malleable iron castings. The first bulletin, giving full details of the researches already carried out, is now being issued to the members. The membership of the Association is increasing and foundries are taking a keener interest in its work.

The Association has published a small pamphlet setting forth its aims and objects, and its constitution. Several ways in which it can help manufacturers are suggested. Its offices are at Central House, New Street, Birmingham.

NOTES.

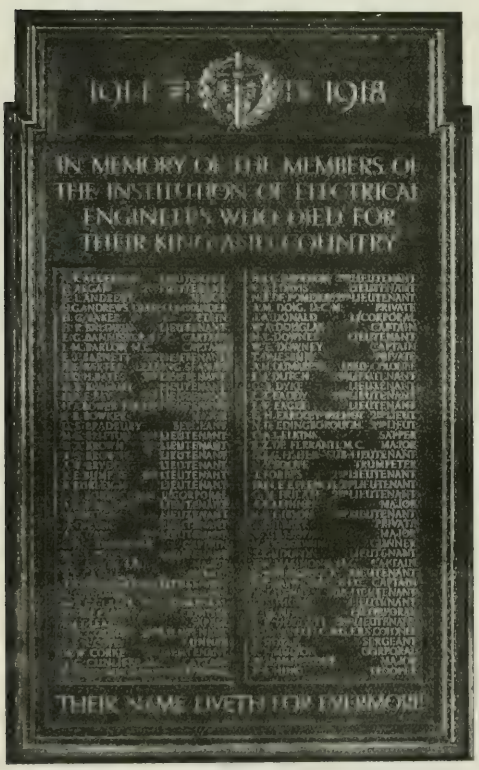
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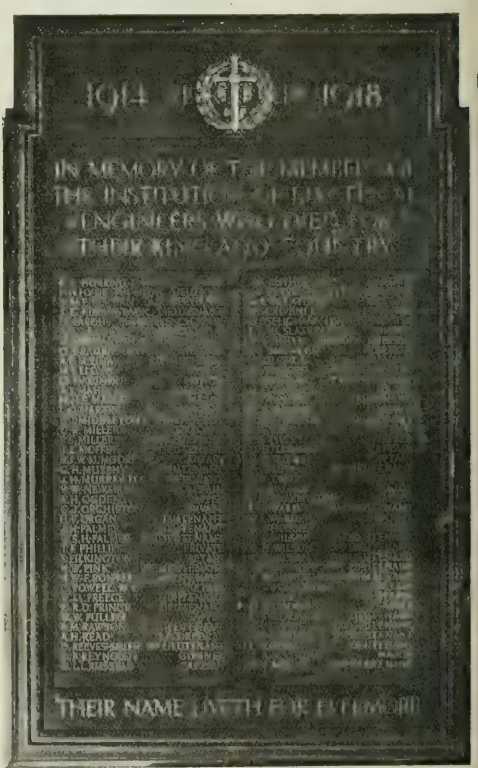
Appointments Vacant.—Jointer (district rate), for Peterborough Electricity Department; shift engineer (Class C, Schedule S), for Wimbledon Electricity Department; foreman (£410-£12-£500), for the Nigerian Posts and Telegraphs Department. (See our advertisement pages to-day.)

Tram-route Indicator.—The *Daily Express* states that some London tramcars have been fitted with an ingenious locality indicator, consisting of a moving tape running on rollers, which synchronises with the route. An indicator shows on the tape the exact position of the tramcar at any particular moment. Disks on the tape not only show cross-roads and stopping-places, but have the fare-stages marked on them. The half-mile of route in advance is shown on the tape and the half-mile just traversed.

A hundred of these useful machines are being installed on the Metropolitan electric tramcars to Palmers Green and Enfield.

The War Memorial of the Institution of Electrical Engineers.—In our issue of June 30th (p. 921) we described the ceremony of unveiling the memorial which has been erected by the Institution of Electrical Engineers to its members who gave their lives in the war. We now reproduce photographs of the large bronze tablets, which are fixed to the marble walls on either side of the entrance hall, and bear the names and rank of the members who thus conferred honour upon the body to which they belonged, at the cost of the supreme sacrifice. In the words of the memorial, "Their name liveth for evermore."





The War Memorial of the Institution of Electrical Engineers.

The German Briquetting Experts for Morwell.—The *Melbourne Age* of May 23rd, publishes the following:—"The State Government has been faced with many problems regarding the six German engineers who were engaged some months ago to assemble the briquetting plant of the Morwell power scheme, and to instruct the Victorian engineers and workmen to handle it. After the opposition of the Prime Minister to their admission to the Commonwealth had been overcome, it was considered that the Electricity Commissioners would have no further trouble in securing the experts. But apparently the opposition of the Prime Minister is still a formidable thing in parts of Germany; at all events, further delay has occurred in securing the services of the German experts. As the result of cable messages, which have been passing between the Electricity Commissioners and the experts, however, it is not anticipated that there will be any additional hindrance. It is understood that the German engineers have been assured that they need fear no hostility on their arrival in Victoria. They appear to have thought that such an assurance was necessary in view of the hostile attitude which was adopted by Mr. Hughes."

Automatic Train Control.—An experiment has been made on the Paris-Orleans Railway, says the *Evening News*, with a new apparatus which is the invention of the French engineer Rodolausse. The apparatus is intended to control and regulate automatically the speed of the train and to limit it to a maximum speed previously provided for; to stop the train in case the driver fails to apply the brakes at a signal, and to reduce or accelerate automatically.

London's Electric Signs.—*The Times* states that the Westminster City Council is determined that there shall be no second Broadway in the area under its control and is therefore seeking to prohibit the erection and maintenance of electric signs. The ostensible reason for this attitude is that a number of these overhang the public way and constitute a source of danger. Our contemporary points out that the proprietors of the signs in Piccadilly pay between four and five thousand pounds per annum in rates besides providing employment to fifteen or twenty men; this is apart from the value of the work to the manufacturing industries concerned.

The Trade Revival.—There is sardonic humour in the following inquiry—"the only genuine one for a day or so"—received by a Midland firm of electrical engineers this week: "Gentlemen.—Have you any job lines in advertising novelties which would be suitable for lucky bags; if so, will you send me samples and quote me lowest price per gross, and oblige, &c."

Extension of the Metric System.—The Federal Council has asked the Swiss Parliament to ratify the decision of the Paris Weights and Measures Conference of October, 1921, at which 27 States were represented. The decision in question was intended to amend the Metric Convention of May 20th, 1875, by extending the activities of the International Bureau of Weights and Measures to other units than those of length and volume, and especially to electrical units.—*Reuter.*

High-speed Photography.—M. Bull, of the Marey Institute, Paris, has described to the French Academy of Science the means by which he has been successful in obtaining 250 kinematograph photographs of the usual size in one-hundredth of a second—a rate of 25,000 pictures a second. In order to achieve this extraordinary speed the inventor caused a prism to revolve at the rate of 100 revolutions a second, which being lighted by a succession of electric sparks, "threw" the pictures on to a stationary film. It is interesting to know that this development, which is full of significance to the kinema world, was worked out at the institute founded to carry on the work of the scientist Marey, whose studies formed the starting point for "moving pictures."—*Evening News.*

Standardisation of Electrical Equipment in Australia.—In response to the pleadings of a deputation representative of the engineering and chemical trades, the Australian Minister for Customs has requested the Director of the Bureau of Science and Industry to investigate and report upon the practicability of standardising electrical equipment. It was pointed out that if Australians were to produce goods of a quality and at a price comparable with those produced by their competitors in different parts of the world the adoption of standardisation principles was essential.—*Reuter's Trade Service* (Melbourne).

Service Notes.—Captain C. E. Kennedy-Purvis, R.N., has been posted to the Admiralty for service with the Wireless Board. Brevet Lt.-Col. D. S. Collins, D.S.O., Royal Engineers, has been appointed chief instructor at the School of Electric Lighting, in succession to Major P. S. Watkins, D.S.O. Lt.-Col. Collins is well known as a leading expert on electric lighting.

Birmingham Electrical Golfing Society.—The seventeenth meeting of this Society was held on the Little Aston Golf Course in fine weather. The Bayliss Cup, which was up for competition, was won by Mr. J. H. Berry, with Mr. W. A. Baxter second and Mr. W. A. Jackson third. The Sealed Nine Holes was won by Mr. W. A. Millinger. The autumn meeting will be held about the end of September, when the "Dr. Railing" Cup will be up for competition. Golfers in the Midland electrical industry can obtain full particulars of the next meeting, also the 1923 programme, on application to the hon. secretary at 9, Livery Street, Birmingham.

Legal.—THE KING *v.* THE ELECTRICITY COMMISSIONERS (*ex parte* the Ealing Borough Council).—In Appeal Court II on Wednesday this part-heard case was continued, and at the conclusion of the arguments, their Lordships allowed the Electricity Commissioners' appeal, and discharged the rule.

The hearing in the Divisional Court was reported in the ELECTRICAL REVIEW for June 2nd, 1922, p. 766.

Association of Consulting Engineers.—The latest list of members, professional rules, &c., has come to hand, showing a total membership of 85. The names of officers and committee members for 1922-23 appear.

Educational.—UNIVERSITY OF LONDON: KING'S COLLEGE.—Considerable extensions have been made in the Engineering Department of King's College, including a large drawing office, lecture-room and laboratory for hydraulics and strength of materials; and electrical engineering research rooms, including wireless telegraphy. The four years' course of study in engineering provides opportunities for practical training in works.

UNIVERSITY COLLEGE, LONDON.—Diplomas in electrical engineering have been awarded in the Faculty of Engineering to N. Axford, L. T. Bird, A. J. Emery, A. N. Jackson, W. F. Marriage, D. C. North, and W. J. Webb.

The Hydro-Electric System of Ontario.—In a report prepared by Mr. W. S. Murray and published by the National Electric Light Association, U.S.A., the system of the Hydro-Electric Power Commission of Ontario (the largest government-owned system in existence) is criticised as being in efficient, expensive, and wasteful, and it is contended that service rendered by privately-owned undertakings is cheaper and better. Mr. Murray points out that 87 per cent. of the Power Commission's output is generated at Niagara, where the conditions are most favourable to cheap production of energy. The Commission has exceptional administrative powers, and no law-suit can be brought against it without the fiat of the Attorney-General, which has never been granted. All its property is tax-free, except land, whereas private companies pay 7.1 per cent. of their income in taxation.

In 1920 the Province of Ontario owned one-half of its electricity supply undertakings, and received two-thirds of the total revenue from electricity supply; the Province of Quebec, on the other hand, owned only 4 per cent. of the undertakings, and received 5 per cent. of the revenue. The income per dollar of salaries and wages paid was 32.5 per cent. higher in Quebec than in Ontario, and the cost to the consumer per kilowatt-hour generated averaged 0.66 cent in Quebec (96 per cent. private undertakings) compared with 0.878 cent. in Ontario (50 per cent. private undertakings), whilst in the latter case the government-owned undertakings supplied at 0.925 cent. as compared with the private undertakings at 0.76 cent. The average revenue per kilowatt-hour generated for the American Niagara power district was about 17 per cent. less than that of the Hydro-Electric Power Commission; and the average cost of power returned to the public in the Niagara district by the Canadian municipalities served by the Commission was 67 per cent. more than on the American side. The average cost of power to the people of Quebec was 32 per cent. less per kilowatt-hour generated than to the consumers in the Canadian Niagara district. With regard to the new Queenston-Chippawa devlopment, with an ultimate capacity estimated at from 495,000 to 650,000 h.p., whereas the Commission formerly purchased 100,000 h.p. from the Ontario Power Co. at slightly more than $9 per horse-power-year, the cost of supply to the municipalities of Ontario from Queenston will be $28.05 per h.p.-year, plus $9.40 for transmission from Niagara Falls, or $37.45 in all. This, says Mr. Murray, is an increase over the cost of $19.80 per h.p. year stated by the Commission in its 1920 report of $17.65 per h.p.-year, or 89 per cent. The increase in production cost per h.p.-year at the point of delivery to the Niagara system from $10.40 for 1920 to $28.05 amounts to approximately 170 per cent.—*Electrical World.*

A New X-ray Protective Material.—The necessity for improved protective material in connection with radiological work has arisen from the work of the Protection Committee, and Mr. H. C. Head, M.I.E.E., points out in the *Journal* of the Röntgen Society, that his firm, in co-operation with Messrs. Murray, Parkyn & Co., of Stockport, has been carrying out experiments (at the instance of Dr. Morrison, of Manchester) which have enabled them to produce a material which has been registered under the name of Parraynite, which can be claimed as a step forward in the subject. This substance is made by Messrs. Murray, Parkyn in two forms, a pliable form C and a solid form F. The former is used for such articles as aprons, nurses' overalls, the lining of existing tube-boxes, &c., while the latter can be built up or moulded in any desired shape, such as panel sections, portable screens, &c. The composition of Parraynite is a trade secret, which owes much to Messrs. Muray, Parkyn's unique experience in the manufacture of ebonite. The ingredients vary, depending whether the solid or pliable form is required. Accurate and careful working is essential if the material is to function as a non-conductor, as well as possess a definite equivalent in lead. The softening point of Parraynite F is high, yet the material is not unduly brittle in its solid sheet or moulded form. Parraynite is tested electrically up to 2,500 volts for proof of non-conductiveness, this being merely a precautionary measure, as in actual fact the material will resist the much higher potentials used in X-ray work. Samples of the material have been tested at the National Physical Laboratory, when the following results were obtained: Parrynite C (pliable)—3.1 mm. thickness, equivalent to 1 mm. metallic lead. (2) 5.3 mm. thickness, equivalent to 1.7 mm. metallic lead. The results were the same whether the applied peak voltage to the tube was 100 or 120 kilovolts.

Parraynite F (solid).—9.9 mm. thickness was found to be equivalent to 1.5 mm. metallic lead with an applied voltage to the tube of 100 kilovolts, and to 1.3 mm. metallic lead with an applied voltage of 120 kilovolts.

A full length apron made of Parraynite C, equal in protection to 1 mm. of metallic lead, although weighing about 19 lb., is far more comfortable to wear than the average lead rubber variety, on account of the special supporting system of straps designed by Mr. Glover.

Parraynite C can be produced in sheets in any reasonable length and thickness, and in any width up to 26 in. Parraynite F can be produced in sheets up to 43 in. long, any reasonable thickness and, if necessary, up to 26 in. wide. A point of interest is that Messrs. Murray, Parkyn & Co. have a special process whereby Parraynite, vulcanite, &c., can be applied to wood or metals (steel, cast-iron, &c.), the method of application ensuring a chemical bond between the product and the metal. The effectiveness of this bond has been demonstrated by means of radiography. Metal work thus covered or lined is tested electrically up to 2,500 volts, to ensure that the covering is effective and free from porosity.

A False Accusation.—At Gedburgh, last week, Harry Smith, Leeds, was sentenced to three years' penal servitude on being convicted of charges in connection with fire raising at a Hawick mansion house with intent to defraud an insurance company. One of the arguments for the defence was that the cause of the fire was probably a defect in the electrical installation. Mr. W. E. Townsend, electrical engineer, Edinburgh, said the installation was obviously an old one. Wherever he could see, the wires were in wooden casing, but where a ladder was necessary there was no casing to be found. The joints he had seen were so bad that he was not surprised at all that a fire took place. In cross-examination, he agreed that the mere fact that an installation was twenty years old did not call for its condemnation. Prof. F. G. Baily, Heriot Watt College, Edinburgh, also gave evidence as to the electrical installation. The verdict, however, was one of "Not guilty" for the electrical installation.

Electrical Treatment of Vegetables.—Experiments in electro culture were made at Bellevue, on the outskirts of Paris, in 1920. The results for that year and 1921 are now published. A system of field wires was laid over the ground and subjected to a powerful electric current. This was done daily from 6 to 8 o'clock, morning and evening. The results, as compared with the growth on similar ground not so treated, were as follows:—

	Electrified.	Ordinary.
Cabbages	27	25
Lettuce	10	7
Cos Lettuce	3	2
Potatoes	15	9
Leeks	6	3
Tobacco	47	68

—*The Times.*

Post Office Tube Bill.—A Select Committee of the House of Commons, presided over by Sir Fortescue Flannery, on July 12th considered a Bill promoted by the Postmaster-General to enable him to acquire for Post Office purposes a tube running from St. Martin's-le-Grand up Eversholt Street to St. Pancras. Mr. Bruce Thomas (for the Postmaster-General) explained that this Bill was promoted, says the *Morning Post*, to confirm the agreement made between the Pneumatic Despatch Co. and the Postmaster-General for the acquisition of a tube running between St. Martin's-le-Grand and St. Pancras. There was no opposition. The plan of the tube produced by counsel showed four breaks, one being at the junction of Tottenham Court Road and Oxford Street, where the Underground Railway station was situated, another at Kingsway, caused by the L.C.C. tramway subway, and another at the bottom of Gray's Inn Road, where the L.C.C. sewers cut through it. The purchase price, subject to confirmation by Parliament, would be £7,500, which, compared with current prices for the laying of a conduit, would enable him to effect a saving of approximately £42,000. The immediate use to which the Postmaster-General intended putting the tube was to lay cables from the General Post Office to Tottenham Court Road, and it was in this connection that the saving referred to would be effected. Mr. John Sinnott, Assistant Engineer-in-Chief to the General Post Office, gave evidence. The Committee decided to report the preamble of the Bill as being proved.

The Times explains that the Pneumatic Despatch Co. was formed before 1859, with the object of laying automatic tubes under the streets of London for the conveyance of parcels, messages, and dispatches. This tube was constructed in 1866, but since 1874 it has been out of use through the difficulty, it is understood, of keeping it airtight. The Engineering Department of the Post Office is satisfied there was no serious deterioration caused by corrosion.

"What is happening to the Post Office 'tube' railway constructed to carry mails and parcels between Paddington and Whitechapel?" the *Evening News* asks, and goes on to explain that up to date more than £1,000,000 has been spent on the scheme. The estimated cost of the whole scheme, when it was started in 1914, was £950,000, but as yet the electrically-driven cars which are some day to replace the street van services and expedite the delivery of mails are not in existence. The official answer for the delay is that the Post Office is holding its hand until costs fall. The tube itself is complete and ready for use, but all the tenders so far sent in for the cars and other electrical equipment have been considered too high. The object of the undertaking is to quicken and cheapen the transmission of letters and parcels between the chief west offices in east and west London. The railway will be laid in a single tube 9 ft. in diameter and 6½ miles in length, from Paddington District Post Office to the Eastern District Post Office at Whitechapel. There are intermediate stations at the western and west central district offices, the G.P.O., Broad Street, and Liverpool Street Stations, where the diameter of the tunnel is increased to 25 ft. The trains run on two narrow-gauge tracks. Between the stations these trains which will travel at 35 miles an hour, will be controlled by distant switches. The mails will be loaded and unloaded by automatic means.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. J. M. McElroy, who recently retired from the position of general manager of the Manchester Corporation tramways, was presented by the Tramways Committee on Tuesday last week with a silver tea service. The presentation, which took place at the tramway office at the conclusion of the business of the Committee, was made by the Chairman (Alderman James Bowes) in the presence of the Lord Mayor of Manchester, the Town Clerk, and the members of the Committee. The Chairman, in making the presentation, spoke of his long and harmonious association with Mr. McElroy, and said that the parting was a real wrench for him. He hoped that Mr. McElroy, as a result of his well-earned rest, would be so restored to health as still to be able to do much useful work for the industry in which he had been such a prominent figure. The Lord Mayor also paid a high tribute to Mr. McElroy for his services to the Corporation of Manchester, and to the tramway industry generally, and referred particularly to the report which Mr. McElroy had written on the "Passenger Transportation Problem," which he, the Lord Mayor, described as a text-book on the subject, and one of which Mr. McElroy and the Corporation had every reason to be proud. Several of the members of the Committee added their testimony to the great work which Mr. McElroy had done for Manchester in connection with the organisation and administration of the tramways, and they emphasised the very high example he had set by his personality during his period of office as general manager. Mr. McElroy, in responding, thanked the Committee for its kindness in making the presentation to him, and spoke of the happy relations which had always existed between the Committee, the staff, and himself during the 22 years he had been the manager; and although the parting was a sad one for him, it was made glad by the manifestations of goodwill which he had received from the members of the Committee assembled there.

Mr. W. D'Arcy Madden, M.I.E.E., general manager of Messrs. Hick, Hargreaves & Co., Ltd., Bolton, has joined the board of the company, and has been appointed managing director.

A sub-committee of the Dundee Corporation Electricity Committee proposed to recommend for the post of engineer and manager, in succession to Mr. Harry Richardson, Mr. Douglas H. Bishop, who has charge of the generating station at Carolina Port, at a commencing salary of £800, rising by annual increments of £50 to £1,000, the present salary of the engineer. Mr. Bishop, however, declined to be a candidate unless a commencing salary of £1,000 was guaranteed. The committee decided to recommend the Town Council to advertise the post at a commencing salary of £800 rising to £1,000. Mr. Bishop, it is stated, pointed out that the responsibility of the post was very great, and that it would damage him in the electrical world if he were to accept such an important post at the figure suggested. The convener of the committee favoured £1,000, his opinion being that if they offered a lower figure they would not get a suitable man. It was pointed out that the Electrical Engineers' Association's basic rate for Dundee was £1,300.

A Manchester paper states that Ald. Dagnall, chairman of the Manchester Corporation Electricity Committee, has been elected chairman of the South-East Lancashire Electricity Advisory Board, and Dr. Parshall, a director of the Lancashire Electric Power Co., vice-chairman.

On Saturday last, upon leaving Loughborough to take up the position of station superintendent to the Wallasey Corporation electricity works, Mr. Pausey was presented with a silver rose bowl suitably inscribed. The presentation was made by Councillor F. A. Stenson, chairman of the Electricity Committee, who spoke very highly of the activities of Mr. Pausey during his three years' stay in Loughborough. Mr. R. B. Leach, the chief engineer, endorsed Councillor Stenson's remarks.

Mr. R. A. Chattock, chief engineer of the Birmingham electricity supply department, has been elected chairman of the District Industrial Council for the Electricity Supply Industry (No. 5), West Midlands area; Ald. J. Gregory (Labour representative) is the deputy chairman, and the office of joint secretary and treasurer for both sides of the Council will continue to be performed by Mr. E. J. Jennings (secretary of the Birmingham electricity supply department).

Mr. R. H. Selbie, general manager of the Metropolitan Railway Co., was last week elected to a seat on the board in place of the Earl of Lauderdale, who has retired owing to ill-health. Mr. Selbie will continue in his position as general manager of the company.

At the Yale University, on June 21st, the honorary doctorate of science was conferred upon Mr. J. J. Carty, vice-president of the American Telephone and Telegraph Co., and "a pioneer in the development of telephone science since 1879."

Mr. Bernard L. Myer, A.M.I.E.E., of 51, Oxford Street, Liverpool, has ceased to represent Messrs. Napier-Kimber, Ltd., for the Lancashire district.

On July 14th, at Stafford, the marriage took place between Mr. J. W. Elliott, B.Sc., A.M.I.E.E. (district superintendent, Cardiff, for the Edison Swan Electric Co.), only son of Mr. and Mrs. J. W. Elliott, of Enfield Highway, and Miss Nora Elsie Cooper, of Stafford. The bridegroom's father is lamp sales manager to the Edison Swan Co.

The Aberdare Council at a special meeting adopted recommendations of a committee with reference to the advertised appointment of an electrical engineer and general manager. The advertised salary was £450, plus bonus £200, per annum. In view of the transfer of the charge of the tramway department to the surveyor's department, the committee recommended that Mr. W. T. Hilder, M.Inst.E.E., the mains superintendent to the Council, be appointed as general manager and engineer at £450 per annum, to include bonus.

They further recommended that the works superintendent to the Council, Mr. W. J. Williams, take over charge of mains as part of his duties, the salary for the joint post to be £400 per annum, including bonus. The saving to the Council by these changes was estimated at £500 a year. The Council confirmed the appointments as recommended. There were 51 applicants for the position as advertised.

Obituary.—Mr. S. W. Trentham.—The death is announced at Nuneaton of Mr. Sidney Wallace Trentham, younger son of the late Mr. George Trentham, public works contractor, of Birmingham. He was trained as an electrical engineer, and held appointments at Aston, Derby and Llanrwst before joining the firm of G. Percy Trentham, Ltd., public contractors, of Birmingham. Since the war, he has been the managing director of the Hartshill Quarry Co., Ltd., Atherstone.

Will.—The late Mr. John Temple, C.B., who was a director of several colliery and other companies, and is described as for many years acting as engineer to various cable companies in the Atlantic and the Mediterranean, left £261,597 gross and £261,248 net personalty.

NEW COMPANIES REGISTERED.

Hodgson (London), Ltd. (182,969).—Private company. Registered July 7th. Capital, £100 in £1 shares. To acquire the business of the Hodgson Manufacturing Co., and to carry on the business of inventors, patentees, mechanical and electrical engineers, manufacturers of machinery, wireless and other instruments, &c. The permanent directors are:—F. A. G. Hodgson, 37, Comeragh Road, West Kensington, W.4; H. R. Hodgson, 37, Comeragh Road, West Kensington, W.4; E. J. Mason, 51, Meath Road, Ilford, Essex. Qualification, £20. Remuneration, £15 per annum, divided between them. Secretary: W. C. Wood. Registered office: 2, Gerrard Place, Shaftesbury Avenue, W.1.

H. C. Tofield, Ltd. (183,066).—Private company. Registered July 12th. Capital, £2,000 in £1 shares. To carry on the business of electricians, electrical, mechanical, gas, water, heating, lighting, motor, and general engineers, &c. The permanent directors are:—H. C. Tofield, 111, Hagley Road, Edgbaston (chairman); Ann E. Tofield, 111, Hagley Road, Edgbaston. Qualification, £1. Remuneration of H. C. Tofield as managing director, £500 per annum. Secretary: Ann E. Tofield. Registered office: Temple Passage, Upper Temple Street, Birmingham.

Cullompton Electric Supply Co., Ltd. (183,058).—Registered July 12th. Capital, £6,000 in £1 shares. To carry on business as indicated by the title. The first directors are:—Dr. G. G. Gedley, Cullompton, Devon; Major F. G. Sellwood, M.C., Cullompton, Devon; W. Plumpton, Cullompton, Devon; W. T. Burnard, Cullompton, Devon. Minimum cash subscription, 2,500 shares. Qualification, £25. Remuneration (except managing directors), as fixed by the company. Secretary: E. Browning. Registered office: Fore Street, Cullompton, Devon.

General Engineering & Electric Welding Co., Ltd. (183,065).—Private company. Registered July 12th. Capital, £2,000 in £1 shares. To carry on the business of mechanical engineers, boiler makers, electrical engineers, ship repairers, ironfounders, machinery manufacturers, tool makers, &c. The permanent directors are:—F. Severton, 10, Oakland Road, Mumbles, Swansea; G. P. Jones, 62, Queen's Road, Mumbles, Swansea. Qualification, £250. Secretary: G. P. Jones. Solicitor: E. McDahne, Victoria Buildings, Swansea.

A. P. Steven, Ltd. (12,298).—Private company.—Registered in Edinburgh July 12th. Capital, £60,000 in £1 shares. To carry on the business of makers of electric and hydraulic passenger and goods lifts of all kinds, manufacturing, civil, and mining engineers, ironfounders, &c. The first directors are:—A. Steven, 181, St. James' Road, Glasgow, engineer; J. M. Steven, 181, St. James' Road, Glasgow, engineer; M. Stephen Dick, 181, St. James' Road, Glasgow, engineer; W. J. Maclure, 181, St. James' Road, Glasgow, engineer. Qualification, 100 shares. Registered office: Provanside Works, 181, St. James' Road, Glasgow.

Bolton Wireless Installation Co., Ltd. (183,083).—Private company. Registered July 13th. Capital, £200 in 195 6 per cent. preference shares of £1 each and 100 ordinary shares of 1s. each. The objects are as indicated by the title. The first directors are:—J. Drucquer, Palace Hotel, Birkdale, Southport; D. W. Drucquer, 29, Bath Street, Bolton; R. A. Livock, "Porthleven," Blundellsands, Lancs. Qualification, five ordinary shares. Registered office: 2, Rook Street, York Stret, Manchester.

Manchester Wireless Installation Co., Ltd. (183,092).—Private company. Registered July 13th. Capital, £200 in 195 6 per cent. preference shares of £1 each and 100 ordinary shares of 1s. each. The objects and all other particulars similar to Bolton Wireless Installation Co., Ltd.

Morgan & Taylor's Radio Electric, Ltd. (183,104).—Private company. Registered July 13th. Capital, £1,000 in £1 shares. To acquire the business of a radio specialist and electrical and wireless engineer, and agent for the sale and distribution of wireless apparatus and goods carried on by A. Taylor as "Morgan & Taylor," at 146, King's Road, and 10a, Sneyd Street, Cardiff. The permanent governing directors are:—Arthur Taylor (chairman), 146, King's Road, and 10a, Sneyd Street, Cardiff; Alfred Taylor 146, King's Road, and 10a, Sneyd Street, Cardiff; G. P. Taylor, 58, Hertford Road, Bootle. Qualification of governing directors, 100 ordinary shares; of other directors, 25 ordinary shares. Solicitor: E. Horley, Andrew's Buildings, 67, Queen Street, Cardiff.

Angus Railway Control, Ltd. (182,898).—Private company. Registered July 5th. Capital, £6,000 in 1s. shares. To acquire from A. R. Angus the benefit of and turn to account certain existing inventions relating to railway safety appliances and signalling apparatus; and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in railway, electric, magnetic, galvanic, and other apparatus, &c. The first directors are: A. R. Angus, Frensham Grove, Frensham, Surrey; L. Christensen, Sandefjord, Norway; B. Aagaard, Larvik, Norway; C. Gyllensvard, Djursholm, near Stockholm, Sweden; E. P. Williams, "Redbourne," Priest's Lane, Shenfield, Essex; C. A. Fell, 47, Durham Road, East Finchley. A. R. Angus may retain office while holding 20 per cent. of the shares issued. Registered office: 66, Fenchurch Street, E.C.3.

John Richards & Co. (Electrical Engineers), Ltd. (183,000).—Private company. Registered July 10th. Capital, £6,000 in £1 shares. To acquire the business of an electrical engineer carried on by J. Richards at 9, High Street, Burton-on-Trent, and 75, Victoria Street, Westminster, S.W. The business acquired is not connected in any way with the similar electrical engineering business carried on by the said J. Richards as "John Richards & Co." at Longton. The permanent directors are:—J. Richards (chairman), "Highfields," Uttoxeter; F. Langton (managing director), "The Rise," Tatenhill, Staffs. Secretary: F. Langton. Registered office: 9, High Street, Burton-on-Trent.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

T. W. Jefferson, Ltd.—Mortgage dated June 30th, 1922, to secure all moneys due or to become due from the company to Lloyds Joint City and Midland Bank, not exceeding £5,000, charged on 25, Hurst Street, Liverpool. Also particulars of £5,000 debentures authorised June 30th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

Rangoon Electric Tramway & Supply Co., Ltd.—Satisfaction to the extent of £8,850 on April 21st, 1921, and £9,167 on July 1st, 1922, of debenture stock dated January 1st, 1906, [illegible] November 5th, 1913, securing £250,000.

Transit Co., Ltd. (109,799).—Return dated December 31st, 1921 (filed May 12th, 1922). Capital, £5,000 in £1 shares. 4,055 shares taken up. £2,517 10s. paid, being £1 per share on 1,955 shares and 10s. per share on 2,100. £50 remains to answer. Mortgages and charges, nil.

Bath Electric Tramways, Ltd. (74,278).—Return dated May 24th, 1922. Capital, £230,000 in £1 shares: 70,000 preference, 120,000 preferred ordinary, and 30,000 deferred ordinary); 75,000 preference, 75,000 preferred ordinary, and 30,000 deferred ordinary shares issued. £150,000 paid, £30,000 considered as paid. Mortgages and charges, £145,750.

Hardy & Nash, Ltd.—Particulars of £1,200 debentures authorised March 21st, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

Fellows Magneto Co., Ltd.—Particulars of £60,000 debentures authorised June 12th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

CITY NOTES.

General Electric Co., Ltd.

The annual general meeting was held on Tuesday at Magnet House, Kingsway, Mr. H. Hirst presiding. In proposing the adoption of the report (already published in the Electrical Review) the chairman said he imagined that many of them would be somewhat disappointed at that, the first setback in the results of the company, after its marvellous record during the last fourteen years. For the benefit of those who came with that feeling he read one of the opening sentences of his last year's address, when nearly four months of the present financial year had elapsed:—

> To-day it is my privilege to put before you the balance-sheet of the year just completed, of which we have every reason to be proud, yet the four months of the new year that have just elapsed are casting a shadow over these results. Unrest in the labour world, the stoppage of the coal mines, the shutting down of most of the steel works of the country, the standstill of the shipbuilding industry and automobile industry, the condition of the textile industry, and many more that I could mention have all at once reduced our home market beyond recognition. The general fall in the values of securities has impaired the purchasing power of the public. Simultaneously the state of exchange in many of our foreign markets has interfered with export and has added to the present state of depression, bordering on paralysis.

On that occasion he added the hope that things might improve, but indicated that unless they did the company was temporarily in for a bad time. Things did not improve, and to the long lists of ailments there were to be added a number of additional strikes, the engineering dispute, the state of civil war in Ireland, the state of sedition and civil commotion in India and South Africa, and last, but not least, through various causes a further deterioration of the economic conditions in all European countries, which were already suffering from weak or collapsed exchanges. Bearing in mind these conditions they had done remarkably well—better than they dared to hope—and the results spoke well for the soundness and strength of the company and for the ability of the staff and employés. It was true the results of some electrical concerns published during the last few months might have justified the hope that things were better, but an upheaval such as they had witnessed during the last fifteen months did not affect every company in the same manner. The financial years under consideration did not always cover the same period—a period beginning three or four months earlier or later might make a great difference and some concerns, particularly those whose work might be called mainly contract work, had the benefit of starting the year with an order book full of unexecuted remunerative contracts accumulated during the end of the war and the period immediately following. Their company happened to be one of different characteristics. They manufactured very largely for stock to fill the shelves of the world with their material, and they suffered naturally from the fact that they produced that stock when wages and raw materials were still high, whilst throughout the year they were selling in a falling market. It was not likely that there would be a further serious drop: stocks had both been replaced at cheaper rates and were reduced. Thus it happened that their sales organisations, which year after year had been the main contributors to their profits, had failed them this year. A carefully built-up organisation could not adapt itself quickly to such extreme changes; its expenses remained substantially the same, but the drop in turnover and falling prices had reduced satisfactory profits in those departments to a minimum. One could not immediately lower wages and reduce staff, and a firm like theirs, which had so many valuable well-trained and loyal old servants, must think twice before parting with any—not only on account of sentiment, but also with an eye to

the turning point, when things got better once more. In addition, he would like to remind the shareholders that year after year they had dwelt—with their approval—on their desire, and on the necessity from the country's point of view, to make themselves a full-gauge electrical concern. They started new departments and works, or extended those in which they seemed deficient or incomplete at great capital expense, and through the conditions which had arisen those new works could not be fully employed at their completion. To have a reduction of net earnings of only about 30 per cent. from their record year in such a year as had just passed was not at all a bad performance; the unpleasant part to them was that it coincided with the year in which they made a debenture issue of some magnitude, and therefore the ordinary shares for a time were rather acutely affected. He had no anxiety for the future of the company, it was as bright as ever. He wished, however, to strike one more warning note that the improvement, which was visible since the termination of the engineering dispute, would have to be continuous and serious if it was to make good the damage which that unfortunate dispute had already caused in the first four months of this financial year. They must, therefore, be prepared for the possibility of another lean year before they got into full swing once more. It had been said "war is the continuance of diplomacy by sword instead of by pen." In the same way one might say "strikes and lock-outs are an attempt to settle negotiations by force whenever peaceful methods have failed." The actual days, weeks, or months of a strike indicated only the actual crisis. Just as a country took years, and sometimes generations, to recover from a war, so the industrial world required months, and sometimes years, to recover from strikes and lock-outs. The country still suffered from the effects of the first coal strike after the war, not to mention last year's hold-up in that important industry. The traces of another strike, not much noted by the public, but very serious for the whole industry of the country, and largely responsible for the suddenness of the industrial collapse which they witnessed at the end of 1920, namely, the moulders' strike of two years ago, were still noticeable, and it might be that the disputes of the last fifteen months might have strained the great resources of the country more than was apparent. They might, therefore, have to wait for another year before they could record a progress over the figures of recent years. In the meanwhile they had to adapt themselves to the conditions which prevailed and mitigate the evil of reduced trade by all further possible economies. Labour and salaries being in their industry the most important item, an adjustment of wages and salaries was the first essential for competitive production. He was afraid wages and salaries would have to be further lowered. It was no pleasure to the employer to reduce wages; it was a great pleasure to every employer to be able to give rises, yet a country that had to live on industry in order to be able to live at all, but which would not take steps to protect that industry efficiently, could not keep in employment millions of workers if it produced at a cost which the world could not afford to pay, or if its prices were above those at which other countries could produce. The papers have been full of late clamouring for the rights of the consumer to buy in the cheapest market. It sounded very well, but had they considered what such a policy meant to the British working man and his family? He doubted whether the saving effected would equalise the additional doles that would have to be paid. Did the public realise that this country paid in sixteen months £85,000,000 in unemployment pay? If the consumer were to pay 10 per cent. more for British-made goods it would require a production of 850 millions on home-produced goods to equalise that expenditure on doles. From those figures they would see it could afford to pay 20—30 per cent. more on home-made goods before the country was any the worse off, because 200 millions of additional business would mean at least 100—120 millions expended in wages (more than the total doles). Good wages under good working conditions improved the race—doles bred degenerates. If labour only understood that it was not the employer, but the foreigner, who fixed his wages, a lot of the conscious and sub-conscious distrust between employer and employed would disappear. When they saw, in spite of the lessons of the war, public bodies, and even Government departments, beginning to place orders with their foreign competitors, when contracts at home and in the oversea dominions were awarded to tenderers from countries with collapsed exchanges, it was high time that both employer and employed should put their heads together to see what cuts must be made in order to enable them to compete, and enforce from the Government such help as it could give to keep industry steady and prosperous, and thus automatically stamp out the evil of unemployment. They had not built the works to see them empty; they wished to fill them, and they could fill them, because they knew the demand was there and instead of 12,000 workers, they could employ at least 24,000 in due course if they could produce at the right price, and if, at the same time, they could rely on the Empire primarily as their market. It should be no hardship to the worker to accept wages as at present proposed so that they could compete with such industrial countries as America and Switzerland, more especially as great care and expense had been incurred to make the life of their workers in factory and office attractive, healthy and happy; and also, as they were aware, provisions had been made for sickness and old age benefits. All this showed that they had no desire to go back to pre-war conditions, but both employer and employed would have to practise self-denial during the next few years if they were to get the wheels of progress into full swing again. A publication by the so-called Labour Research Bureau had recently been placed in his hands, in which they were taunted with playing into the hands of the capitalist by paying a high price for capital. He did not know the importance of that Research Bureau, but it impressed him with somewhat of an official stamp. If this Research Bureau were to study the problem more thoroughly with a less biased mind it would find that the dearness of capital had been largely the result of the unfortunate attitude of misguided labour during the last few years. There were other conditions prevailing which did harm to industry at the present moment, but which industry alone could not settle unless it had the support of the Government. They could only get that support if employer and employed co-operated; they should insist jointly that public money should only be spent for British labour. They should also insist on better protection against countries with collapsed exchanges. They in this country had tried hard to deflate, and they were proud to-day of the value which the pound sterling had again attained, but no such effort had been made in other countries, enemy or allied. It was not due to political conditions, as was alleged, though political conditions might be contributory. He was convinced those countries thought it good business not to deflate; they preferred to pay the interest on their large internal debts with an inflated currency. He was certain it was easier for them to raise their taxation under deflated conditions; he was certain inflation was an indirect way of cheapening wages. The mark, the krone, the franc, and the lire could drop daily and hourly; wages adjustment in those countries took place quarterly or half-yearly. No sooner did it seem that a settlement was arranged than the exchange went back, all the time at the expense of the British worker. He suffered two-fold: (1) The cheaper labour of the foreign competitor secured contracts which by rights ought to go to Britain; (2) the increased ratio between the value of the currency of their country and ours impaired the purchasing power of their nationals. Our business with them was shrinking. It would thus be seen that both factors contributed towards the unemployment from which they were suffering. It was no satisfaction to them to be told that the internal value of their currency was higher; they were mainly affected by the value of that currency for purposes of export. He enlarged on some of those features because they did not wish to deceive themselves as to the difficulties which they had to overcome before they were in smooth waters again. The world had got to go on, and distinctly saner views were prevailing everywhere, both in foreign nations and at home. Electricity, as he had often before mentioned, would play a leading part in the reconstruction of the world. Many big schemes which had been dangled before their eyes had to be deferred owing to the conditions on which he dwelt. Thanks to the chaos in the building trade the big telephone programme which the Postmaster General developed before the House of Commons had been delayed for a whole year. When it did come that company was entitled to a fair share of the work which would be offered, both in manual and automatic exchanges. Broadcasting was coming shortly, and would mean a great deal of work for that company for a number of years. Their telephone works were particularly suitable for this class of work. Though they had not as yet appeared in the Press, shareholders and their customers would be glad to know that the company meant to play an important part in the development of broadcasting service and in the manufacture and supply of receiving sets. They had preferred to let the whole scheme mature before they burst out with premature advertisements, but they had designed sets which had been approved by the Postmaster-General, which they had reason to believe were second to none, and they relied on their well-trained sales organisation throughout the country to obtain a considerable share of that business. Orders had been placed with their factories, and they should be ready to supply when the stations were ready to operate. Preliminary arrangements for licences, where required, had been made with the Marconi Co., with which company they proposed to collaborate in giving good broadcasting service. Railway electrification was another development which would help to fill their works. It had been talked of since the early days of the war. It was only just beginning to take practical shape, and they had had their share of what little had been placed so far, and expected to get their full share when the work was being seriously proceeded with. It would lead him too far to go into details as to why it was held up, but it could not be held up much longer. Big power stations would shortly come, and these meant additional work in their industrial department, and when they were started they would give at last the cheap unit of power for which the country had been searching so long, and which, in effect, for many years to come, would be the essential raw material of an industrial country. They had been entrusted with the installation of a 20,000-kW turbo-alternator for the Birmingham Corporation, which he believed would be the standard size of plant for these power

stations in the future. When the cheap unit of energy did come it would create a demand for their staple business, *viz.*, industrial and domestic appliances, in such quantities that would stretch the manufacturing resources of this country. But all this development could not come overnight—they might have to go through lean times before they were in sight of that Eldorado, the electric age, of which so much has been said and written, and the arrival of which had been largely delayed through a small body of firebrands who had set the whole country by the ears, and, for reasons which were now apparent to everybody, had caused distress and misery where plenty and happiness might reign. They were in no way disheartened, they were as enthusiastic as ever as to their future. They had used the quiet period of the last twelve months on the one hand to simplify their organisation, and on the other hand to effect economies wherever possible, but they had at the same time expended time and money in research and development in every branch of the electrical engineering industry, and they would be ready for their task and rise to their responsibility and expectations whenever the signal to march forward was sounded.

Mr. E. G. Byng seconded the motion, which was carried unanimously.

Brazilian Traction, Light & Power Co.

The revenue for 1921 amounted to $4,410,057 (against $7,036,824), and interest on investments, &c., amounted to $127,657 (against $206,619). General administration expenses, interest, &c., amounted to $1,000,033 (against $988,320), and $300,000 (against $260,000) is provided for general amortisation, leaving a net revenue of $3,237,681 (against $5,995,123). After deducting the preference dividend and adding $3,082,132 brought forward there remains a balance of $5,719,813 to be carried forward. It is stated that the claims against the Federal Government for exchange differences during the last three years are still unsettled. The directors feel justified in resuming the payment of ordinary dividends, and have declared a dividend of 1 per cent., payable on September 1st.—*The Times.*

United Electric Tramways of Montevideo, Ltd.

Sir George A. Touche, Bart., presided at the annual meeting held on July 14th. In presenting the report, which was abstracted in our last week's issue, he pointed out that the gross receipts of £555,725 constituted a record. Against this, however, operating expenses had shown a greater increase, proving that, while the company's facilities were increasing, no benefit was being received. As mentioned in the report, there was an urgent need for revision of tariffs. It was fundamental that a company which served the public had a right to public protection and fair compensation. A Bill authorising an increase in the 4 cent fare to 5 cents, but disallowing an increase in the price of monthly tickets, had been passed by the Uruguayan Lower Chamber, but was held up in the Senate pending a general election in November next. This Bill also introduced a variety of conditions, one of which was that any surplus over a certain dividend on the ordinary shares should be divided with the municipality. The speaker referred at length to the seizure of the company's system by the municipality, which has received previous mention in our pages. No ultimate remedy obtained by legal process could counteract the effect upon authority and discipline of this unjudicial interference between employers and employed. The action of the municipality had received general disapproval in Uruguay. Turning to the economic situation in the country, the chairman said that Uruguay, like many other countries, was passing through a difficult period. Expenditure had increased; trade was stagnant; reserves had fallen; and the fiscal year closed with a heavy deficit. In conclusion, Sir George paid a tribute to Señor Cat, who had carried out his duties faithfully during a very trying period.

Chile Telephone Co., Ltd.

The report to March, 1922, shows that the subscribers at all centres aggregated 20,104, an increase of 237 for the year. The gross revenue from all sources was £167,911 and the gross expenditure £121,895, leaving £46,016 profit, plus £16,505 brought forward, making £62,521 available. A final dividend of 3s. per share, free of tax, makes 6 per cent. for the year; £24,547 is put to general reserve; £5,000 to reserve for renewal of plant; £3,274 carried forward. The depression in the general commercial situation in Chile has continued, owing mainly to the paralysis of the nitrate industry. The average rate of exchange during the year was 6½d., as compared with 10¾d. during the preceding year.

Marconi International Marine Communication Co., Ltd.

The gross revenue for the year ended December 31st, 1921, amounted to £1,084,160, as compared with £933,568 in preceding year. The net profit of £118,043, however, shows but a small increase as compared with £117,570 in 1920. This is mainly due to the year's having been one of great depression in the shipping trade, necessitating the laying up of a large number of ships. The directors thought it proper to meet the wishes of shipowners during the time that ships were laid up and the consequent rebates of rentals and payments to operators whilst unemployed amounted to approximately £100,000, affecting the year's profits to this extent. The exceptional conditions prevailing were responsible for a number of shipping companies going into liquidation. £12,000 is written off in respect of bad and doubtful debts. In the circumstances, notwithstanding the fact that the company's business has continued to increase, the profits for the year have been sensibly reduced. The directors recommend a final dividend at the rate of 5 per cent., which, together with the interim dividend, will amount to 10 per cent. for the year. Some improvement has taken place in the shipping trade this year, and the number of ships laid up has been reduced by approximately one-half. Meeting: July 25th.

Manila Electric Corporation.

The name of this company was until December last the Manila Electric Railroad and Lighting Corporation. The gross revenues for 1921 were $3,681,398, an increase of $262,991, or 7.69 per cent. Net revenue, $1,450,058, an increase of $221,484, or 18.12 per cent. Four quarterly dividends of $1.50 per share were paid, leaving $646,231, which was transferred to surplus, making the total accumulated surplus, including reserves, $3,673,054, an increase of $658,658. Business conditions in the Philippine Islands suffered a severe depression during the year, but in spite of this the gross operating revenues of the company were greater than in any previous year. It is believed that the worst of the depression is over and that conditions will gradually become normal. The company supplies the entire electric light, power, and street railway service in the city of Manila (the capital of the Philippine Islands) and its environs, serving in all a population in excess of 350,000. The properties operated comprise some 55 miles of railways, and power stations, supplying light and power for Government, municipal, and private use. An issue of $2,500,000 first refunding mortgage 7 per cent. gold bonds due 1942 was made in April, 1922, to provide funds for the redemption of the three-year 7 per cent. notes due September of this year, and for extensive additions to the generating plant, now nearly completed, and other corporate purposes.

Prospectus.—*The Bengal Telephone Corporation, Ltd.*—The list was to close "on or before" to-day, in an offer for sale by the P. and O. Banking Corporation, Ltd., of £350,000 7 per cent. first mortgage bonds to bearer at 97 per cent. The issue is made to provide funds for capital outlays already made for the development of the business and for further extensions and improvements, and for carrying into effect the requirements of a new agreement with the Government of India.

The list was closed early on Tuesday morning, but country applications were to be considered if received by first post on Wednesday.

Capital Issues in Germany.—Although there has been a very perceptible decline in the capital increases in general in Germany during the past two months, the totals for the first half of 1922 still represent considerable sums in paper marks. The emissions of new shares in the case of existing electricity and gas works, which totalled 1,995 millions of marks in 1921, amounted to 1,402 millions in the first quarter in 1922, and to 398 millions in the second quarter. In addition new companies in these two branches raised 1,709 millions in 1921, as compared with 82 millions in the March quarter of the present year, and 209 millions in the second quarter.

Anglo Argentine Tramways Co., Ltd.—The results of the working for the first half of the year 1922 will permit of the payment of a half-year's dividend on the 5½ per cent. cumulative second preference shares. This will satisfy the arrears to June 30th, 1918.

Dublin United Tramways Co., Ltd.—Dividend at the rate of 6 per cent. per annum, less tax, on the preference, and an interim dividend at the rate of 3 per cent., per annum, less tax, on the ordinary shares, for the half-year ended June 30th.

W. & T. Avery, Ltd.—Further dividend of 10 per cent., less tax, on the ordinary shares, making 15 per cent., less tax, for the year. £10,000 to reserve; £36,163 carried forward.

Edison Swan Electric Co., Ltd.—The dividend on the first preference shares for the period to July 31st, 1922, will not be paid. The preference dividend for the half-year ended January, 1922, was also unpaid.

Electrical Distribution Co. of Yorkshire, Ltd.—Interim dividend of 7 per cent. per annum, free of tax, on the ordinary shares.

Kaministiquia Power Co.—Dividend of $2 per share, at the rate of 8 per cent. per annum, on the common stock, for the quarter ending July 31st.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—Interim dividend of 5 per cent. on the ordinary shares for the half-year ended June 30th last.

Clontarf and Hill of Howth Tramways Co., Ltd.—Interim dividend, 3 per cent. per annum.

Mather & Platt, Ltd.—Interim dividend of 3 per cent. actual, tax free.

Yorkshire Electric Power Co.—Interim dividend of 3 per cent., less tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The expected reduction in the Bank Rate to 3 per cent., which took place yesterday week, failed to stimulate business to any material extent in the Stock Exchange markets, although, of course, it is another step in the right direction, emphasising the cheapness of money and the folly of accepting the nominal rate of one per cent. which bankers now allow on deposit money. The immediate result has been a stiffening of prices amongst purely investment stocks. It becomes again a matter of increasing difficulty to obtain sound securities at anything like the issue prices. Several big companies contemplate the issue of more stock in the early future. It may be that this week will see underwriting arrangements in progress for a substantial amount of new stock to be offered by one of the London Electricity Supply companies. The 4½ per cent. debentures lately offered by the London Electric and the City & South London companies have already become so well placed that it is difficult to buy the former company's stock, while the prices of both have risen to 1½ premium. The recent offers of Indian Electric debentures continue to lag behind the general improvement that is noticeable amongst most securities of their class. The Calcutta Electric second debenture maintains its premium of 2½, but the Indian fives and Madras sevens stand at 94 (" par ") and 95¼ (1¼ premium) respectively.

An offer by the P. & O. Banking Corporation of £350,000 seven per cent. first mortgage debenture bonds of the Bengal Telephone Corporation, at 97, was promptly snapped up by the public. The subscription lists closed soon after they were opened.

Electricity Supply shares are generally strong. Investors are quick to notice the Clause passed last week by the Electricity Supply Bill Committee, which gives the Electricity Commissioners power to extend the tenure of the companies to any period they see fit, provided the local authority concurs. As is well known, most of the companies are working under the 1882 Act, and although this has been modified out of knowledge, to the advantage of the companies, there remains even to this present day a lurking, if superstitious, apprehension of the companies being treated with the generosity usual in such circumstances as those where legal authorities are able to exercise any power of control. Charing Cross ordinary shares have risen to 7¼, and the remainder of the share list shows no alteration, although the difficulty of acquiring good stock is as apparent as ever. Smithfield ordinary shares stand at 3¼ and the 4 per cent. debenture stock at 70.

In the Provincial list, Oxford ordinary have risen to 3¾ and the preference to 3½. With regard to the former, it is worth noticing that the last time the shares changed hands in the Stock Exchange was at 50s. 7½d., some nine months ago. Newcastle-on-Tyne ordinary stand at 14s. for the old and new alike. The 5 per cent. non-cumulative preference are 15s., and the 7 per cent. cumulative preference 21s. 6d. The 6 per cent. second mortgage debenture stock changed hands this week at 102⅞. Urban ordinary at 10s., and the preference at 44s., are marking time.

Victoria Falls ordinary keep good at 14s., and the first preference are an active market at 22s. 6d., the present animation in South Africans drawing people's attention to these shares. South Wales Electric Power Distribution ordinary have been done at 5s. within the last few days, and the 5 per cent. debenture stock came in about 55¼, at the end of last week. A quiet business continues to be done in North Metropolitan Electric 8 per cent. second preference stock on the basis of 102½-103. Midland Counties ordinary shares are 12s. 6d. The 7½ per cent. mortgage debenture stock remains firm at 106. Electric Supply ordinary shares are being dealt in around 35s. Clyde Valley Electric Power 8 per cent. second preferences remain close to £12.

The report of the Marconi International Marine Communication Co. shows that although the company's business is progressive, the expenditure tends to keep pace with the income. For the year ended last December, the gross revenue was just over a million pounds sterling, and the net profits came to £118,000, some three or four hundred pounds higher than those of the year before. The directors have decided to adopt a conservative dividend policy, owing to the depression in the shipping trade and the consequent laying-up of ships; therefore the shareholders will receive 10 per cent. for the year, as against 15 per cent. for 1920, and £25,000 goes forward. The effect upon the price was to cause it to drop about a florin to 1 5-16, and the parent shares, which from 2¼ had risen to 2 5/16, reacted to 2 1/16. It is generally expected that, unless the Marconi Co. can show some substantial payment from the Government in the accounts to be presented at the end of this month, the dividend in this case also will be reduced from 15 per cent. to 10 per cent. No doubt a reduction is considerably discounted, but in the circumstances it is not surprising that holders should feel a little nervous.

The Eastern Cable group remains good, and part of the dividends deducted last week have already been recovered by Eastern Telegraph ordinary stock and Eastern Extension shares. Globe ordinary rose to 19½, the preference to 11¼, Westerns to 18⅜. In this, the jubilee month of the Eastern Telegraph Co., it is interesting to notice that the price of the ordinary stock at 186½ stands at very nearly the highest point reached in its history, because, although the quotation went over 200 when the last bonus distribution was made (by the issue of stock at 100 to the proprietors), the present quotation is, of course, for the extra capital. Chili Telephones at 6 3/16 are ⅛ down. Indo-Europeans fell a point to 36¼. The manufacturing group is firm, Telegraph Constructions recovering the dividend of 5s. net deducted a week ago. Crompton ordinary at 15s. are also ex the dividend of 1s., and show no change in the price. General Electrics are quieter, the price of the ordinary being unchanged at 18s. 3d. English Electrics retained their rise on the recent success of the company in securing the contract for 34 electric locomotives ordered by the Japanese Government.

Anglo-Argentine Trams second preference are 2s. 6d. up, on the dividend announcement; the company goes steadily ahead with the payment of arrears on the shares. Brazilian Tractions weakened in sympathy with the Government bonds' decline. A rise of 5 points lifted Mexico Tramways seconds to 42½. Electric Railway stocks are somewhat irregular. Underground incomes subsided to 79½, but the £10 shares are a good market at 2⅜. The Stock Exchange is asking when it may expect some kind of reorganisation of capital scheme that may, conceivably, be of decided benefit to the £10 shares. London General Omnibus first debenture is better at 89, and the income debenture hardened to 86.

Armament shares are quiet, with a dullish disposition, and the rubber market remains comatose.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price July 18, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	7¼	+ ¼	6 4 2
do. do. do. 4½ Pref. ...	4½	4½	8⅜	—	5 16 2
Chelsea	6	6	5⅝	+ ⅛	5 4 4
City of London	14	14	2	—	7 0 0
do. do. 6 per cent. Pref....	6	6	22/6	—	5 6 8
County of London	8	8	1⅞	—	6 2 0
do. do. 6 per cent. Pref....	6	6	1⅛	—	5 13 0
Kensington Ordinary	9	10	7⅛	—	7 0 7
London Electric	2½	4	2⅛	—	5 14 0
do. do. 6 per cent. Pref....	6	6	5	—	6 0 0
Metropolitan	7	7	5⅝	—	6 13 4
do. 4½ per cent. Pref....	4½	4½	3⅝	—	5 16 2
St. James' and Pall Mall	12	12	8⅝	—	6 17 2
South London do.	7	7	5⅛	—	8 0 0
South Metropolitan Pref.	9	9	1⅞	—	6 18 0
Westminster Ordinary	10	10	7½	—	6 18 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104xd	+1	5 15 5
do. Def.	1½	84/6	23⅜	—	7 7 6
Chile Telephone	6	6	6⅛	— ⅛	4 17 0
Cuba Sub. Ord.	7	9	8½	—	8 4 8
Eastern Extension	10	10	18½xd	+ ⅛	5 8 1
Eastern Tel. Ord.	10	10	186½xd	+1½	5 7 3
Globe Tel. and T. Ord.	10	10	19⅜	+ ⅜	5 4 7
do. do. Pref.	6	6	11¼	+ ¼	5 6 8
Great Northern Tel.	24	22	28½	+ ½	7 16 3
Indo-European	10	10	36¼	—1	6 17 0
Marconi	25	15	2⅜	— 1/16	6 17 0
Oriental Telephone Ord.	12	12	28	—	*5 1 1
United R. Plate Tel.	8	8	7⅛	—	*5 12 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅜	+ ¼	*5 6 8
Home Rails.					
Central London Ord. Assented ...	4	4	68	—	5 17 8
Metropolitan	1½	2½	48	— ⅛	4 13 9
do District	Nil	Nil	39	+1	2 11 8
Underground Electric Ordinary ...	Nil	Nil	2⅝	+ ⅛	Nil
do. do. "A" ...	Nil	Nil	6/6	—	Nil
do. do. Income ...	2	4	79½	—2	*5 0 8
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref. ...	5½	12½	3½	—	7 17 2
do. do. 2nd Pref... ...	Nil	5½	3⅝	+ ⅛	7 7 0
do. do. 5 per cent. Deb. ...	5	5	81½	—	6 4 3
Brazil Tractions	Nil	Nil	51	—1	7 16 10
British Columbia Elec. Rly. Pce. ...	5	5	80½xd	+2	6 4 3
do. do. Preferred ...	5	93/-	69½	—	*6 13 0
do. do. Deferred ...	3	124/-	75½	+1	*8 4 6
do. do. Deb.	4½	4½	78	—1	5 9 0
Mexico Trams. 5 per cent. Bonds ...	Nil	Nil	71½	—	—
do. do. 6 per cent. Bonds ...	Nil	Nil	42½	+5	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	52	—	Nil
do. 1st Bonds	Nil	5	68½	—	7 6 0
Manufacturing Companies.					
Babcock & Wilcox	15	16	3	—	5 6 8
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2¼	—	7 1 2
Callenders	15	15	2⅛	—	7 5 3
,, 6½ Pref.	6½	6½	1⅛	—	5 9 5
Crompton Ord.	10	5	15/-xd	+9d.	6 13 4
Edison-Swan	10	Nil	4/6	—	Nil
do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	8	5	17/6	—	5 14 3
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/3	—	5 9 7
Henley	15	15	2¾	—	6 13 4
do. 4½ Pref.	4½	4½	4¾	—	5 2 10
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	2⅞	—	6 11 2
Siemens Ord.	10	10	1⅞	—	*7 12 4
Telegraph Con.	20	20	26xd	+ ½	*4 12 2

* Dividends paid free of Income Tax.

AN ALL-ELECTRIC KITCHEN.

The Witton G.E.C. Club Installation.

In connection with the visit of inspection paid to the Witton engineering works of the General Electric Co., Ltd., at Birmingham, during the recent I.M.E.A. Convention, the following descriptive account and illustrations relative to the electric cooking installation in the "Magnet" Club, which is attached to the Witton works, and is used for the benefit of the employés there, should be of interest. Incidentally, it may be mentioned that the fine club-house was erected by the company in memory of the many who went from Witton to the Front and who did not return.

The club possesses an up-to-date electric kitchen, the whole of the equipment for which was manufactured at the company's heating and cooking works at Birmingham. The kitchen was planned for the supply of meals to the staff and employés, approximating 2,000, and has been in operation for over 18 months, with complete success.

The main equipment comprises four ranges, each fitted with three ovens, grillers, steaming ovens, vegetable boilers, fish fryers, stock pots, hot cupboards, saucepans and boilers, together with the necessary control gear.



Fig. 1.—General View of the Kitchen.

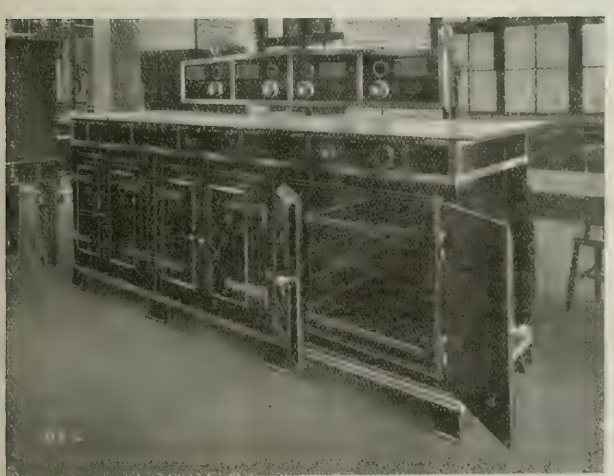


Fig. 2.—The Electric Ovens.

When considering the planning of the kitchen, it had to be borne in mind that, whilst large numbers had to be catered for, there was no need to make provision for great variety in the type of meal. Any portion of the plant for cooking in any particular way had to be capable of providing for the full number of diners at any one time.

In the design of the whole of the appliances the guiding principle adopted was simplicity of construction, so that access could be easily obtained to any particular part. In the ovens the whole of the electrical portion can be readily removed, leaving an entirely free space for cleaning. There are no crevices for fat or dirt to accumulate in, and all seams are welded.

With the exception of the stock pots, all appliances have



Fig. 3. A Group of Electric Boilers.

self-contained elements, whilst the problem of vegetable boiling has been successfully solved by providing such loading that an ample reserve of heat is available to raise the temperature quickly to the boiling point.

The following details of the equipment are of interest:—

Ovens.—Four ranges are provided, each fitted with three ovens of 8 cu. ft. capacity, wired for 5 kW maximum consumption, with low heats of 2½ kW and 1¼ kW. They are operated by series parallel switches and the elements are of the Firenza type. On two of the ranges plug receptacles are provided for separately heated utensils.

The *Grillers* are arranged with hot cupboards above and below the upper ones receiving the heat from the actual grilling elements. Each half of the griller is wired to consume 8 kW, and sub-divided again so that only a quarter of the total grilling area need be in use if so desired.

Steaming Ovens.—These are double-cased and lagged, and the doors are arranged with steam-tight joints. A constant water-level attachment is fitted to avoid the possibility of boiling dry. Current consumption is 5 kW maximum, with low heats of 2½ and 1¼ kW. They are operated by series parallel switches.

The *Vegetable Boilers* are each of 30 gallons capacity, made in heavy copper, double cased, and arranged with series parallel switches. Current consumption is 6 kW, 3 kW and 1½ kW. They are fitted internally with the usual wire baskets and strainers, &c.

The *Fish Fryers* are welded steel pans 36 in. x 18 in. x 8 in., the current consumption to each section being 4 kW with low heats of 3 kW and 1½ kW.

Stock Pots and Stand.—The stock pots are made of heavy copper, and the heating elements are not so exposed, but the stand is provided with a hot-plate 20 in. square loaded

to 50 kW maximum, with low heats of 2½ kW and 1¼ kW, and series-parallel operation is provided for.

Hot-cupboards and Carving Tables.—These are each provided with three carving wells, separately heated, the consumption for each being 500 watts. The hot-cupboards have a maximum consumption of 3 kW. Overhead control is fitted.

Saucepans and Boilers.—These are all fitted with self-contained heating elements, with series parallel control. Pilot lamps are fitted near the plug receptacles, to which they are connected.

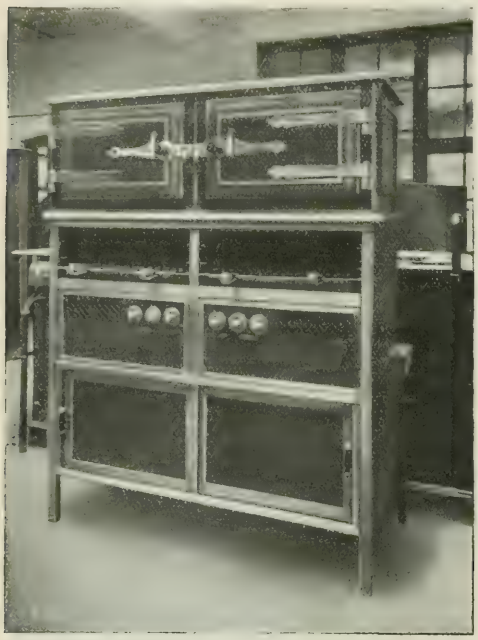


Fig. 1. An Electric Oven and Grill.

Control Gear.—The series-parallel principle has been adopted throughout the whole of the cooking apparatus in the canteen, and pilot lamps are fitted in every circuit. The internal connections in the apparatus are almost entirely of stiff strip metal, and the use of beads is almost eliminated. Mica insulation is adopted throughout, except where red-hot coils are used.

The whole of the apparatus has been wired for use on a 220-volt 3-wire system, the various items being arranged so that they can easily be balanced.

LIGHTING IN FACTORIES AND WORKSHOPS.

H.O. Departmental Committee's Third Report.

The third report of the Home Office Departmental Committee on the above subject,* which has just appeared, contains some useful information on industrial lighting. The first portion is devoted to a summary of previous recommendations, which appeared in the first interim report (1915) and the second interim report (1921). The contents of these have already been noted in our pages, but it may be useful to recall some of the chief conclusions.

The chief recommendation was that there should be a statutory provision "(*a*) requiring adequate and suitable lighting in general terms in every part of a factory and workshop, and (*b*) giving power to the Secretary of State to make Orders defining adequate and suitable lighting for any part thereof or for any processes carried on therein." The Committee also stated the illumination necessary in the interests of convenience and safety, *e.g.*, a minimum of 0.25 foot-candle over the "working area," 0.4 ft.-c. in foundries, and 0.1 ft.-c. in parts where people are liable to pass, but work is not done. These values were given irrespective of the illumination necessary for the actual carrying on of work. The second report dealt in general terms with the avoidance of glare, inconvenient shadows, and flicker. Avoidance of glare was covered by a special clause, limiting the position of bright sources with respect to the eye.

There remains the problem of specifying the degree of illumination necessary for the carrying on of various industrial processes, and this is dealt with in the report now issued. Two alternative courses suggest themselves:—

(1) Definite minima may be laid down, below which illumination on any part of the working plane must not fall, and (2) standards of illumination may be specified as recommended practice, to serve as guides in determining whether lighting is adequate.

Such standards would not be legal minima, but would conform to the best modern practice and would represent figures which may reasonably be expected for the general standard of illumination over the working plane.

The Committee, after visiting various factories where measurements of illumination were made, and reviewing data available on codes in use in other countries, has decided on the second course. In an appendix a great variety of processes is classified as "fine work" requiring 3 foot-candles, and "very fine work" requiring 5 foot-candles. It considers that extensive investigations are needed before definite minima to be enforced by legislation can be recommended.

As a preliminary to more detailed procedure, and in order to avoid hardship to employers and much administrative difficulty, a careful and systematic inquiry is needed on the following lines:—(1) The collection for every process concerned of a sufficient number of observations to give some indication of the best existing practice; and (2) experimental research with the object of discovering the conditions of illumination desirable on physiological and psychological grounds.

Ample proof is now forthcoming of the relation between lighting and production and safety, and it seems reasonable to expect the co-operation of all the chief industries in which lighting is specially important. It is therefore suggested that these industries should assume partial responsibility for the scheme of investigation by collecting data—possibly through the research associations where they exist.

Various other experiments are described in the report, notably an inquiry into the debateable question of the effect of a mixture of natural and artificial lighting. While this was somewhat inconclusive in the main object aimed at, it led to some interesting results. Workers, for instance, asserted that in full artificial light "the surrounding darkness acted like a nagging foreman," with the result that for the short period of the test output was increased far beyond what could have been maintained for any length of time. But the conditions in these circumstances were very fatiguing, and quite different from those experienced with semi-indirect lighting. This experience seems to confirm the view, expressed elsewhere in the report, that an excessive contrast between the brightness of illumination on the work and the surrounding area is objectionable.

Attention is also drawn to the well-marked relation between accidents and inadequate illumination. It is gratifying to note that the standard of industrial lighting has improved greatly during recent years.

The appendices to the report also contain a summary of the requirements, as regards amount of illumination, of the various American codes on industrial lighting.

*H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1. Price 9d. net.

ELECTRICITY IN FACTORIES.

H.M. Electrical Inspector's Report.

The annual report of H.M. Chief Inspector of Factories and Workshops for 1921 was issued on July 8th*, and with it an abridged form (official edition, form 954A) of the regulations made by the Secretary of State for the generation, transformation, distribution, and use of electricity in premises under the Factory and Workshop Acts, 1901 to 1920.

In the chapter on the generation and use of electricity Mr. G. Scott Ram, M.I.E.E., senior electrical inspector of factories, reports that the most notable incident in his section during the year has been the appointment of four additional electrical inspectors. The need for an addition to the staff has long been felt, and was recognised by the authorities as far back as 1914, in which year four such appointments from amongst inspectors already on the staff had actually been arranged, when the war intervened and prevented the scheme from being carried out. The present appointments have been made from outside the staff, as it was felt that only men who had been properly trained as electrical engineers and whose subsequent experience has been entirely in electrical engineering should be appointed. Hitherto, even with such help of the district staff as has been available, not only has it been impossible to investigate many of the accidents, but the amount of inspection of electrical stations and plant on factory premises has been very inadequate when it is considered that there are over 600 electricity supply undertakings, having generating stations and several thousand sub-statoins, and about 70,000 works wherein electricity is used for driving machinery and other purposes.

Reports from the district staff covering the past year confirm of Mr. Ram's own observations that in general the quality

*H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1. Cmd. 1705; price 3s. net.

of new work on factory premises continues to improve, but there are exceptions, generally where the occupier, not having technical knowledge, relies entirely on a contractor, who secures the order on the question of price only. The contractor sometimes being incompetent or unscrupulous, an inferior and often dangerous job results.

Electrical manufacturers have done much to improve apparatus and accessories from the safety point of view.

The number of accidents due to electricity reported during the year was 322, of which 12 were fatal—a reduction of 81, or 20 per cent. on the total and 50 per cent. on the fatal cases compared with each of the two preceding years. The reduction in the total is no doubt partly due to a higher standard of electrical work generally, but it may be to some extent influenced by slackness in trade, many works having for part of the period been partially shut down. The reduction in the relative proportion of fatal cases is also satisfactory, but cannot, Mr. Ram fears, be regarded as a premanent improvement, so much depending upon the chance circumstances of the accidents. The reduction in the fatalities is entirely in respect of the low-pressure shock cases, there being only five, as against 19 and 20 in the two preceding years. Incidental circumstances, such as the duration of the contact measured in seconds, the naure of the floor on which the victim happens to be standing at the moment, and whether there is efficient first-aid promptly at hand, have an important influence in determining whether such accidents have merely slight or fatal results.

Twenty-one of the accidents occurred on high-pressure or extra-high-pressure systems, seven being fatal. Seventeen of them, including five of the fatal cases, occurred in public supply stations, eight of them (two fatal) were to skilled persons, and nine (five fatal) to unskilled persons. Four of those to skilled persons were due to foolhardiness, and five occurred to unskilled persons who were set or permitted to work under similar circumstances. The employment of labourers or other unskilled persons in dangerous work in such stations and without proper supervision is still far too prevalent.

The other four accidents to skilled and two of those to unskilled persons were due to those in charge of the work erroneously supposing that the conductors had been isolated and made dead. In this class of accident, many of which have occurred in previous years, the result when not fatal is often serious permanent injury, and any additional means of prevention is to be welcomed. An actual test by a suitable instrument to prove that the conductors have been isolated and made dead before the work is commenced is obviously the safest course. In some works, where the pressure is high enough, a rough and ready test is made by means of the insulating rod provided for operating the isolating switches, the metal hook at the end of the rod being held close to the conductors which, if live, will show a spark discharge. It is much better, however, to provide a special instrument for the purpose. Such an instrument, consisting of a vacuum tube on the end of an insulating rod, has been in use for many years in a few cases. The vacuum tube will glow if the conductors are live. In case the tube should be out of order, it is first tried on a conductor known to be live. Another instrument, specially designed for the purpose, is now available and indicates by a spark discharge. This instrument has been designed by the engineer of one of the large electricity supply companies and has already been in use in the stations of that undertaking long enough to prove its usefulness, more than one serious accident having been known to have been prevented. It has been readily taken up by other undertakings where Mr. Ram has drawn attention to it, and it only needs to be more widely known to be more generally adopted. Its range of use, as at present available, is for systems between 3,000 and 11,000 volts, and an instrument suitable for still higher pressures is being experimented with.

Of the low-pressure and medium-pressure accidents, a large proportion (70) was, as usual, due to persons, both skilled and unskilled, cleaning or repairing live switchboards or other apparatus. Portable apparatus and connectors accounted for 57, and a number again occurred in the renewing of fuses not constructed or protected as required by the regulations. The circumstances and causes of these accidents were in general similar to others described in detail in previous reports. Attention may be usefully drawn to a fatal case involving an increasingly widespread risk, regarding which a warning was issued in the 1916 edition of the published memorandum. This concerns the use of the screw-socket type of lampholder. When used, as was always the case up to a few years ago, with lamps fitted with screw caps which entirely entered the screw socket, there was no objection. Recently, however, lamps, both of small and large sizes, are made with a metal extension of the screw cap in the form of a cup covering the neck of the lamp and extending far outside the screw socket of the holder. It is invariably overlooked that this exposed extension of the screw cap is in electrical connection with the circuit and is live and may be dangerous to touch. In the case in question a man was attempting to remove a lamp from the holder and took hold of the metal cup and was killed. This accident occurred on the premises of an important electrical power supply undertaking, where one might expect that the wiring would have been correctly carried out. The single-pole switch controlling the circuit was, however, connected in the earthed neutral lead instead of in the phase wire of the circuit, so that even had the switch been turned off it would not have prevented the accident. It appears that for lamps of small size there is no need whatever for this cup extension of the screw cap, but for large size lamps it is necessary for the secure attachment of the lamp. The use of the metal extension is not in accordance with the regulations unless the lamp is used with a holder or fitting which will entirely screen the live cap so that it cannot be touched whilst in contact with the circuit. Lampholders for use with these lamps should be provided with a petticoat extension of insulating material to shield the live metal, or preferably any necessary extension of the screw cap should be made of a suitable insulating material.

In June a pamphlet on electric arc welding,* dealing with the precautions necessary in respect of dangers met with in the process, was issued by the Department, and has proved very useful.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Homelite" Lighting Plant.

Fig. 1 illustrates a small lighting plant of novel design, which is being sold by the Sun Electrical Co., Ltd., 118 & 120, Charing Cross Road, W.C.2.

The set, which weighs only 100 lb., has a height of 18½ in., a length of 20 in., and a width of 13 in. As seen in the illustration, it is mounted on springs. The engine is a single-

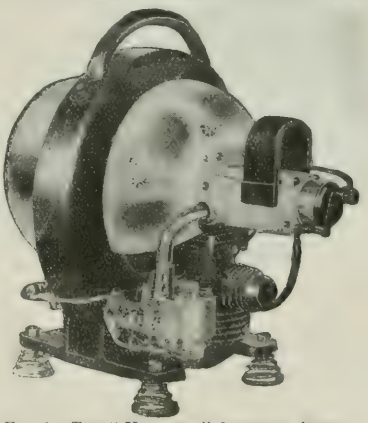


Fig. 1. The "Homelite" Lighting Plant

cylinder, two-stroke, air-cooled petrol motor running at a speed of 1,450 r.p.m. It is direct-coupled to a six-pole shunt-wound dynamo giving an output of 400/450 W at 32 V. Ignition is provided by a Simms h.p. magneto mounted on the main shaft. Batteries of 16 cells, capable of outputs of 50 Ah or 75 Ah are provided with the "Homelite" set.

"Ballsok" Insulating Beads.

Messrs. Lionel Robinson & Co., 3, Staple Inn, W.C.1, have sent us a sample of insulating beads which would appear to be of great value to manufacturers of electric heating and cooking appliances. It is customary to cover the wires which

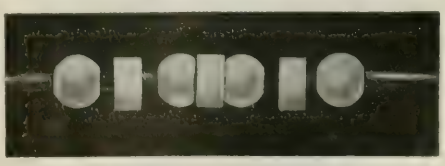


Fig. 2. "Ballsok" Insulating Beads

connect the elements of such appliances to the controlling switches with glass beads, which, while satisfactory at the lower temperatures, always leave parts of the wires unprotected, and at high temperatures are unable to stand up to the conditions

* Memorandum on Electric Arc Welding. Form 426. price 3d., obtainable from H.M. Stationery Office, and usual agents.

The present invention employs a material which, while perfectly resilvroscopic, is capable of being used in very high temperatures. By a special method of moulding, the beads form a ball and socket arrangement (hence their name—Basock"), ensuring the complete protection of the wire to which they are applied. The arrangement is shown in fig. 2. The makers (who are English) claim that the beads are moulded to within [illegible] of the correct size.

The Runbaken "Ford" Commutator.

The out-of-date design of commutator forming part of the "Ford" car ignition system, is short-lived, and a constant source of trouble owing to the fact that the current has to pass through an oily roller and bearing pins causing sparking and pitting. To remedy this the Runbaken Magneto Co., Ltd., Cheetwood Road, Derby Street, Manchester, has put a new form of commutator, fig. 3, on the market for incorporation in the existing "Ford" ignition system. The commutator consists of eight copper sections, four "live" and four "dead," insulated from one another by thin walls of "Stabilite" which is said to wear at the same rate as copper. The segments are moulded in the insulation under hydraulic pressure. The rotor sleeve carries a sprung arm holding a small copper-wire brush. The terminals are fitted at the top of the casing, where they are clear of the oil and belt. These terminals are of the split pin type, fitting into brass sockets which are moulded into the insulation. They are distinctively coloured and numbered to prevent mistakes in connection. The timing arm has a large range of adjustment, ensuring greater accuracy than usual.

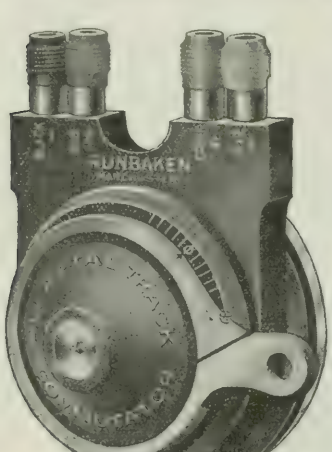


Fig. 3.—The Runbaken "Ford" Commutator.



Fig. 4.—The "Sentry Kettlejack."

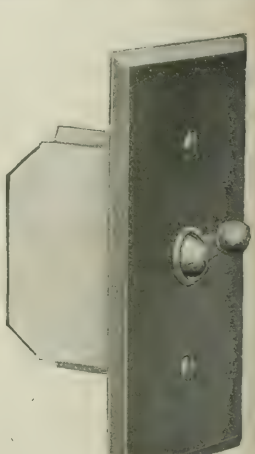


Fig. 5.—Hart Tumbler Switch.

The "Maco" Adjustable Template.

We have received from Mr. E. James Brown, 12, Montserrat Road, Putney, S.W.15, a simple device for securing the profile or shape of articles with little or no trouble. This is the "Maco" template illustrated in fig. 6. It consists of hundreds of steel or brass strips, .007 in. thick, held in position between

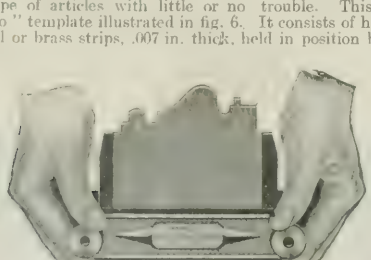


Fig. 6.—The "Maco" Adjustable Template.

two end plates, at each corner of which are tightened up by means of milled thumb-screws and springs. In use, the screws are loosened and the edges of the strips are pressed against the profile required. The strips then move to take up the outline and, in addition to this, their opposite ends give a similar "solid" outline. The thumb-screws are then tightened and the template is ready for use.

It will be seen that an enormous amount of labour and expense can be avoided by the use of this device; in fact, it is one of those things that "should have been thought of before."

The Hart Tumbler Switch.

A new tumbler switch has just been placed on the market by the Hart Manufacturing Co., of 76, Rochester Row, London, S.W.1, which differs entirely from any other tumbler switch in existence, the mechanism being similar to that employed in the same company's well-known push-button switch. As shown in fig. 5, it is of the flush type, and makes a very neat job. The action is positive, giving a rapid make and break; the contacts are of phosphor bronze, and all wearing parts of case-hardened steel, and the mechanism is very efficiently insulated from the parts that carry current.

These switches are being manufactured in single-pole, d.p., 2-way, and 4-way patterns.

Kettle Suspender for Electric Fires.

Messrs. Wood, Russell & Co., 31 and 36, Oxford Street, W.1, have produced a simple but useful device, specially designed for use with electric fires. This is a jack for holding a kettle over a fire or boiling ring, fitted with a pot-hook and adjustable links. The "Sentry Ketteljack," as it is called, is illustrated in fig. 4.

Auroral Phenomena.—Mr. A. Gibbs, M.I.E.E., deputy chief telegraph engineer of the Dominion of New Zealand, writes to the *Post Office Electrical Engineers' Journal* on the telegraph, telephone, and wireless interferences experienced during an exceptionally brilliant display in May last year, and states that they were of greater magnitude and more far-reaching in their effects than any of which the New Zealand Telegraph Department has record. It is the first time, also, that the effect of the aurora upon wireless communication in this, or probably any other country, has been so noticeable.

An interesting experiment was performed at Awarua, where during the height of the disturbance an insulated counterpoise (or network of insulated wires) was substituted for the usual earth connection. In effect the wireless receiving system was entirely disconnected from the earth, and therefore not subject to direct interference from electrical charges circulating therein. This removal of the earth connection did not in any way affect the prevailing variations of the signals, which continued to be as erratic as ever. During the period referred to there were brief intervals at all New Zealand stations when signals returned to normal and nothing unusual was noticed. The effects at New Zealand stations may be summarised as follows: (1) Great and sudden variations in signal-strength from maximum to minimum; (2) signals from different directions not simultaneously affected; (3) dead periods when neither signals nor statics were heard; (4) period of abnormal intensity of signals and statics; (5) signals from European long-wave stations unaffected during the whole period. All of the New Zealand stations are connected by land telegraph lines with the telegraph centres, and it was noticed at times that great variations in radio signals were simultaneously accompanied by earth currents in the land telegraph lines of sufficient intensity to render the Morse circuits inoperative.

THE NEW QUEENSTON-CHIPPAWA GENERATORS.

The rapid advance which Canada has made in the field of electricity-generating by water power is exemplified by the huge sets recently put into commission at the Queenston station of the Hydro-Electric Power Commission of Ontario. These 45,000-kVA sets have been built by both the Canadian General Electric Co. and the Canadian Westinghouse Co. The particulars following were recently made public by the Engineering Department of the latter company, and may be taken as typical of the machines of both companies.

The magnitude of these sets may be judged from the first illustration; the height to the top of the exciter, which is mounted directly upon the main shaft, is 35 ft., and the diameter of the generator casing is 24.5 ft. The water turbines are of the Wellman-Seaver-Morgan type, developing 55,000 h.p., and the generators produce 3-phase, 25-cycle current at 12,000 V.

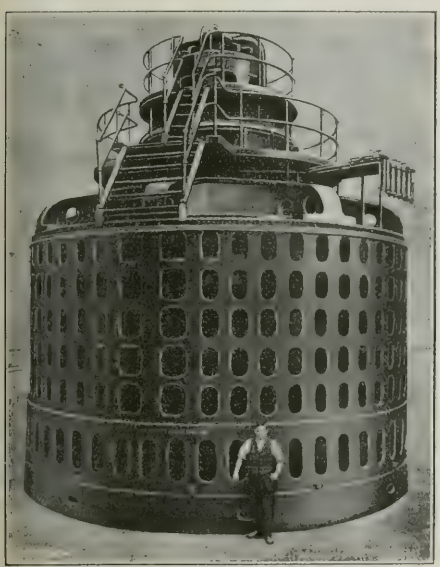


Fig. 1.—A Queenston 45,000-kVA Turbo-Generator.



Fig. 2. An Armature Coil.

The stator of one of these machines is shown in fig. 3. The frame is an annular cast-iron ring webbed at the base at frequent intervals. It is in five parts: first, there is a solid base ring, and then the upper part, which is divided into four radial sections, each of which is 10 ft. in height and weighs 42,000 lb. The armature core is built up of segmental laminations of thin sheet steel. After these were punched, and before assembly, they were annealed and enamelled. In building the core, vent ducts, spaced about two inches apart, were put in between the layers, extending all round the core. The laminations are braced together by heavy bolts and cast-iron end plates. The winding of the armature is carried out with copper strip of rectangular section, there being a number of strips in each conductor. The individual strips forming a conductor are insulated from one another by means of mica tape, and the complete coils are covered with "micarta folium" insulation—a compound patented by the Westinghouse Co. This insulation has a high dielectric strength, is very compact, and withstands high temperatures. A complete armature coil is illustrated in fig. 2. The connections between the various parts of the winding are made of insulated copper straps carried on supports above the upper ends of the coils. The windings are arranged for star connection, and both ends of each phase winding are brought out through the frame in order that protective relays may be inserted in each circuit, while between coils in the slots a number of thermo-couples are distributed throughout the winding for checking the temperature of the various parts.

The rotating field consists of 15 laminated poles dovetailed to the rim of a spider mounted on the shaft. The field coils are composed of insulated heavy copper strip. Sheet asbestos and shellac are used in insulating between turns, while on the inside of the coils, adjacent to the poles, and on the upper and lower edges of the coils, insulation consisting of mica, asbestos, and bakelite is built up and moulded to shape. The coils were baked after insulation. Although the peripheral speed of the spider is not excessive, a laminated steel rim is used, owing to the uniformity of the material. The hub of the spider is a webbed steel casting secured to the shaft by a heavy steel key. On the lower side of this hub there is a brake ring to which air brakes, mounted on the lower bearing bracket, can be applied in case of emergency. The hub weighs about 55,000 lb.

The shaft is a hollow steel forging with a bore of 8 in. Its total length is 30 ft., its diameter at the hub is 32 in., and it weighs 70,000 lb. The leads from the field coils are carried through the shaft to the cast-iron collector rings mounted on the shaft above the thrust bearings.

The upper and lower bearing brackets are of cast iron, heavily webbed for strength and rigidity. The approximate weights of the upper and lower brackets are 80,000 lb. and 45,000 lb. respectively. There are three bearings to the generator; the main one is a 69-in. Kingsbury thrust bearing carried on the upper bracket. This bearing is designed to carry a load of 1,000,000 pounds, including the rotor and the water thrust on the turbine. The rotating part of the bearing consists of a carefully-surfaced cast-iron collar fastened to the shaft. This collar is supported by babbitt-faced segmental steel shoes which are pivoted so that they can rock a little in any direction. The complete bearing is immersed in oil which is cooled by water circulating in copper tubes. The oil is also circulated. Two guide bearings are also used; one of these is placed above the rotating field and is mounted on the upper bracket below the thrust bearing; the other is below the rotor, upon the lower bracket. The bearing housings are of cast iron, arranged with water jackets through which cooling water is circulated. The bearings are lined with babbitt, which has numerous grooves to carry the oil to all parts of the bearing surface. Forced lubrication is employed.

The cooling of the generator is accomplished by forced ventilation. Free air is drawn up from underneath the generator, from which it passes through the spider to the upper part of the rotor. Vane blowers attached to the spider distribute the air uniformly to various parts of the generator, from which it passes through the various ducts in the iron and openings in the coils and the frame to the space between the generator and the walls of the pit in which the machine is mounted, from whence it is drawn by an exhaust fan. Openings in the generator leading to the generator room above, in which is situated the upper part of the machine, consisting of the thrust bearing and exciter, are closed by means of sheet steel covers. The quantity of free air passing through the generator is about 120,000 cu. ft. per minute.

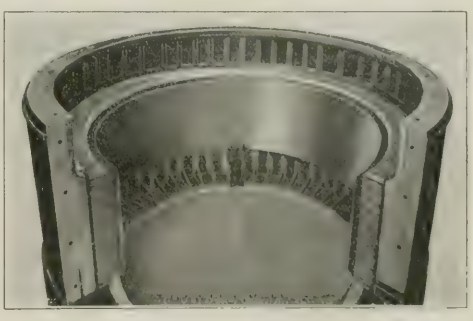


Fig. 3. The Stator of the 45,000-kVA Generator.

At present the machine described is the largest of its kind in the world, and the firm which designed and constructed it, as well as those which are building similar sets, is to be congratulated upon the accomplishment of a splendid engineering feat.

LEGAL.

Whitgate Brick Co., Ltd., v. O'Brien & Co.

In the King's Bench Divisional Court on July 12th, Justices Lush and Bailhache heard appeals from the decision of a Special Referee in this case arising out of the purchase and supply of an electric motor.

Mr. Rowson, for the plaintiffs, said that towards the end of 1920 they were anxious to install an electric motor in their brickworks, and they approached the defendants for that purpose. They pointed out to the defendants that they wanted a motor for traction current. Defendants supplied a motor which was put into the works, but within the first three days there was trouble with it, and it eventually burnt out. Plaintiffs therefore brought an action to recover the price paid and for damages for breach of contract. The case came before Commissioner Parfitt at Manchester Assizes, and he came to the conclusion that it was a technical matter, and referred it to arbitration. Professor Walker, of Manchester University, was appointed special referee for the purpose. The case was heard by him about March of this year. The arbitration was closed, and then, without the plaintiffs' consent or knowledge, the Referee heard, or had a conversation with, certain gentlemen employed by the English Electric Co., who were the manufacturers of this motor, and carried out experiments at their works, of which plaintiffs were not notified. The award was made in the defendants' favour, and each side was ordered to pay its own costs. Plaintiffs now appealed against the whole award on the ground that the Referee had committed legal misconduct by hearing these gentlemen, and plaintiffs asked for the award to be set aside. O'Brien & Co. were the agents of the English Electric Co. in Manchester.

Mr. Moresby, for the defendants, contended that the test carried out by the Referee was done with the consent of both sides, and there was no evidence that the persons who witnessed it were witnesses at the arbitration. The test was made after the arbitration was closed.

Mr. Rowson said his clients thought this was to be merely an inspection of the motor and not a test; and if his clients had known there was going to be someone there representing the English Electric Co. they would have had one of their own experts there. The real defendants were the English Electric Co., and they were backing O'Brien & Co. There was no suggestion throughout the correspondence from the Referee that he was going to conduct a test. As a matter of fact, the plaintiffs did not agree with the results of the test.

Mr. Justice Lush: Everything seems to have been above board. You knew what he was going to do.

Mr. Rowson: We did not know he was going to have representatives there from the English Electric Co.

Mr. Justice Lush: How could he do what he was going to do without assistance?

Counsel: He could have taken one of his own assistants.

Mr. Justice Lush, giving judgment, said it appeared from the correspondence that the Referee took special care to inform the plaintiffs' and defendants' solicitors that he wished to inspect the motor. He had gone further, and said he wished to have a test, and plaintiffs' solicitors did not object to the test. In making the test, therefore, there was no doubt the Referee acted with the knowledge and consent of the plaintiffs. It was impossible to make a test without saying something to the employés at the works, who would know how to put the motor in a proper condition for the test to be made. There was not a particle of evidence that the Referee did anything more than what was necessary to obtain the test, and no evidence that anything passed between him and the employés of this company about anything except the test he was going to make. He therefore held it was not proved that the Referee had been guilty of any misconduct.

Mr. Justice Bailhache concurred, and the appeal was dismissed, with costs.

Their Lordships then heard the defendants' appeal against the order of the Referee that each side should pay its own costs.

Mr. Moresby submited that the wrong principle had been applied, and that it was wrong that the defendants, who had been wholly successful, should have to pay. The Referee laid down the extraordinary principle that it was the duty of the defendants to acquaint the plaintiffs of the fact that the latter had no case.

Mr. Justice Bailhache: I suppose you said in your defence to the action that the plaintiffs had no case?

Mr. Moresby: Most emphatically.

After hearing counsel for the plaintiffs, their Lordships held that the fact that the defendants did not acquaint the plaintiffs with their view that plaintiffs were wrong could not be a ground for depriving them of their costs.

Defendants' appeal as to costs was therefore allowed.

Fairchild v. Lytham Pier Co.

At Blackpool County Court, on July 12th, John Fairchild claimed £27 from defendants for professional services connected with the electrical installation on the Pier and direction of repairs to a dynamo.

The action had been remitted from the High Court.

Plaintiff said he agreed to accept 18 guineas, but stipulated that it was without prejudice.

Plaintiff, engaged by St. Annes Electricity Works, said there was no fixed rate of remuneration. He not only advised on the strength of cable and wires, but on the whole installation.

The Judge, in an argument in which it was admitted that plaintiff had received a cheque for £18 18s., described the case as "a storm in a tea-cup."

Judgment was entered for the defendants, with costs, defendants stating that plaintiff had agreed to accept £18 18s. in settlement.

B.T.H. Lamp Patent Infringement Cases.

Lord Blackburn, in the Court of Session, Edinburgh, on July 12th, delivered judgment in three actions at the instance of the British Thomson-Houston Co., Ltd., against (1) Naamlooze Vennootschap Pope's Metaaldraadlampenfabriek, Venlo, Holland, and Charlesworth, Peebles & Co., mechanical and electrical engineers and merchants, 134, St. Vincent Street, Glasgow; (2) Charlesworth, Peebles & Co.; and (3) King and Co., Leith Electric Works, Prince Regent Street, Leith, in each of which the pursuers concluded for payment of £5,000 as damages for infringement of patents belonging to them.

The Lord Ordinary in the first action granted decree against the defenders conjointly and severally for payment of £760 13s. 4d.; in the second action for £1,770 7s. 6d.; and in the third action for £39 1s. 10d., with expenses to the pursuers, taxed as between agent and client.

His Lordship said the defenders on record disputed both the validity and infringement of the patents, and he allowed a proof. Before going to proof, however, the defenders admitted the validity and infringement, and the only question left to be decided was the damages to which the pursuers were entitled in each case. The pursuers not only manufactured and sold lamps themselves which embodied their patents, but also granted licences to others to do the same on payment of royalties on the lamps sold. In these actions they had elected to measure the damage by the amount of royalties they would have received had the defenders been their licensees, and as such entitled to use their patents. The defenders argued that this method was inapplicable to part of the period during which lamps were sold by some of the defenders in infringement of the 1913 patent. It appeared that this patent was on November 15th, 1920, held to be invalid in England by the Court of Appeal. This judgment was, however, reversed by the House of Lords on December 19th, 1921. It was argued that during this interval the pursuers would have been unable to issue licences, and that therefore this method of estimating damages was inapplicable. It was further suggested that the defenders, having sold lamps during this period in the *bona-fide* belief that the patent was invalid, the damages to be assessed should be merely nominal. His Lordship was unable to give effect to either of these contentions. The defenders certainly had good cause for believing the patents to be invalid; but, in relying on the judgment of the Court of Appeal before that judgment became final, they took the risk of its being reversed. In using the patents without a licence they acted improperly, and the royalties which they would have paid had they been licensees provided, in his Lordship's opinion, a fair measure of the pursuers' loss through their improper action. After an examination in detail of the expert evidence, his Lordship reached the conclusion that damages were due in the amounts for which he granted decree.

The First Division of the Court of Session on Saturday disposed of reclaiming notes for the respondents in actions of suspension and interdict at the instance of the British Thomson-Houston Co., Ltd., London, against Charlesworth, Peebles and Co., Glasgow, and King & Co., Edinburgh, in which the complainers asked to have the respondents interdicted from importing and selling incandescent electric lamps having a filament of tungsten or other refractory metal of large dimensions or of cross section or of concentrated form and a gas or vapour of low heat conductivity at relatively high pressure or otherwise in infringement of letters patent belonging to the complainers. The respondents, before the Lord Ordinary, put in a minute withdrawing their defences, but they maintained their plea that, in any event, interdict could not competently be granted against exporting such lamps from the United Kingdom, which did not in itself constitute an infringement.

In the Outer House, Lord Blackburn granted interdict.

The First Division on Saturday, Lord Skerrington dissenting, dismissed the reclaiming notes, and affirmed the Lord Ordinary's interlocutor, with expenses as between agent and client.

The Lord President said the prayer craved interdict against both importation to this country and exportation from it, as well as the usual interdict against making, using, exercising, and selling. The reclaimers frankly explained that, while they had no intention of importing for use or sale in this country, their desire was to be free in the matter of exporting from it. If there was the smallest chance that the reclaimers would regard themselves free—under an interdict which did not expressly include exportation—to import these lamps and, instead of selling them in this country, to export them to purchasers abroad, it was very clear that exportation should be covered by the interdict. The reclaimers also explained that

they anticipated receipt in the future from the Dutch maker, or other persons, of infringing lamps among, or in lieu of, supplies of non-infringing lamps ordered by them. This might no doubt occur by mistake; and they desired to be free in such an event to return the goods without incurring penalties for breach of interdict. It was accordingly suggested that a refusal on their part of the infringing goods which they had not ordered, and the return thereof to the sender—if that was all that was intended—might easily be reserved to them (if necessary) by a few qualifying words to the interdict. But they declined to avail themselves of an opportunity of proposing such words which was afforded to them. His Lordship thought in these somewhat unusual circumstances it would not be fair to the patentees to refuse interdict, in the case of merchants of this class of goods, against exportation.

Lords Mackenzie and Cullen concurred.

Lord Skerrington, who dissented, thought the interdict granted was unduly wide in that it restrained the respondents from infringing the complainers' patent by exporting the lamps from the United Kingdom. He thought the interdict ought to be limited by omitting the words "or exporting therefrom."

Fatality at Leeds Electricity Works.

At Leeds City Police Court, on July 12th, the Leeds Corporation Electricity Department was fined £20 and costs for a breach of the Factories and Workshops Act, which had resulted in the death of a workman named George Brown, whilst cleaning the switchboard at the main generating station. Mr. Saywell, from the office of the Director of Public Prosecutions, contended that the gear should have been better screened or that the switchboard should have been rendered "dead" before work on it was undertaken. Mr. H. O. Brown, of the town clerk's department, defending, said the staff at the electricity works had not interpreted the regulations in the way they were interpreted by the Home Office, but since the accident they had been fully observed in that way, and would continue to be so.

Cannock Chase Colliery Co., Ltd.

In the Chancery Division on July 14th, Mr. Justice Astbury sanctioned an alteration of the articles and memorandum of association of this company by an extension of objects so as to enable the company to become undertakers for the supply of electricity for power and light. Counsel for the company said this proposed new business would be subsidiary to its main business of colliery owners. The company already had a generating plant for the supply of energy to itself, and its cables were in a suitable position for the distribution of power to the district. There was a large demand for power from the area, which included Cannock Chase, and an inquiry was recently held by the Electricity Commissioners as to the requirements of the districts within the area.

His Lordship said any order he made would be subject to what might be done by the Commissioners.

Counsel agreed, and said the company could do nothing till permission was given it, and its petition to the Court was only for power to undertake the supply of power of which it had a large surplus.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JUNE, 1922.

The June returns of electrical export and import business, which we tabulate below, show a further falling off in all sections.

The exports, which in May were valued at £840,017, fell in value to £782,656 in June, the decrease being mainly attributable to the falling off in the machinery, telegraph and telephone, and electrical goods and apparatus exports, while only in one section was a minor increase in value recorded. The electrical imports also showed a decrease in value of £5,000 as compared with the previous month. The re-exports totals for the month were £11,543, as compared with £17,769 in May.

	Exports.	Imports.	Re-exports.
	£	£	£
Electrical goods and apparatus	83,145	34,988	4,080
Insulated wires and cables ...	114,570	11,008	16
Glow lamps	28,646	11,588	528
Arc lamps and parts	1,186	2,552	15
Batteries and accumulators ...	42,867	6,797	15
Meters and instruments ...	19,120	5,000	549
Carbons	2,446	2,614	523
Electrical Machinery—			
Railway and tramway motors	17,307	—	—
Other motors and generators ...	144,780	—	—
Switchboards (not telegraph or telephone)	12,967	199	—
Electrical machinery (unenumerated)	100,658	112,697	3,812
Telegraph and Telephone Cable and Material—			
Telegraph and telephone wire and cable (not submarine)	26,975	1,258	—
Submarine telegraph and telephone cable	44,821	—	—
Telegraph and telephone instruments and apparatus ...	143,168	13,780	2,005
Total	£782,656	£202,141	£11,543

PARLIAMENTARY NOTES.

(By Our Special Parliamentary Reporter.)

Ayr Burgh Electricity Bill.—On July 12th, a Committee of the House of Commons again considered this Bill, and, as the Kilmarnock Town Council had withdrawn its opposition to the Bill, the three other petitioning parties took the same course. The Committee, therefore, unanimously found the preamble of the Bill proved. The effect of the agreements which were arrived at is that Ayr Burgh and County and Kilmarnock Burgh will have a joint electricity undertaking, constituted by the co-operation of all the existing plant of the three local authorities, as well as the transfer of the new statutory powers for the Loch Doon scheme. On July 13th the Committee gave formal approval to the new clauses giving effect to the terms of the agreement.

Post Office (Pneumatic Tubes Acquisition) Bill.—During the Committee stage of this Bill, on July 13th, Mr. Kellaway, the Postmaster-General, said that the tube which the Post Office proposed to utilise was one which had been lying derelict for 40 or 50 years, and the Borough Councils of St. Pancras and Holborn and also the London County Council had made incursions into certain parts of it. But the portions of the tube interfered with by those incursions was extremely limited, and they would be got over by the Post Office engineers by an inexpensive diversion which would in no way interfere with the telegraph and telephone lines which would be laid. The Post Office had got a bargain, and he was advised by competent engineers that if instead of being able to use this tube for carrying the wires, they had to open up the streets and lay new ducts in which to place the wires, it would cost between £50,000 and £70,000. They were now getting a tube which, over the greater part of its length, had not been interfered with in any way and was still sound, for £7,500.

The Black Country Tramways and Light Railways Bill.—This Bill, on July 13th, was read a first time in the House of Commons and referred to the Examiners of Petitions for Private Bills. The Bill seeks "to make provisions with reference to the undertakings of the Birmingham District Power and Traction Co., Ltd., the Dudley, Stourbridge and District Electric Traction Co., Ltd., the South Staffordshire Tramways (Lessee) Co., Ltd., and the Wolverhampton District Electric Tramways, Ltd." The Bill has already passed through the House of Lords.

Iron and Steel Trades Unemployment.—On July 11th Sir M. Barlow, Parliamentary Secretary to the Ministry of Labour, informed Mr. T. Thomson that the numbers registered as wholly unemployed in the iron and steel manufacturing trades were 150,361 on May 27th, 1921 (the time of the coal stoppage); 91,395 on December 2nd, 1921; and 89,821 on May 22nd, 1922. The corresponding percentages of unemployment were 57.8, 35.1, and 34.1 respectively.

Wireless Broadcasting.—On July 18th, Lieut.-Col. A. Murray asked the Postmaster-General whether any decision had been reached as to the terms and conditions under which licences for wireless broadcasting were to be issued, and whether the licences were to contain a provision that only British instruments should be used.

Mr. Kellaway said that he had intimated to a Committee representing the manufacturers of wireless apparatus in this country the conditions on which he proposed to grant licences for broadcasting, and he understood those proposals would be submitted to the general body of manufacturers forthwith. He had informed the manufacturers that in the event of their supplying the capital required and providing efficient broadcasting services, he would agree that the apparatus which it would be permissible to use under the Post Office licence for the reception of those services, should for two years be restricted to apparatus manufactured in Great Britain.

Discussion followed, in the course of which it was asked whether the Postmaster-General had the power to do what he proposed. In reply, he stated that he had power under the Act passed by that House to issue licences, and it was inconceivable to him that we should allow a new form of communication in this country to be exploited by foreign manufacturers. He was not taking advantage of the powers of licence to impose a protective system in this hole and corner way. He was imposing a proper method of protecting a new means of communication in this country.

Railless Traction.—On July 13th Sir R. Cl[illegible] asked the Parliamentary Secretary to the Ministry of Transport what was the policy of his Department towards railless traction, and whether, in view of the need for efficient roads where it was

used, he was stimulating the policy of more enduring road reconstruction.

Mr. Neal said that subject to the design and weight of railless trolley vehicles being suitable to the roads on which they were run, he saw no general objection to them, but each case must be judged on its merits. There was no substantial difference from the road damage point of view between railless trolley vehicles, motor omnibuses, and other heavy traffic, and no special kind of road reconstruction was necessary.

Aluminium Imports.—On July 17th Mr. Baldwin informed Mr. Hogge that the imports of aluminium domestic hollow-ware into the United Kingdom, consigned from Switzerland, registered during the first six months of this year amounted to 25 tons.

South Wales E.P.D. Co. Bill.—On July 17th the South Wales Electrical Power Distribution Co. Bill, which has passed through the House of Lords, was read the third time.

London Bills.—The House of Lords has agreed, without amendment, to the London Electric and City & South London Railway Companies Bill, to the L.C.C. (General Powers) Bill, and to the L.C.C. (Money) Bill.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C.1.

17,802. "Automatic signalling apparatus." W. B. Dick, R. A. Hopkinson, [illegible] & Co., Ltd. June 28th.
17,805. "Electrical [illegible]." C. C. Garrard, A. H. Rettag, and W. W. Scott, Jun. 28th.
17,807. "Starting coils for electric ignition devices in internal-combustion engines." W. H. Crossland and H. G. Smith. June 28th.
17,814. "Automatic [illegible] electric systems." Metropolitan-Vickers Electrical Co., Ltd. June 28th. (United States, June 30th, 1921.)
17,819. "Lever signalling construction." Western Electric Co., Ltd. June 28th. (United States, August 16th, 1921.)
17,822. "Telegraph receiving apparatus for producing punched tape." F. G. Creed and Creed & Co., Ltd. June 28th.
17,833. "Circuit-breaker switches for electric lighting, &c., of railway carriages, &c." A. H. Darker and J. Stone & Co., Ltd. June 28th.
17,842. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th.
17,843. "Systems of connections for railway train units." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th.
17,860. "Electro-magnets and electro-magnetic machines." S. L. Hitchcock. June 28th.
17,866. "Electric switches." J. A. Crabtree. June 29th.
17,874. "Electric motors and generators." H. J. Howard. June 29th.
17,888. "Obtaining intermittent unidirectional currents of electricity from alternating currents." A. Barnett. June 29th.
17,889. "Electric switches." I. Calvete. June 29th.
17,910. "Electric switch." G. Marr. June 29th.
17,914. "Electric heating units." W. Cubbitt. June 29th.
17,915. "Electric clock." C. P. Williams. June 29th.
17,921. "Electric transformers." British Thomson-Houston Co., Ltd. (General Electric Co.). June 29th.
17,922. "Excitation of turbo-alternators." British Thomson-Houston Co., Ltd., and R. F. Halliwell. June 29th.
17,924. "Electric signalling, &c., lamps." W. R. Baltimore. June 29th.
17,929. "Electric advertising device." A. W. P. Young. June 29th.
17,932. "Electric [illegible] and manufacture thereof." Etablissements Davey, Bickford, Smith et Cie. June 29th. (France, January 30th.)
17,942. "Process for starting synchronous electrical machines." Akt. Ges. Brown, Boveri et Cie. June 29th. (Switzerland, July 30th, 1921.)
17,948. "Miners' lamps, &c." W. Morgan. June 29th.
17,951. "Quick-break electric switches." St. Cerf. June 29th. (France, March 29th.)
17,954. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. June 29th.
17,955. "Crystal detectors for wireless telegraphy." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. June 29th.
17,968. "Test point terminal." B. J. Davies. June 30th.
17,971. "Radio receiving apparatus." C. M. Farquhar and W. S. Stephenson. June 30th.
17,991. "Electric power transmission by means of underground cables." A. M. Taylor. June 30th.
18,002. "Preventing wireless interference." I. W. Wilson. June 30th.
18,025. "Aerials for wireless telegraphy and telephony." W. A. Chambers and R. H. Tapp. June 30th.
18,028. "Electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Anderson). June 30th.
18,048. "Sound-producing apparatus for electro-magnetic receiving or emitting device." Soc. des Etablissements Gaumont. June 30th. (France, February 17th.)
18,050. "Switching devices for telephone systems, &c." Western Electric Co., Ltd. June 30th. (United States, July 2nd, 1921.)
18,057. "Electrically insulating pipe section for high-vacuum pipe lines." Akt. Ges. Brown, Boveri et Cie. June 30th. (Switzerland, September 30th, 1921.)
18,064. "Sparking plugs." J. G. van der Weerd. June 30th. (Holland, [illegible] 1921.)
18,067. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th.
18,077. "Apparatus for coding, &c., telegraphic messages." A. Tracey. June 30th.
18,080. "[illegible] Intercommunicating Wireless Appliances Corporation. June 30th. (France, August 29th, 1921.)
18,098. "Electric fuses or cut-outs." V. Hope. July 1st.
18,106. "[illegible]." P. R. Kirkland. July 1st.
18,113. "Electrically-operated indicators for theatres, &c." C. Lawson. July 1st.
18,115. "Vapour lamps for lighting, &c." A. C. Jones, A. Kirby, and Metropolitan-Vickers Electrical Co., Ltd. July 1st.
18,134. "Wireless [illegible]." K. Chandler. July 1st.
18,142. "[illegible]." A. Siemens Ges. July 1st.
18,154. "[illegible]." A. M. Taylor. July 3rd.
18,190. "[illegible]." R. [illegible]. July 3rd.
18,195. "Self-winding insulated reel for electric cables, &c." A. McKim. July 3rd.
18,197. "Oil-immersed electric switch fuses." H. W. Clothier and J. Mirrey. July 3rd.
18,199. "Leading-in tubes for electric installations." F. H. Weurman. July 3rd. (Holland, July 4th, 1921.)
18,203. "Time-setting device for controlling maintenance of electric current." L. Angel. July 3rd.
18,211. "Radio apparatus." C. B. Kersting. July 3rd.
18,219. "Measuring times, angles, lengths, and determination of direction of sound, &c., impulses." Signal Ges. July 3rd. (Germany, August 1st, 1921.)
18,222. "Submarine cables." Western Electric Co., Ltd. July 3rd. (United States, August 16th, 1921.)
18,224. "Supports for telephone transmitters." Automatic Telephone Manufacturing Co., Ltd., Lals and [illegible]. (United States, December 19th, 1921.)
18,225. "Electric motor control systems." Metropolitan-Vickers Electrical Co., Ltd., [illegible] Miller and W. Richardson. July 3rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

35,721. "Illuminating devices." Duplexalite Corporation. December 19th, 1919. (155,593.)
36,055. "Control of [illegible]." V. R. Vagin. December 23rd, 1920. (181,752.)

1921.

240. "Electro-galvanising machine." F. H. Rogers (Meaker Galvanising Co.). January 4th, 1921. (181,756.)
2,850. "Electro-magnetic wave-signalling systems." H. J. J. M. de Regnauld de Belescize. January 22nd, 1920. (158,556.)
5,137. "Colliery trams." D. D. Jones and J. James. February 14th, 1921. (181,766.)
5,334. "Electric measuring-instruments of the hot-wire type." A. Lederer, jun. February 25th, 1920. (159,203.)
5,671. "Electric switches." H. B. Cornish. February 19th, 1921. (181,778.)
7,787. "Casing of substantially-rectangular shape, particularly adapted for electrical apparatus." Lumos A. G. vorm. Akt. Ges. March 14th, 1920. (160,136.)
8,233. "Electric cables for the conveyance of high-tension electrical energy." L. N. Kennedy and Pirelli & Co. March 16th, 1921. (181,750.)
8,277. "Reception of continuous-wave wireless signals." H. J. Round. March 16th, 1921. (181,799.)
8,331. "Dimming devices for the electric head-lights of motor road vehicles." B. H. O'Dixon. March 17th, 1921. (181,803.)
8,370. "Sparking-plugs for internal-combustion engines." P. Challis. March 17th, 1921. (Cognate application 27,284/21.) (181,805.)
8,412. "Ionic or vacuum tubes or relays." W. J. Mellersh-Jackson (Compagnie Générale d'Electricité). March 17th, 1921. (181,812.)
8,606. "Electro-mechanically-controlled telephone system." H. Baron (F. Aldendorff). March 19th, 1921. (181,826.)
8,630. "Directional wireless apparatus." C. K. Chandler. March 19th, 1921. (Cognate application 19,727/21.) (181,827.)
8,735. "Railway train control." National Safety Appliance Co. October 27th, 1920. (170,814.)
8,948. "Portable switchboard." J. McCloskey and C. C. Berryman. March 23rd, 1921. (181,841.)
9,105. "Magneto-electric generators." M-L Magneto Syndicate, Ltd., and E. A. Watson. March 24th, 1921. (181,845.)
9,131. "Processes for carrying out electro-chemical reactions and apparatus for use therein." G. Plauson (née Hildenbrandt). March 24th, 1921. (181,848.)
9,132. "Processes for carrying out electro-chemical reactions and apparatus for use therein." G. Plauson (née Hildenbrandt). March 24th, 1921. (181,849.)
9,490. "Automatic electric switch or circuit breaker." E. C. R. Marks (Elektriska Aktiebolaget Volta). March 30th, 1921. (181,857.)
9,599. "Automatic electric circuit interrupting apparatus." G. A. Cheetham and Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1921. (181,859.)
9,771. "Method of fixing in place stator cores of induction motors and other laminated cores." Electric Construction Co., Ltd., and H. Jones. April 2nd, 1921. (181,867.)
9,857. "Electro-mechanical railway fog-signalling apparatus." G. A. Farmer, L. J. Coussmaker and E. A. Campbell. April 4th, 1921. (181,871.)
9,909. "Electrically-heated muffle furnaces." Akt. Ges. Brown, Boveri et Cie. April 4th, 1921. (Addition to 159,195.) (181,875.)
10,504. "Vapour lamps." W. H. Cleburne and E. J. Cleburne. April 9th, 1921. (181,885.)
10,561. "Transformers for high voltages." Akt. Ges. E. Haefely et Cie. October 16th, 1920. (170,547.)
11,274. "Telegraph keyboard perforators." A. C. Booth and A. S. Wetmore. April 19th, 1921. (181,895.)
11,783. "Vacuum electric discharge tubes." E. C. R. Marks (Siemens and Halske Akt. Ges.). April 23rd, 1921. (181,903.)
12,131. "Speed-controlling devices for railway and tramway trains." E. Rudolphus. April 27th, 1920. (162,617.)
12,148. "Static frequency changers." Ges. für Drahtlose Telegraphie and M. Osnos. April 27th, 1921. (181,909.)
12,318. "Synchronising systems, particularly applicable to printing telegraphs." Western Electric Co., Ltd. May 1st, 1920. (162,621.)
14,067. "Thermally-operated relays." Metropolitan-Vickers Electrical Co., Ltd. June 9th, 1920. (164,729.)
14,562. "Electric heating units." British Thomson-Houston Co. (General Electric Co.). May 25th, 1921. (181,940.)
15,204. "Permanent way signalling devices for railways." R. Johnstone. June 1st, 1921. (181,949.)
15,431. "Electric contact fingers." British Thomson-Houston Co., Ltd. (General Electric Co.). June 3rd, 1921. (181,953.)
15,485. "Spark plug." O. Trow. June 4th, 1921. (181,954.)
16,331. "Arrangement for the operation from a distance of an overload switch provided with a main current winding and a tension winding." F. Krupp Akt. Ges. August 30th, 1920. (168,040.)
17,583. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Begg. June 28th, 1921. (181,985.)
18,215. "Methods of coating, [illegible] and the like with liquid enamel or similar material." British Thomson-Houston Co., Ltd. (General Electric Co.). July 5th, 1921. (181,989.)
19,258. "Electric door protecting alarms." R. Dittmer. July 16th, 1921. (182,002.)
19,520. "Electrically heated appliances." C. W. Marriott. December 10th, 1920. (172,662.)
19,928. "Incandescent electric lamps." F. H. Eeles and A. J. Barnett. July 25th, 1921. (182,007.)
22,910. "Construction of rotors for high-speed dynamo-electric machines." Akt. Ges. Brown, Boveri et Cie. September 9th, 1920. (168,883.)
25,699. "Electric incandescent lamps and methods and apparatus for their manufacture." Patent Treuhand Ges. für Elektrische Glühlampen. November 20th, 1920. (171,974.)
27,454. "Auxiliary sparking unit for spark plugs." F. E. Wade. October 12th, 1921. (182,047.)
27,689. "Telephone systems." J. F. Pollak (Siemens & Halske Akt. Ges.). October 18th, 1921. (182,049.)
33,109. "Apparatus for dressing railway, tramway and like rails." F. Krupp Akt. Ges. April 30th, 1921. (179,507.)

1922.

1,129. "Electrical ignition apparatus." R. Bosch Akt. Ges. February 14th, 1921. (175,608.)
11,135. "Rotary pump." Metropolitan-Vickers Electrical Co., Ltd. May 10th, 1921. (179,916.)

THE

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LONDON ELECTRICITY SUPPLY AND THE L.C.C.

THE report of the Special Committee on Electricity Supply submitted to the London County Council meeting of July 4th is a document which defines in an instructive way the attitude of that body to any proposals made to reorganise and improve the electricity supply of London. The document was not, one imagines, designed as an act of self-revelation, but it serves that purpose all the better.

And it is a revelation which may well astound and perplex the reader who finds that the London County Council, the nearest thing to a representative central governing body vouchsafed to London, puts right into the background the first interest of its constituents in the subject of electricity supply. This interest, the supreme, immediate, and permanent interest of the inhabitants of this great area, eight million people, nearly one-fifth of the population of Great Britain, is a more abundant and a much cheaper supply of electricity than that now provided. It is unnecessary to tell the readers of the ELECTRICAL REVIEW what benefits will accrue to London if and when this need is met.

The L.C.C. takes a quite different view. The Report mentioned deals with two particular subjects. The first is the consent of the Electricity Commissioners to the erection of the County Company's station at Barking. The L.C.C. has opposed the granting of this consent from the first moment, and, finding the consent given despite its opposition, still cavils at the terms, and "regrets," in the words of the Report, that the consent should have been given before a Joint Electricity Board for London has been set up. The L.C.C. is a "bad loser." It is an open secret that the Commissioners' consent would have been given two years ago but for the opposition of the L.C.C. The L.C.C. considers itself better qualified than the Electricity Commissioners to decide what is the proper policy for London electricity, well qualified, as everyone admits that body to be, to do the work for which it was established.

The Report referred to makes it quite clear how this conflict of opinion arises. The Electricity Commissioners have one chief duty, it is that pointed out to them in the 1919 Act, to promote a "cheap and abundant supply of electricity." The L.C.C. takes a different view; it comes out again and again in this Report. It is the appointed purchaser of the London companies at so near a date as 1931. It has expressed its willingness to allow a joint electricity authority to succeed to this purchase right, and one cannot blame it for seeking to preserve the benefits of that right for its prospective successor. But that is not the first public interest; it is in the second rank at best. Yet the Report puts forward as its reason for objecting to the County Company's proposals, and to certain provisions of the Commissioners' consent thereto, that these will "prejudice the position" of the purchasing authority. What this really means, so far as one can judge, is that the purchasing authority will have more to buy and will therefore have more to pay for. It might surely have occurred to the Special Committee of the L.C.C. that under the terms of purchase set out in Section 2 of the 1888 Act, the purchaser will get the properties, bought at an extremely favourable price, without addition for prospective profits, and the more there is to buy the

bigger and the better the business bought. The L.C.C. has delayed the erection of the County Company's station for two years. It has by that time deferred the date at which that company's actual and potential consumers will get the benefit of that station, and if the people so deprived could be made to realise what the L.C.C. has done for them, they would let their members know in a very definite way their opinion of the notions of "public interest" which have been put in the forefront.

The other matter dealt with in the Report is the Commissioners' inquiry into the application of the S.E. & C. Railways and the West Kent Electric Co. to erect new stations, both intended to supply the S.E. & C. Railway load. Now, one can understand that the L.C.C., as a guardian of the public interests, instructed counsel to attend this inquiry and to put its views before the Commissioners. Why it should have opposed the West Kent Company's application *in toto* is not clear. That it should have asked the Commissioners, if they saw fit to grant the application, to attach conditions to it is reasonable. But the attitude and utterances of counsel for the L.C.C. on other points were more amazing. He acted under instructions, and there can be no personal reflection upon him. In the course of the inquiry the County of London Company put forward an offer to supply the railway load from the Barking station. Counsel for the L.C.C. cross-examined the witness for the County Company far more severely than did counsel for the railway company, and in his speech besought the Commissioners to do nothing which would permit such a supply. He suggested that it would be an infraction of the terms of the Commissioners' consent to the Barking scheme, which one would have thought the Commissioners capable of looking after for themselves. Again, why? Because such an extension of the Barking business would "prejudice the position of the purchasing authority," and would fetter the future joint electricity authority in its policy. Not until the very end of his speech, and then only in reply to a direct question from the Chief Commissioner, did counsel say that his instructions were that the Council offered no objection to the erection of a station by the railway companies for their own supply.

These two things must be taken together. It is a duty of the Commissioners to direct the early policy of the Joint Electricity Authority; the Commissioners have already plainly stated that it is in the interests of the London supply that the railway loads shall be taken by stations for general supply; and the L.C.C. has stated that it concurs generally in the Commissioners' expressed views. Yet, on the very first occasion, it strongly supports a radical departure from the policy deliberately selected by the Commissioners, and offers the strongest opposition to proposals entirely consistent with these views. It goes so far as to threaten the Commissioners that if they decide against the Council's views, it will gravely consider withdrawing the L.C.C. support and assistance from the constitution of a joint electricity authority, and throw the tormented affair of the future electricity supply for London back into the melting pot.

In short, if London electricity reorganisation is not to be carried out as the L.C.C. dictates, the people of London may wait until the Greek Kalends for the cheap and abundant supply which they sorely need.

The L.C.C. in this matter is labouring under an obsession which obscures from it the real public interest, the only permanent and supreme interest—that of the consumer.

It is perhaps a phase of the municipal *v.* company controversy which has damaged electrical enterprise, and, of course, the consumer, for nearly forty years, and which might have been allowed to die after 1919. It is of immensely greater importance to the consumer, and that means to the whole community, that there shall be good service, than that the service shall be given by one or another kind of undertaker. Council or company, Tom, Dick, or Harry, the community interest is in good service. Names don't count.

Spain's Tariff Wall.

Conflicting reports have been current regarding the outcome of the tariff dispute between France and Spain, and the actual effect of the settlement, if ratified. In Paris those who negotiated the arrangement claim that it is based on the principle of reciprocity. Spanish manufacturers urge that it substantially weakens the protection that is essential to their prosperity. Indeed, it was believed in Barcelona that Catalan industrialists would prove sufficiently importunate to prevent the Government at Madrid from signing the agreement. A section of the Press regards the pact as the last straw, which will break the back of British trade in Spain, because, after many months of almost prohibitive duties on United Kingdom goods, Britain has, it is said, now lost to France the position of most-favoured nation. Thus far we have been talking of reports. Now let us state the facts. The situation is of special interest to our readers because amongst the concessions granted to France is a substantial reduction in the import duty on electric motors. The truth is that at present our exporters of electric motors and of the other goods covered by the new Franco-Spanish convention—which has now actually been signed—are in a better position than they have been for some time, for the simple reason that a most-favoured-nation arrangement still exists between this country and Spain, and consequently we benefit by all reductions in tariff rates which are granted to any other country. That is the position at the moment of writing. A change may have taken place by the time these lines appear, for a new agreement has been under discussion for many months. This may possibly annul the most-favoured-nation principle. British traders with Spain are asking why there should be so much delay in concluding arrangements by which their business may be placed on a definite basis, whilst France has obtained a settlement and, it is rumoured, a convention with Germany is almost concluded. The reason may lie in the fact that Britain has carried on no tariff war with Spain, as France and Germany have, because we have no effective weapons with which to wage it.

Domestic Appliances and the Cost of Electricity.

It is both interesting and useful to obtain expressions of opinion from the public in matters mutually affecting them and the electrical industry. The reasons for the comparative neglect of domestic electrical appliances, in spite of their admitted advantages, are generally well known to the industry, but the subject has recently been ventilated in the columns of *The Times*, and a brief review of the correspondence may be beneficial. The matter was opened by a letter regretting that the British housewife should be so unenterprising as not to adopt electrical labour-saving devices in her home. This drew a number of replies in which the reasons for her attitude were given, including the following: the initial cost of these appliances; the lack of hire-purchase systems; insufficient electrical education by exhibitions, &c.; the complication of electricity tariffs; and, of course, the high price of electricity and electrical installations. Subsequent letters centred around the last points. Two or three correspondents expressed their inability to understand why "power" charges should be lower than those for lighting, and this shows that there is ample scope for explanations similar to that recently issued by the Woking Electric Supply Co. (mentioned in our issue of July 7th), which, while dealing with the necessity for the minimum charge, could easily be extended to cover the other question. The separate circuits for lighting and power were objected to, and one or two correspondents favoured the adoption of a "two-part" system based on rateable value or floor area, which would also eliminate the tariff complications which the householder often finds so difficult to understand. Yet another letter advocated the remission of the burden of installation expense which the consumer has to bear.

All these questions, we believe, are receiving attention,

but there is still a need for a more general recognition of the disability under which electricity labours while these matters are allowed to go unremedied. To attempt to draw up a uniform scheme is no doubt out of the question owing to the lack of uniformity in local conditions. Nevertheless we believe that each undertaking might "do its bit" by instituting at least one of the following necessary reforms:—A two-part tariff; "free" wiring, *i.e.*, gradual repayment of cost by the consumer; a comprehensive hire or hire-purchase system (in conjunction, perhaps, with local contractors); a more generous extension of mains; and a scheme for the education of consumers or prospective consumers. To urge the reduction of the price of energy would be superfluous, as this is one of the supply engineer's objects in life.

Labour Representation on J.E.A.'s.

We have previously commented on the claim of Labour to be represented on the Joint Electricity Authorities, and we took the view that as the electricity supply industry was so comprehensively organised industrially under the Whitley Councils there was no call for representation on the J.E.A.'s. However, in the Electricity (Supply) Bill there has now been introduced a clause which makes such representation permissible. The original amendment put forward was that "organisations" representing persons employed in the industry should be entitled to seats on the J.E.A.'s, but this amendment was withdrawn and a new clause agreed. This new clause provides that the "interests" (referred to in the 1919 Act) which may be represented on the Joint Electricity Authorities shall be read as "including the persons employed in connection with the supply of electricity." The new clause, as we have mentioned, is entirely permissive, and representation is left as a matter which may or may not be included in a scheme for a J.E.A. Up to the present, none of the schemes has included such representation, and in view of the fact that the National Industrial Council for the industry is the supreme and quasi-legal body for dealing with all industrial questions, there would seem to be no occasion for making any alteration in the present policy. Moreover, a further anomaly would be introduced by such representation of the Trade Unions, since the representation must be of the persons in the area employed in the industry and not in any way representing "organisations," that is, Trade Unions. Altogether the only proper way to give representation seems to be by providing a seat for a member of the particular District Industrial Council for the area concerned, who would act on the Joint Electricity Authority as a kind of liaison officer between the two bodies. This would also cover another provision of the same new clause in the Bill which states that the scheme may lay down the conditions of employment of persons employed by the J.E.A. since this matter is again, of course, the particular domain of the District Industrial Council. Representation of this kind might the more readily be given since the various industrial districts under the Whitley scheme roughly coincide with the districts delimited by the Electricity Commissioners for Joint Electricity Authorities (or equivalent bodies).

Central European Reconstruction.

That a certain degree of restoration has been effected in Central Europe is apparent from three official reports that have recently been issued by the Department of Overseas Trade. They deal with countries where difficulties due to the low rate of exchange for their currency have been a great obstacle to foreign trade, at any rate with Britain, the United States and Switzerland.

Referring first to Rumania, a country whose agricultural resources are such that a succession of two or three good harvests would mean a substantial recovery in purchasing power, it is satisfactory to know that the Government is actively endeavouring to place its existing indebtedness on a satisfactory basis. At the time Mr. Adams, the Commercial Secretary at Bukarest, revised his report (April, 1922), no reason could be seen for any rapid rise in the value of the leu in Rumania or in its international quotation. Prospects may have improved slightly since, but not materially. He advocated the removal of the restrictions upon the petroleum industry and the freeing of export trade. In the latter connection, something has since been done, *i.e.*, the lifting of the embargo on exports of certain cereals.

With regard to Hungary, foreign trade, hampered though it has been by the difficulties of exchange and restrictions in the form of import and export licences, has, according to the Commercial Secretary at Budapest, shown a distinct improvement on the previous year. He observes that British business men have shown exceptional keenness to take advantage of every opportunity; they have been at pains to find out what customers require, and have done everything possible to meet their wishes. There are signs that Hungarian industries, despite serious setbacks, have turned the corner, and the prospects for the future are encouraging.

In Poland much progress has taken place. Poland's natural assets have been considerably increased recently by the incorporation of a part of Upper Silesia, with its rich mining, metallurgical, engineering and chemical industries. Sound economic measures have been introduced by the Government, and these, coupled with the natural benefits of a good harvest, have improved the economic position. The Commercial Secretary of Warsaw points out that the process of consolidation has begun, and the country has given proofs of the capacity to become self-supporting. All these developments give hope that more business such as the recent contract for an electrically-driven cotton mill, will before long be placed in this country.

The Eastern Telegraph Jubilee.

The manner in which the Eastern Associated Telegraph Companies signalised the fiftieth anniversary of their incorporation on Monday last was worthy of the occasion and of the huge organisation which owns 130,000 miles of submarine cable, representing a capital of nearly 25 millions sterling, and comprising four-tenths of the cable system of the world. The banquet and fête which were held at the Royal Botanic Gardens were planned on a scale of the most lavish hospitality, and the entertainments provided were as diversified as they were excellent, whilst the illuminations in the gardens, employing many thousands of "lighting points," were extremely effective, and the display of fireworks was not merely brilliant but even thrilling—all London heard the heavy reports, and it is said that many people thought an air raid was in progress. To crown all, the weather was all that could be wished. Congratulations are due to the Eastern Companies, not only in respect of the completion of their first half-century as an incorporated body, but also on their admirably successful celebration of that noteworthy event.

It will not be forgotten that the electrical industry was founded upon telegraphy, which, 50 years ago, was in fact the industry itself; and the manufacture of submarine cables, which was begun in 1850 in this country alone, provided the experience which rendered England pre-eminent in the manufacture of insulated cables for electric lighting and power, a position which she still retains. The spirited article by Mr. Roland Belfort, which is concluded in this issue, briefly reviews the romantic history of submarine telegraphy, and recalls the names of some of the great telegraph pioneers whose work has so largely contributed to the establishment and maintenance of the greatest Empire that the world has ever seen.

This is a year of jubilees. The Society of Telegraph Engineers, now the Institution of Electrical Engineers, has already most fittingly commemorated its first meeting, which was held in 1872. It will shortly be the privilege of this journal, which was established in November of that year, likewise to celebrate its jubilee, in its own way.

D

SOME PRODUCTS OF THE ELECTRIC CONSTRUCTION CO., LTD.

Amongst the works thrown open to members of the I.M.E.A. at the recent Convention was that of the Electric Construction Co., Ltd., of Wolverhampton. As we mentioned in connection with the Convention, this company represents one of the earliest electrical manufacturing concerns, deriving its origin from the firm of Elwell-Parker, Ltd., which was established in 1880. It is significant of the youth of the electrical industry that a pioneer company such as this should still count only 42 years to its age—amongst its employés there are some whose service dates from the first day that the works opened its doors, and who are not yet old men. Since that day extraordinary progress has been made in every branch of the industry, and the "E.C.C." has borne its share in the onward march of enterprise and invention; it can look back upon great engineering achievements which have made history, and to-day, as though endowed with perpetual youth, it retains its place in the front rank of British electrical firms, relying only upon its own strength, and looking confidently to the future prosperity of the electrical industry.

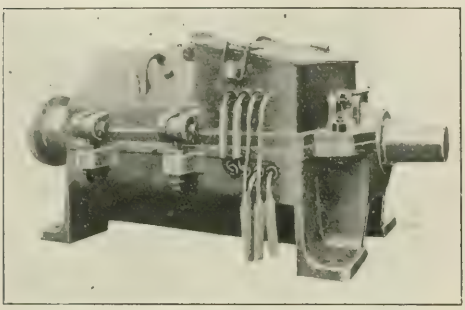


Fig. 1.—E.C.C. 60-h.p. Steel-Works Motor.

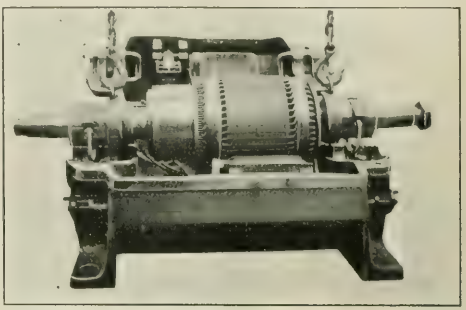


Fig. 2.—Removing Armature and Bearings of Motor.

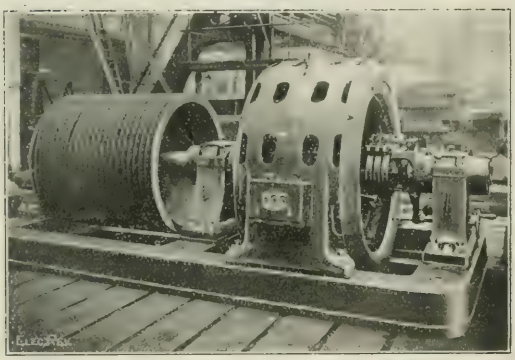


Fig. 3.—E.C.C. 750-h.p. Three-phase Motor for Rope Driving.

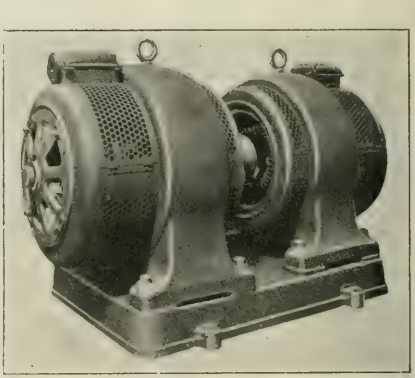


Fig. 4.—E.C.C. Type G.M. d.c. 30-kW Motor-Generator.

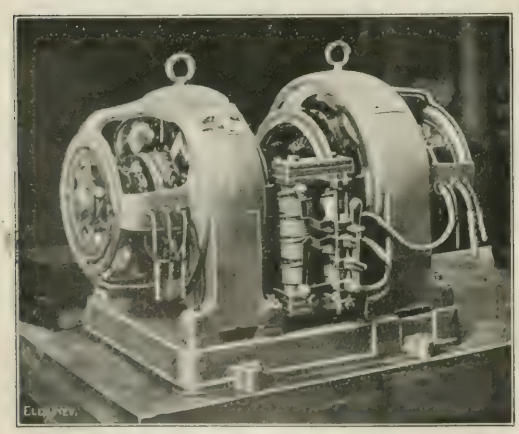


Fig. 5.—E.C.C. Welding Set.

As becomes a concern with so long and honourable a record, the relations between the management and the workpeople are exceptionally cordial, and the interests of the latter are the special care of the former. During the recent labour troubles, the Electric Construction Company endeavoured to provide employment for as many of its workers as possible, with a large measure of success, and on the occasion of our visit to the Bushbury works during the Convention we saw a variety of machines and apparatus in course of manufacture, ranging from wireless telegraphy to steel-works machinery. The workshops are well equipped with up-to-date machine tools, and a noticeable feature was the extreme care bestowed upon the preparation and application of the insulating materials, as well as the thoroughness with which the processes of impregnation and baking of windings were carried out.

A batch of 60 h.p. E.C.C. motors for driving live-rolls in one of the mills of the Steel Company of Scotland was recently completed, and one of these is illustrated in figs. 1 and 2. It will be seen that the machine is of very substantial construction, of the totally enclosed 4-pole, d.c. type, and provided with a double-ended shaft.

Accessibility of parts is a special feature of the design, the ease with which the armature and bearings can be removed being obvious from the illustration, fig. 2.

Fig. 3 shows an a.c. motor for a Lancashire cotton mill; this machine is rated at 750 h.p., at 500 r.p.m., and is built for 440 volts, 50 cycles, three-phase, with a grooved pulley for driving by ropes.

A new standard type of d.c. machine is illustrated in fig. 4, which shows a 30-kW motor-generator, transforming from 600 to 220 volts; and fig. 5 is a view of a standard motor-generator set of which many examples have been supplied to the Equipment and Engineering Co., Ltd., for arc-welding work, the generator of this machine having a special differential compound winding, and an inductive diverter for adjusting the compounding to suit varying welding currents from 50 to 250 amperes, at 35 volts (the diverter will be seen between the yokes).

A specially interesting motor alternator is shown in fig. 6; this is destined for the Manchester Corporation, for use in connection with cable testing at the Barton power station. The alternator is designed for an output of 2,600 kVA at 6,600 volts, 50 cycles, single-phase, with a leading power factor ranging from zero to 0.02; it is driven by a 440-V motor of 250 h.p. at 500 r.p.m., and is provided with its own exciter. Figs. 7 and 8 show respectively the stator and rotor of this set.

Several single-phase high-frequency motor-alternator sets for use in connection with wireless installations, generating at a frequency of from 300 to 500 cycles per second, were also seen in the works.

Mr. Will M. Furniss is the manager, in succession to the late Mr. Builoch, and we tender our thanks to him for the courtesies offered us on the occasion of our visit, as well as to the chief engineer, Mr. Tonkinson, for photographs and particulars of the apparatus described in this article.

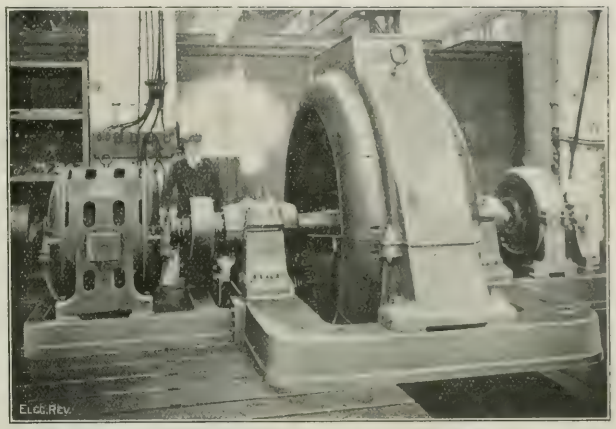


Fig. 6.—Motor-Alternator of 2,600 kVA at 6,600 V.

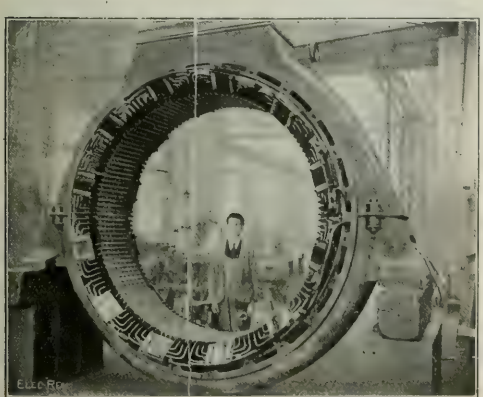


Fig. 7.—Stator of 2,600-kVA Alternator.

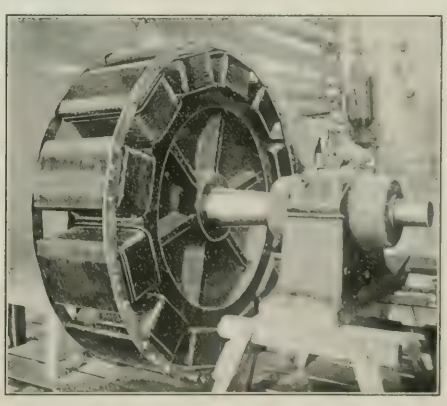


Fig. 8.—Rotor of Alternator.

Photograph Drying Machine.—Two young London engineers, both keen photographers, have succeeded in producing a machine which dries a photographic print in four minutes. The drying is done by means of an electrically-heated absorbent "blanket," and at the end of four minutes the print is automatically ejected, perfectly dry and uncurled, into a tray. While it takes four minutes to dry a single print the machine can take a batch at a time. By being continually "fed" more than 3,000 prints an hour can be perfectly dried, says the *Evening News*.

THE GLASGOW TRAMWAYS.

Annual Report.

The annual report of the Corporation tramways for the year ended May 31st, 1922, contains a mass of statistics relative to every phase of working, but from this emerges the fact that the year's operations proved eminently satisfactory, enabling the Committee not only to extinguish the balance of the 1919-20 deficit, but also to carry forward a sum of £140,880.

The revenue of £2,450,755 was slightly lower than that of the previous year (£2,392,854), but the working expenses decreased in greater proportion, the figures for the two years being £1,937,066 and £1,804,652 respectively. The gross profit was thus £546,101, as against £455,788 in 1920-21. The principal divisions of the expenditure side of the revenue account all showed decreases. Traffic expenses fell from £1,018,501 to £1,007,318; general expenses from £254,573 to £248,820; general repairs and maintenance from £461,999 to £413,521; and power expenses from £199,517 to £162,761. To the balance carried to the net revenue account was added £5,541, interest, making a total of £519,624. Against this were charged: Payment to Paisley District Tramways Co., Ltd., for use of lines, £15,635; capital charges, &c., £71,933; and contributions to depreciation and permanent way renewals fund, £309,350; leaving a net surplus of £152,724, comparing with £[illegible] in the previous year. Part of the surplus (£2,750) was utilised to pay off the remainder of the 1919-20 deficit, and the balance was appropriated to the "Common Good." A balance of £[illegible] remains at the credit of the depreciation and permanent way renewals fund. The capital account records a capital expenditure during the year of £591,285, making the gross total expended on the system £1,646,177. The principal items of the year's expenditure were:—Electrical equipment of cars, £91,290; buildings and fixtures, £118,861; and power and sub-station plant, £126,749.

The traffic returns show a decrease in the number of passengers carried from 117,201,811 to 131,372,473, but an increase in the number of car-miles run from 26,902,874 to 27,024,520, the energy used per car-mile remained the same—1·6 kWh. The number of double-track miles which the Corporation owns, or over which it has running powers, was practically 100 miles at the end of the year. The track was renewed at various places over a total length of 25½ miles, and the extension from Netherlee to Clarkston was opened in August last. Work was commenced on extensions in the following districts:—Provanmill, Milngavie, Millerston, Coatbridge, London Road, and from Anniesland to Dumbarton Road. It is expected that the new depôt at Parkhead will be completed during the present summer; the cars now housed at Whitevale will then be transferred to Parkhead. Whitevale is to be handed over to the Electricity Department.

The output of the Pinkston station during 1921-22 was 46,397,754 kWh, of which 1,245,651 was supplied to the Electricity Department. The maximum load was 13,500 kW, and the load factor 39·23 per cent.

An analysis of the revenue shows that about a third of the total was derived from 1½d. fares, and a slightly lower amount from 1d. fares.

The report contains numerous diagrams showing such statistics as the proportion of operating expenses to receipts; the proportion of wages to receipts; average fare paid; number of passengers carried, &c., from the inception of the undertaking. Five pages are devoted to a statement of the receipts for each week of the system's existence. The highest weekly revenue in 1894-95 was £5,918; in 1921-22 the figure was £50,225.

AN ARRANGEMENT FOR D.C. METER TESTING.

By J. B. WILLINGHAM.

Recent developments in manufacturing circles resulting in the increased efficiency of incandescent lamps and sundry domestic appliances, together with the reduced prices of these commodities, coupled with less expensive and simpler wiring methods, are inducing a great number of small householders and shopkeepers to take advantage of the many benefits to be derived from the use of electricity. In consequence, the supply engineer is called upon to cater in many cases for a class of consumer whose load factor is comparatively low. This specially applies to residential areas, housing schemes, and poorer class dwellings where the B.O.T. units sold are small compared with the total connections to the distributors. In view of the fact that in many districts the number of consumers coming under this category is steadily increasing, the question of periodically checking the accuracy of the meters installed becomes one of great importance to the undertaking concerned. Although of late the "current limiter" has found much favour in some quarters (a system whereby each consumer is charged a "contract" rate over a given period, corresponding to his maximum demand), it is doubtful whether this instrument will replace the supply meter to any great extent in the near future. In any case, it is practically certain that with the majority of undertakings the number of small meters sent out each year is going up by leaps and bounds, and measures have to be considered with a view to adopting some method whereby they may be tested and adjusted from time to time.

Hitherto, perhaps, it has only been considered necessary to replace obviously faulty meters as they are reported by the meter reader; this, however, will give no indication as to the condition of meters which *appear* to be working all right, but which may, if subjected to tests, show considerable errors in registration. The conditions imposed upon the average meter are usually pretty severe, and in order to arrive at the true state of affairs with apparatus of this description, it is necessary to employ reliable instruments and accessories, and a wide range of current values should be available for carrying out the work.

The use of a standard meter coupled in series with the meters to be tested usually entails a great waste of time, as it is essential that tests be taken at different loads corresponding to, say, ¼, ½, and full load of the meters under test; then again, unless the standard is *itself* periodically checked for accuracy, errors will be bound to creep in.

It will, generally speaking, be found much more satisfactory to use standard *indicating* instruments, and when they are employed for no other purpose than checking meters, and are carefully handled, they will be found to retain their accuracy over long periods if of good design. A ready means of easily adjusting the current value is required, and the test room should be well lighted and as free from dust or fumes as possible. In taking short-time tests on motor meters, it is imperative that a reliable stop watch be used; some stop watches have starting and stopping errors which may seriously affect the results of the tests. Any instrument which leaves a shadow of doubt as to its accuracy should be at once discarded. A little consideration will show that a small error in the watch, for instance, may materially affect the tests. Where the test room is in close proximity to a battery room, little trouble should be experienced in obtaining any desired amperage, together with easy means of controlling and maintaining the

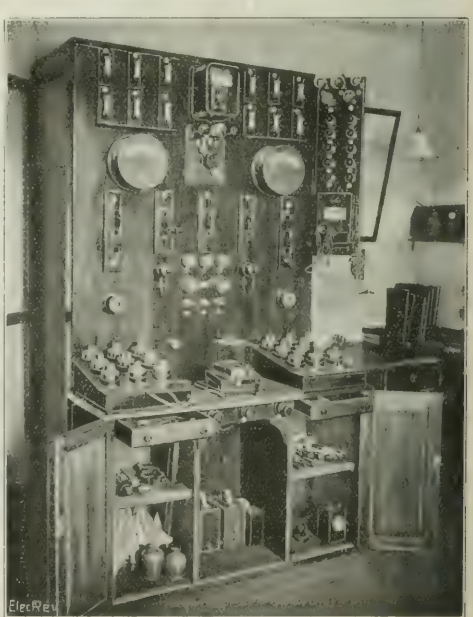


Fig. 1. Testing Board for d.c. Meters.

magnitude of the current constant for any load over a given time, this being usually effected by utilising two or more of the "end" cells and inserting a liquid, or other suitable variable resistance in series with the standard ammeter and meters to be tested; this, of course, applies to meters of the ampere-hour type (in testing energy, or what are better known as watt-hour, meters the pressure circuit should be disconnected from the terminals and separately excited by a source of e.m.f. from the remainder of the battery, or from the mains direct the pressure employed being maintained equal to that marked on the name plate of the meter undergoing test).

Where, however, the test room is situated right away from the power house and battery in another part of the town, the fixing up of apparatus for carrying out these tests calls for more careful consideration."

In contemplating the design of a suitable arrangement under such circumstances, local conditions will, of course, have to be considered, and if the accommodation is available, the question of a motor-generator or a small battery of cells might be entertained, but it is advisable to keep *both* out of the test room proper, the former on account of the noise, while in the latter case the gases given off during charging are detrimental to the instruments and meters, and are certainly objectionable to the tester.

The following is a brief description of a testing board constructed to operate from the service mains direct, the supply being 3-wire, 250-500 volts. The three wires are brought to three cartridge-type fuses and thence to three

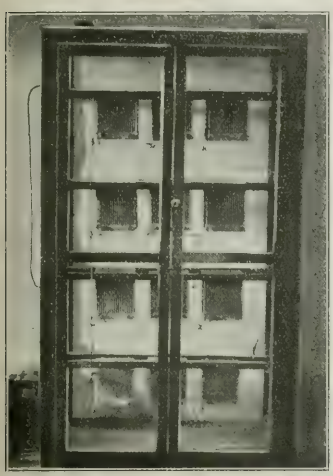


Fig. 2.—Resistances for D.C. Meter Testing.

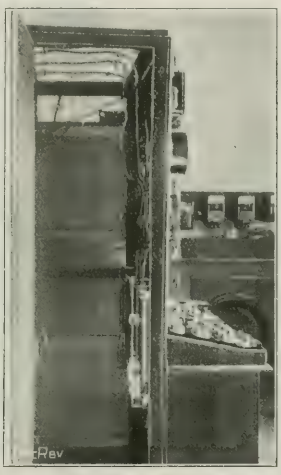


Fig. 3.—Back of Testing Board.

single-pole knife switches mounted on the control panel (shown in fig. 1), current being taken for test purposes between the positive and neutral conductors up to about 40 amps. When arrangements are made to load the negative side in order not to seriously upset the balance of the system, suitable resistances to dissipate the energy are shown mounted in their frame in fig. 2; these consist of a series of "nets" made up of a special alloy of resistance wire interwoven with asbestos. The heat given off when loaded is fairly considerable, but fortunately a place was found for them outside the test room; the conductors led out are also asbestos covered where they enter the frame work. There are in all 12 units mounted in the frame, each arranged to pass a definite current at 250 volts, as follows: six to pass 10 amperes, two to pass 5 amperes, two to pass 3 amperes, and two to pass 2 amperes. The two 2-ampere units are each connected in series to a variable sliding rheostat having a total resistance of 3,000 ohms; these are of the back-of-board pattern, their respective control handles being shown on either side of the panel (fig. 1) immediately under the single pole throw-over switches. It will be seen that wide variations of current values may be obtained by switching in any or all of the resistance units as a "rough" load and then making final adjustments by means of the two regulators. For loads of 2 amperes and under, the rheostats are, of course, used alone, the current passing in the circuit with all resistance in equals about .08 amp. in either regulator, this being considered quite low enough for all practical purposes. A reference to fig. 3, showing the back of the board, will give an idea of the design of the regulators, and also the accessibility to the connections of the whole outfit. It will further be noticed that the framework is covered with a fairly fine mesh wire netting, and that on one side a hinged door (also wire netted) is attached. It may be of interest to remark that the board was designed, erected and the accessories and switchgear assembled on site, the overall dimensions being 7 ft. 2 in. high, 4 ft. wide by 4 ft. 6 in. deep, the woodwork consisting of well-seasoned whitewood stained and varnished. The scheme permits of two entirely independent tests being carried out on separate test benches at the same time; this is effected by manipulating the two throw-over switches referred to above, the switchboard being divided, as it were, into two separate groups, each with its own selector switches and regulator. The position of the switches, as shown in the figure (that is, one in the upper contact and the other in the lower contact), illustrates this method; each bench has now a range of 0.8 to 45 amps. by throwing both switches in the one direction (we will assume into the top contacts), the two groups are combined, that is, the one bench has now a range of 0.08-90 amperes, the two regulators are, of course, also combined; this has the advantage in that the tester has a much greater facility for steadying the current on the higher loads just when it is most needed. By reversing the two switches into the lower contacts, the other bench is served by the same range of current; thus meters of a fairly large capacity may be dealt with at either bench, a pair of terminals being provided on both for making the necessary connections to the meters. Three terminals for obtaining the desired pressure when carrying out tests on watt-hour meters are also situated within easy reach, but are protected by separate switches and fuses mounted on the board, and a red or blue pilot lamp within view of the operator indicates whether either or both "sides" of the system are "alive" to the terminals. The utility in the method of being able to independently "divide" the controls will be apparent, as it enables, for instance, a row of slot meters to "run out" on one bench or a group of meters on "dial test" to be connected up and left to look after themselves while the tester confines himself to ordinary work on the remaining bench. It will further be seen by the arrangement of terminals on the selector switch panels that two standard instruments may be inserted, thus enabling two testers to work at one time, each independently of the other. The pilot lamp board shown on the right indicates by colours the load on each group, so that there is little chance of one man interfering with the other during such tests. A voltmeter (employed for testing watt-hour meters) controlled by a three-way switch giving the pressure on either side or across the "outers," a low reading ammeter for arriving at the "starting" current of the meters under test, and an integrating watt-hour meter for measuring the energy consumed in the test room completes for the most part the general layout. The standard ammeter, it will be observed, is fitted with a magnifying glass to render a clearer vision of the scale divisions; a "striplite" lamp is also provided, but is not shown in the picture.

The great disadvantage of such a scheme is, of course, the waste of energy involved, but this is not so pronounced as one would at first imagine. The records show that on an average taken over a twelvemonth, 0.35 kWh is consumed for each meter tested, the majority of the meters being small service types, ranging from 2½ amps. to 20 amps. capacity.

It was considered advisable to separately fuse each resistance unit on account of the main fuses having to be loaded fairly high. Small tools and instruments are kept in the cupboards and drawers, which are fitted with lock and key, and the whole board makes a compact arrangement, and has given every satisfaction in prac-

tice. The reader no doubt will be able to see many modifications which could be effected to suit any particular range or purpose; for instance, the load might be made up of incandescent lamps instead of resistances, although these are usually objectionable on account of the glare. The success in working such a system depends to a great extent on the steadiness of the applied pressure, but in any case it would be found necessary to employ an observer to watch the instruments in order to make sure that the load was kept constant during tests.

In conclusion, the writer would like to add that thanks are due to Mr. J. E. Stewart, M.I.C.E., engineer and manager, the Llanelly and District Electric Lighting and Traction Co., Ltd., for kindly consenting to the publication of the above prints and particulars.

ELECTRICAL ENTERPRISE IN CHINA.

MR. J. W. ROSS, Canadian Trade Commissioner at Shanghai, recently sent to the Department of Trade and Commerce at Ottawa the following report, dated April 10th last, dealing with electrical development in China:—

When one considers the backward condition of China in some directions, the slow development of modern industrial enterprises throughout the country, and the great need for better transportation facilities and other improvements, it is somewhat surprising to observe the manner in which electrical development and installation has been accepted by the Chinese people, and how quickly they have adopted the electric current in its various methods of application to their different needs. Shanghai, of course, set the fashion many years ago, and all provincial capitals and many of the large cities have quickly followed suit, so that wherever one travels in China to-day in the towns and cities of importance, electric light installations will be found, but it is not only for lighting purposes that the Chinese make use of the electric current, for many small industries in the different towns employ the current for power; this applies particularly to rice mills, silk filatures, small machine shops, and other small industries. Nearly all the electric light plants throughout China are owned by stock companies, and rarely by municipalities. In Shanghai, Tientsin, and Hankow as well as Hong-Kong, the electric light plants belong to the municipalities, but in purely Chinese cities they are owned by stock companies. In all the distinctively Chinese cities along the Yangtsze river, electrical plants have been installed, even as far west as Chunking, the capital of Szechuen Province, and in addition many private enterprises, such as cotton mills and flour mills, have installed small lighting plants for their own use in connection with their mills. Such installations are to be found at Wusieh, Hankow, Tsinan, Tientsin, Tsingtao, Dairen, and at different other points, and a great number in Shanghai. With the continued increase in the number of installations and the general advance in industrial enterprise in different parts of the country, it was to be expected that imports of electrical material into the different ports would show a general increase year by year, and this has been the case. The figures of imports for the past six years, given in Haikwan taels, show clearly the growth of this business as follows: 1914, 2,114,400; 1916, 3,568,700; 1917, 4,378,400; 1918, 4,307,550; 1919, 5,170,100; and 1920, 6,515,000 Haikwan taels.

Chinese Customs returns go to show that many countries contribute in greater or less extent in furnishing China's demand for electrical material, but the chief sources of supply for the past six years have been Great Britain, United States, and Japan. Formerly Germany had a large share of this trade, but she was, of course, shut out during the war. In 1920, however, imports from that country were valued at Hk. tls. 98,500, showing that Germany is again coming back, and as this is one of the lines of manufacture in which that country specialises, increased imports into China from that source in future years may be looked for; in fact, many evidences point to a very active participation by Germany in China's coming requirements of electrical equipment.

The range of imports of electrical equipment, although not specially classified, comprises everything required in complete installations and in the distribution of the current.

All the well-known British, United States, and Japanese manufacturers are represented in China, each of them having their own agents or agencies, and large stocks of standard equipment, as well as small dynamos and motors, are carried, and are constantly obtainable. The demand is large and the market active and expanding; at the same time, it is a market that cannot be exploited through correspondence; to write letters and send out catalogues in the hope of selling electrical goods to China would be a sheer waste of time and postage. On the other hand, an active salesman carrying samples and having special lines to offer could no doubt make sales, for almost anything can be sold in China when personally represented and samples are shown, but the Chinese will not pay any attention to letters or catalogues.

An interesting fact in the development of the use of electricity in China is the number of Chinese who have a working knowledge of electrical mechanics and the general work pertaining to the distribution of the current, and the usual repairs of equipment, wiring of buildings, &c.; in fact, it is the Chinese who do all the work, their direction and organisation being under the management of a foreign engineer. Small repairs, such as the installation of fans and bells, the extension of existing plant and similar work, can always be carried out by a Chinese contractor at a much lower cost than would need to be paid to the large foreign engineering firms—consequently they do most of this class of work.

As yet no hydro-electric generating plants have been established in China, and it is not likely that any will be for many years, for the reason that there are very few sources of water-power supply in the country. Without doubt the Upper Yangtsze river is capable of furnishing many thousand horse-power, but as this source is far away from the manufacturing and industrial centres, there would be little demand for the power even if it were available, but in the vicinity of the seaboard and the present manufacturing cities there is no water power available for development, consequently steam is the only power employed, but fortunately there is an abundance of coal in China for this purpose.

A concern to be called the Electrical Appliances Manufacturing Company of China, has recently been formed, consisting of Chinese capital with German co-operation. This organisation has purchased a large tract of land at Soochow, on the Shanghai-Nanking Railway, fifty-three miles from Shanghai. It is stated that the Hugo Stinnes China Company are associated with the enterprise and that they control certain electrical patents, those of the Siemens-Schuckert Company and others. It is not very clear at present what the plans of this company are, or what they propose to manufacture, but it is presumed that they intend to produce many of the small classes of equipment, all of which are now imported. It is understood that their object in erecting these works at Soochow is that land suitable for such large works would cost a huge sum of money at Shanghai. Taxes at the latter port would also be very high. Soochow is not badly placed for factory purposes; it is on a direct line of railway, and has also water connection by canal to Shanghai and ocean shipping. On the other hand, all skilled labour would need to be brought in from other ports.

The report, referring to the Chinese production of electric lamps, says:—

"Three years ago the General Edison Co. of China began the manufacture of electric light lamps or bulbs. They have been able to train Chinese workmen, and for selected men they pay 80 cents to Mex. $1 (40 to 50 cents Canadian currency) for a ten hour day. Such workmen will produce 1,700 to 2,000 bulbs per day, while expert American workmen for the same class of work receive as high as $10 gold for an eight-hour day, and turn out about 1,200 to 1,500 bulbs. After the bulbs are made they are passed to lamp makers, who receive 40 cents Mexican per day (20 cents Canadian), whereas an American workman receives $4.10 gold per day for the same work. This is not all, for the Chinese-made lamp when completed is a better lamp than the American lamp. The latter has a burning power of 1,000 hours, while the Chinese lamp has a burning capacity of from 1,200 to 1,500 hours. This is an example of the skill of Chinese workmen and the success of Chinese industries when they are operated under systematic foreign management. For the first time in history electric lamps, as above described, were successfully exported to the United States in 1921, to the value of $35,000 (United States currency), and this in the face of a very high import tariff."

From another source we have received the following review of the growth of interest in electrical undertakings (lighting, tramways, and telephones) in Shantung:—In 1894 an electric light company was established at Tsinan, called the Tsinan Electric Light Co. The annual profit is estimated to reach $100,000, and the company is now installed in a new building which is equipped with machinery of the latest type. Next in importance to the Tsinan Electric Light Co. is the Tsining Electric Light Co., which was established in 1918 with a capital of $80,000. The amount of capital has been gradually increased to $200,000. The Electric Light Co. at Fangtze was started by certain Japanese capitalists, but in view of the opposition of the local inhabitants and the financial losses sustained by the company through poor business, it was transferred to a Chinese concern and refloated with a capital of $30,000 in 1920. In view of its contiguity to Weihsien, the company has planned to extend its lighting system so as to supply both cities with electricity. Official permission has been obtained, and the company will shortly move its head office to Weihsien. A new power station has been erected there and a new plant is to be installed. The Electric Light Co. at Tenhsien was started last year with a capital of $60,000. In a few months the number of lamps supplied to the district was increased from 1,000 to 2,000, and by the end of the year the company had declared a dividend of 15 per cent. The Lung Hwang Electric Light Co. will supply electricity to Lungkow and Hwanghsien. Lungkow, a port open to foreign trade, has been growing in importance as a commercial centre since the completion of the work for harbour improvement, while Hwanghsien lies on the Chefoo-Weihsien Railway, a zone rich in natural resources. The

building for the company is being erected at Langkow and a new plant has been ordered. It is expected that the company will be opened for business in the autumn.

In 1920 Ma Tan-ming planned the construction of a system of tramways in Tsinan with a capital of $1,000,000. Applications were made to the Government and the local officials for permission, but sanction was not given till the winter of 1921. Three lines will be built in different parts of the city. The first is to run from Pulimen to Lokow, the second from Pulimen to Yuanchien, and the third line is to pass through the business section outside the city.

The telephone company at Tsinan was started under the auspices of the local officials, but as a result of inefficient management the company was more than once threatened with financial ruin. Unable to meet its financial obligations to a certain foreign firm, the assets of the company were transferred to a group of private persons. Under the good management of private capitalists, the financial position of the company improved considerably, and the dividends went up to 50 per cent. In view of this progress the capital, which had originally been fixed at $100,000, was raised to $700,000. A set of new telephone apparatus was installed in place of the old one, which had been found inadequate to meet the ever-increasing demand of the public. The company recently established three new exchanges at Tsinin, Poshan, and Chowchun respectively, and a new building for the premises of the company is being erected.

NOTES FROM CANADA.

(From Our Special Correspondent.)

It is natural that in a country possessing such immense and widely-distributed water-powers as Canada, the question of railway electrification should be discussed. Some weeks ago this matter was brought up in the House of Commons at Ottawa, and the Minister of Railways indicated that the Board of Management of the National Railways takes great interest in the subject, although present conditions do not favour actually undertaking any scheme of electrification on account of the unduly high cost.

It seems likely, however, that when material and labour costs are down to more reasonable figures the subject will be taken up seriously.

On the discussion of electrification in the House, it was stated that the annual value of the timber lost in forest fires is from 10 to 15 million dollars, and that many of the fires are due to sparks from locomotives, a cause which would be eliminated if the railways were electrified. It is understood that the Canadian Pacific Railway has had electrification under consideration for several years, but that so far it has not been feasible to make an actual start on any section of line.

The Commissioners of the Temiskaming and Northern Ontario Railway, which runs through the mining districts of Northern Ontario, have had the matter of electrification under consideration for several months, as there are various water-powers in the region which would supply ample power for the railway as well as for the mines.

The question of canalising the St. Lawrence River and developing its immense water-power as a joint scheme was reported on some months ago by the International Joint Commission, and since then the matter has been a subject of discussion by both the Canadian and the United States Governments. The latter Government recently asked the former if it would consider the question of entering into a new treaty regarding the permissible diversion of the waters of the international portion of the river, but the Canadian Government replied that under present conditions of high costs it was not considered advisable to go ahead with any scheme. Apparently even the making of a treaty was thought to be premature.

Although this attitude will postpone action, perhaps for a year or more, the matter is sure to be brought up again.

As an offset to the St. Lawrence scheme, a certain element in Canada advocates the Georgian Bay Canal scheme as possessing several advantages, such as the fact that it would be entirely within Canadian territory, immunity from the storm hazards of Lakes Erie and Ontario, and the shorter mileage. The route would be from Georgian Bay on Lake Huron, along the French River through Lake Nipissing, to the Ottawa River, and thence to the St. Lawrence. It is estimated that on the Ottawa and French Rivers about 1,000,000 h.p. could be developed.

In Western Canada the Manitoba Power Co. is engaged in the development of about 170,000 h.p.; the initial plant will consist of two 28,000-h.p. vertical turbines, to which four more will be added later. The working head is 56 ft. The dam will be 750 ft. long, with a maximum height of 70 ft., and the power-house will be 110 ft. wide, 380 ft. long, and 145 ft. high at the highest point. The capacity of each generator will be 21,000 kW, and they will generate at 1,385 r.p.m. three-phase, 60-cycle current at 11,000 volts. The Canadian *Electrical News* states that the machinery cost, including turbines, generators, exciters, thrust bearings, transformers, and switches, will be less than 14 dollars per horse-power.

PARLIAMENTARY NOTES.

(From Our Special Parliamentary Correspondent.)

High-Power Wireless Station.—Last week Sir H. Banner asked the Postmaster-General whether the site for the proposed high-power wireless station had been selected, and, if so, what date it was hoped to have the installation complete.

Mr. Kellaway said that a site for the proposed high-power station had been selected provisionally. Its final adoption depended on the result of certain inquiries which were now in progress. It was not possible at this stage to say by what date the installation was likely to be completed.

Rural Telephones.—Mr. Lort asked the Postmaster-General what progress had been made in the extension of the system of rural telephones since the Post Office estimates were introduced; and to what extent the parts of the system had been adopted in such installations?

Mr. Kellaway said that as a result of the new liberal terms for rural extensions of the telephone system announced in the estimates debate, support had already been obtained for 13 new exchanges. They would be installed as soon as possible. Canvasses were also in progress at a number of places where there was good prospect of securing adequate support. Since May 1st 662 additional rural party-line telephones had been installed and 151 call offices opened at provisional post offices, chiefly in rural districts.

Electricians in the Navy.—On July 18th, during a debate on the Naval Estimates, Sir C. Kinloch-Cooke referred to the policy of the Admiralty with regard to Naval electricians. He said that these men had a very reasonable complaint. The stagnation in their class was due to the lack of decision with regard to the future policy, and it was time that the Admiralty made up its mind what was going to be done with the electricians. No retirements were taking place and no promotions were being made to fill the vacancies. The difference of appointment authorised by Form 1 and the Order in Council was very pronounced, and then there was a difference between the positions of the electrician and the engine-room artificer. All these points could be settled by the policy which the Admiralty could lay down at once.

North Metropolitan Electric Power Supply Bill.—On July 19th this Bill was passed by the Unopposed Committee of the House of Commons, and was ordered to be reported for third reading.

Engineering Trade Employés.—On July 19th, Dr. Macnamara, Minister of Labour, informed Capt. W. Benn that the approximate number of workpeople in the engineering trade, including ironfounding, in 1921 was 1,127,000. The weekly full time rates of wages at July, 1914, were: fitters and turners, 38s. 8d.; labourers, 22s. 11d. The usual range of rates at December, 1921, were: fitters and turners, 76s. 9d.; labourers, 59s. 4d.

Electric Light and Films.—On July 17th, during the Committee stage of the Celluloid and Kinematograph Film Bill, which seeks to make better provision for the prevention of fire in premises where raw celluloid or kinematograph film is stored or used, the following proviso was added to Schedule I, Part II:—"If electric light is used, all conductors and apparatus shall be so constructed, installed, protected, worked and maintained to prevent danger. Vacuum-type lamps only shall be used, and shall be in fixed positions and fitted with substantial outer protecting globes."

Royal Assent.—On July 20th, the Royal Assent was given by Commission, to the following Acts:—South Wales Electrical Power Distribution Company Act, 1922; Torquay Corporation (Electricity) Act, 1922; London County Council (Money) Act, 1922; London County Council (General Powers) Act, 1922; London Electric and City and South London Railway Companies Act, 1922.

Use of Vulcanised Fibre.—On July 24th Mr. Kenyon asked the President of the Board of Trade to what extent vulcanised fibre manufactured in Lancashire was used in Great Britain for electrical purposes; whether he had received representations from electrical apparatus manufacturers as to their dependence on special qualities of this fibre imported from America; and, if so, whether he proposed to take any action upon such representations."

Mr. Baldwin said that as regarded the first part of the question he had no quantitative information. No representations of the kind referred to in the second part had been made to him, but it was, of course, open to any manufacturers interested to make representations to the Committee.

Receiving Sets for Wireless.—Col. Newman asked the Postmaster-General whether he was aware that the patents for the manufacture of receiving sets for wireless telegraphy were in Great Britain in the possession of the Marconi Wireless Co. and one or two other smaller firms, and had he been able to consider the value of the monopoly which the Government intended to confer on the Marconi Co. in the scheme which it had recently placed before the House?

Mr. Pike Pease (Assistant Postmaster-General) said he was aware that the Marconi Co. and other companies claimed to possess patent rights affecting certain wireless telephone receiving apparatus, but the value of these rights, whatever they might be, would neither be increased [illegible] by the conditions on which he proposed to issue [illegible]

Wireless Stations.—On July 21st Mr. Kellaway (the Postmaster-General) informed Capt. W. Benn that statutory authority for the issue of licences to establish wireless stations was conferred by the Wireless Telegraph Act, 1904. The conditions on which licences for the proposed broadcasting stations would be issued were at present under consideration.

Light Railways Bill.—This Bill was read a second time in the House of Commons on July 24th.

Electricity (Supply) Bill.—On July 25th, this Bill was read the third time in the House of Commons. It now awaits Royal Assent. During the Report stage a number of new clauses were added, and a fuller report will appear in our next issue.

Re Burgh Electricity Bill.—This Bill was also read the third time in the House of Commons on July 4th, and now awaits Royal Assent.

CORRESPONDENCE.

Letters received by us* after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity in Rhineland.

Many engineers are familiar with electric transmission as applied in Rhineland. I have recently had an opportunity of seeing something of the post-war developments in one part of rural Germany, and I am impressed with the grand scale on which they have been planned. Wide avenues have been cut through the forests, along which are erected the lattice iron square-tapered poles carrying the main lines which sweep round vast areas of country with branch lines on wooden "A" poles roping in every description of village, hamlet, or town. Apparently the popular connection in small tenements is two lights and an iron and hot-plate, each controlled by one two-way switch. International price comparisons are misleading, but the fact remains that the rates are so low and the method of charging so popular that the use of electrical energy is becoming universal, and this is enhanced by the initial cost of the appliance being within the range of most working families.

There is a tendency in England against the erection of overhead lines, which is only natural when people see the old-fashioned aerial telegraph wires being dismantled, but it is obvious that it is only by the breaking down of this conservatism that the use of electric power on the scale we all contemplate can be carried out.

I have heard it said on more than one occasion: "No one won the war. The war taught us that the world is one whole. The future is commercial." I am not familiar with the German language, but I have not the slightest hesitation in understanding what is at the back of all this—our younger engineers will one day have to fight; it will be "war," mostly industrial—they have got their warning; it is for us to see that they are equipped in time.

F. S. Paterson, M.I.E.E.

Friedrichroda, Thur. *July 21st*, 1922.

A Motor Problem.

In reply to the letter of "Safety First," published on July 14th, the excessive voltage rise to which he refers is due to the iron circuit of the motor being entirely unsaturated at the normal voltage. As long as the motor is connected to the supply, a certain proportion of the field ampere-turns, apparently something like half the total in this case, are balanced by the armature ampere-turns. When the supply circuit is opened, the armature ampere-turns cease to exist, and all the field ampere-turns become available for producing flux. As there is no appreciable saturation in any portion of the iron circuit, the flux will now increase to approximately twice its previous value, causing a corresponding increase in voltage.

The remedy is to reduce the cross section of iron in some portion of the magnetic circuit, so that when the flux is at its normal value there is considerable saturation. This is usually most easily accomplished in a salient-pole machine by machining away a portion from the base of the poles, so as to allow "saturation plates" to be fitted between the poles and the spider, the cross section of iron in the plates being adjusted to give the degree of saturation required to keep the voltage-rise down to a reasonable figure. With regard to the danger to insulation, this, of course, depends on the margin of safety allowed by the manufacturers of the apparatus, but it would hardly seem desirable to subject it to a pressure of double that for which it was presumably intended.

Surely no useful purpose can be served by connecting flywheels to a synchronous set? The motor would serve equally well for purposes of power factor correction if run light, or with only a useful load connected, and "Safety First" would be saved the cost of the energy which he now wastes in driving the flywheels.

H. B. Lee.

Sale, Manchester, *July 22nd*, 1922.

Where are the Young Men of the I.E.E.?

I have read with interest and concern—concern for some of the writers, not the Institution—the correspondence in your journal on "Where are the young 'uns"? Youth is impetuous and unreflecting, else the young men would not put the blame for low salaries on their elder brethren who are in the same boat with them. The people to go for are the company directors and town councils, who are the employers and paymasters.

I have had a long acquaintance with members of Council and Territorial Centre Committees, and, without reservation, I say that I have always found them intensely sympathetic to young men. Either your correspondents are unduly thin-skinned or they have been unfortunate enough to come into contact with bounders who have been unduly puffed up with having just managed to scrape into the I.E.E.

I imagine the real reason that so few young men go to the summer visits is that they cannot afford the cost. Also many of the older men—full members—are equally unable to produce the necessary cash, but I have never heard them grouse about it. I agree that it is most regrettable that their money should stand in the way, but instead of blaming their seniors, why do not the young men try to be men and help themselves? I would particularly call their attention to the Continental tours arranged by the National Union of Students. I am quite sure that the energetic and enthusiastic president of the Union—Mr. Ivison S. Macadam, himself a graduate of the I.E.E.—would gladly do all he could to facilitate his brethren taking advantage of his organisation. I enclose descriptive pamphlets relating to the tours organised, but it may be too late to take part in them this year.

Lastly, let me say that my opening words, far from being a sneer, were an expression of sincere opinion. During last year 781 students entered the I.E.E., and I say without hesitation that no man intending to rise in the electrical profession and entering it at the present day can afford not to be in a position to participate in the benefits offered by the Charter, benefits which will wax as time flows on. The I.E.E. can do quite nicely without more students' subscriptions, but it *does* want the loyal support and personal services of every member, high or lowly, of the profession which it represents and fosters.

The case of a one-time student is that of large numbers of men resident in New Zealand, Australia, and other distant parts of the Empire, and it is greatly to be wished that their disability could be removed. The best way is by increasing the number of members in these far lands and by the young men using every endeavour, whether at home or abroad, to take part in the proceedings of the Institution and its branches.

Apologising for the length of this letter.

C. H. Wordingham.

London, S.W.1, *July 24th*, 1922.

The I.E.E. Wiring Rules.

The proposal for electricity supply authorities to enforce wiring rules should be met with satisfaction by engineers and contractors interested in high-class installation work.

Modern electrical developments, and the possibility of greater demands for supply for domestic and other purposes being made by consumers, call for some standardisation of wiring systems.

The rules of the I.E.E. will generally prove to be satisfactory if due consideration is given to the suitability of various wiring systems to the conditions in which it is proposed to install them. I would suggest some form of standardisation on the following lines, which will generally prove satisfactory:—

1. Power.—(*a*) Armoured cable; (*b*) heavy gauge screwed conduits and inspection fittings, I.E.E. grade cable and iron-clad fittings.

2. Radiators, Cookers, &c.—(*a*) Lead or alloy-covered cables; (*b*) screwed conduits and inspection fittings, fool-proof switch-gear, I.E.E. grade cable.

3. Lighting Installations.—(*a*) Welded conduit and grip fittings, I.E.E. grade cable; (*b*) lead or alloy (twin cables) and fittings; (*c*) *for damp situations*: c.t.s. cable, mounted on bobbin cleats, and front recessed blocks for mounting fittings.

The use of capping and casing and v.i.r. cables run on cleats should be restricted to surface wiring only, and should not be allowed in very hot or damp situations.

I shall be glad to read some further suggestions on this subject.

Horace J. Arthur.

Wolverhampton, *July 22nd*, 1922.

The Electric Cooking Load.

For several years I have been endeavouring to get the South Metropolitan Electric Light & Power Co., Ltd., to supply sufficient electricity to my private house, which is connected to its mains, to enable me to carry out electric cooking in a proper and thorough manner. As it is, I have only been able to get it to lay mains, at my expense, sufficient to give me a supply for lighting and cleaning purposes.

If the ordinary householder, who is no more interested in electricity than he is in gas, has to go to as much trouble to get electricity installed as I have done, I can well under-

stand that the electrical industry can never go ahead in a thorough manner. If I were to write to the gas company in a similar strain, asking it to give me adequate gas supply for any purposes, its representative would be waiting on my doorstep any time from 8 o'clock in the morning until 10 o'clock at night. The reply that I have so far received from the South Metropolitan Co. read as follows:—

"In reply to your letter of the 17th inst., we regret that the position is no better than it was when we were last in communication with you regarding heating load at your residence, and the demand you have now installed is the maximum we can deal with on our existing network."

Are you, or any of your readers, able to advise me what other steps I can legitimately take to get the supply I need?

L. G. Hawkins.

London, W.C.2, *July 19th*, 1922.

More Opportunities for Business.

It is gratifying to note that at least one reader was sufficiently interested in the possibilities of electric trucks for milk distribution to add to my remarks on the subject. I quite agree with Mr. Gavin Ralston that co-operation is necessary between the suppliers of electricity and the builders of trucks, and would suggest that, as it is easier to create a new tariff than to make a new pattern of truck, the suppliers should make the first move by offering an attractive price for what ought to be a very attractive load.

There must be many men who, having piled power on to lighting, heating on to power, and then cooking on to the rest, would like to consign their "day" load to the bottomless pits that yawn between their dizzy peaks. To such the trade-vehicle battery should come as a veritable godsend, for it should be easily arranged as an off-peak load.

Another dam that should make possible the filling of the valleys between the peaks is the lighting of surrounding villages by means of local batteries charged during selected hours by motor generators across the outers of d.c. towns (or a.c. for the matter of that). There must be hundreds of villages and suburbs within two or three miles of a town, where the conditions would make it worth somebody's while to buy electricity at 1d. or 1½d. and sell it at 9d. or 1s. per unit.

The town clerk of this particular town tells me that it cannot be done, because the Corporation has no power to sell electricity *inside* the borough boundary for use *outside*. The Electricity Commissioners say that it is a legal question, and refuse to give an opinion. Remembering, after the first shock, that the "law is a hass," one is led to wonder what would happen if a man, whose house was on the borough boundary, dared to light those rooms that happened to be just outside the enchanted line! One remembers that various garages in the town use the supply to charge customers' batteries which are used outside the borough. In fact, it is difficult to see why the local authority should concern itself as to the place of use of its electricity, so long as the supply is taken at a point within its area and is metered and controlled to the satisfaction of its engineer.

This particular town not only has its circle of suburbs and villages, but has within easy reach its workhouse, where gas to the value of some £600 per annum is used for lighting. About half this sum could be saved by the use of electricity, to the double benefit of the ratepayers, but so far it has proved impossible to cross the magic circle drawn round the borough by the legal Merlins. The plain man may well feel as bewildered as the Yankee at the Court of King Arthur, and I shall be glad if someone can either break the spell or explain the situation.

F. R. Cripps.

Worthing, *July 24th*, 1922.

Where are the Wiremen?

I have read the letter in your present issue under the above heading, signed "Engineer," and consider he must be hard put to it not to be able to find any wireman suitable for his job within a few hours out of all his 200 replies.

Being myself one of the applicants with a varied experience with contractors, chiefly in the North, I have waited in vain for some sort of intimation that the vacancy was filled or I was being considered.

"Engineer" must be very fastidious and lax if he requires more than a week to choose and consider the merits and capabilities of his applicants for so simple a job.

My own application was brief, perhaps too brief, but I was afraid to give many details more than just those of the jobs I had done, and omitted some of my previous employers' names and their references, except the last one, for whom I was foreman, for fear of making the letter like an autobiography.

What more does "Engineer" want than a very few plain facts simply told, which should bring an interview for a fuller cross-examination, production of references, and agreement for wages, without a lot of formalities, preamble, and embellishment to convince him that this or the other applicant is suitable?

One Applicant.

July 21st, 1922.

The assertion made by "Engineer" in your current issue is astounding, to state the case mildly.

A lay reader of our leading technical journal might well assume that the unemployed of the electrical trades consist mainly of incompetents and wasters.

The alternative inferences are, either that the advertiser was unfortunate in the type of applicant (a reflection I am not disposed, personally, to make), or that the remuneration offered was not sufficient to secure a competent man—even though there are many, unfortunately, who are reduced to subordinating their hopes of adequate wages to the necessity for mere subsistence.

The writer, personally, although answering the requirements pretty closely, and extremely desirous of steady employment rather than the fragmentary sort that now is a little less difficult to find, gave the "advert." a "miss" because of the usual objection—the box number. One does not wish to detail one's private affairs to a stranger who does not disclose *his* name and standing in the trade, while he asks personal particulars from the many.

His man *is* obtainable, may I suggest with all respect, if he will but go the right way about it. He might do worse than apply to the Secretary of the London Electrical Engineers' Old Comrades' Association, whose name and address I take the liberty of enclosing.

Ex-L.E.E.

July 22nd, 1922.

My attention has been drawn to the letter appearing in the current issue of your valuable paper, signed "Engineer," and dealing with the subject of wiremen.

I am directed to say that members of this Association, owing to the slump in trade, have had to reduce their staffs, and that to their knowledge a number of competent wiremen are at present unemployed.

If "Engineer" will get in touch with me, I shall be pleased to assist him in obtaining the man he desires.

A. Brammer,
Gen. Sec., National Assocn. of Supervising Electricians.

London, E.C.4, *July 24th*, 1922.

In reply to "Engineer's" letter in your last issue stating his experience with young wiremen, it certainly appears possible that out of two hundred applicants a suitable man should have been available; but why is a young man required? Is it because the wage offered would not attract a thoroughly practical man? Many of the young men have had rather a broken apprenticeship owing to the war, and, as trade has been since the Armistice, have not had much opportunity of gaining further experience.

Are we going back to the "too old at forty" stage again? The firm by which I was employed before the war has been unable to keep me on (although giving me a first-class reference), but those men who did not join up but stayed at home and got the big money are retained, the ex-Service men being the first to be stopped now things are slack. I have spent over £50 this year advertising, answering adverts., and interviewing firms. I have also inquired at many Labour Exchanges, but have never yet drawn the dole. I should be very glad of a job such as "Engineer" offers, and, having had charge of plant up to 200 kW and carried out complete installations up to 200 points, perhaps I could manage the job without getting "mixed up"; but, alas, I am no longer a young man, being now 39, and those few years on the other side jumping out of trenches, and no boy to carry the "tools," seem to be costing me very dearly.

Indentured Electrician.

July 24th, 1922.

In reply to "Engineer," I was one of the 200 applicants for the position as "handy man, age 35, thoroughly experienced, and practical electrician, wiring and all systems, telephones, motors, generators, overhead work, &c., and quite willing to do any kind of work, electrical or otherwise."

I have written for 70 jobs in different papers, and never had one reply, although in a good many cases I enclosed stamped addressed envelopes.

I am quite willing to go anywhere or do anything, and let the man who employs me give me what he thinks I am worth. I am not a member of the E.T.U., but have been for 10 years, and if anyone likes to give me a trial I will work on payment by results or living wage.

Wireman.

July 24th, 1922.

In reply to "Engineer's" query, I should like to point out that apparently he is asking for a "handy man" and not a specialist; therefore, he may experience some difficulty in obtaining a man with qualifications to cover the three branches of the profession stated, *i.e.*, wiring, overhead line work, and general station work. Also the applicants are probably singled out by their letters and references, and I suppose the man who "tells the best tale" gets the job, the rest of the 200 sharing in the distrust raised by the incompetency of the favoured few; but I suppose this is unavoidable while the present methods of "getting into touch" between employers and applicants prevail.

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In conclusion, I may add that there are men who, although they do not possess references covering the specific duties or a life experience, are sufficiently ambitious and adaptable to fulfil satisfactorily the position of handy man.

Fed-up Applicant.

July 22nd, 1922.

"Engineer's" letter is rather amusing, if it were not so tragic. Here is a man, who uses a nom-de-plume, with 200 applications in his hand wanting someone to recommend an electrical "combination." Who would risk a recommendation to one who considers that one-half per cent. of the applications are not satisfactory? I hold a similar position to that he describes, *i.e.*, a general electrician, and I know at least 20 good men who would jump at and work hard for a situation [illegible] "Engineer's." Possibly he has judged the 200 by their letters; if so, I would like to remind him that out of the 200, possibly 150 would be good men (but not correspondence clerks), which is much more than one-half per cent., as suggested. Possibly also the "root of the trouble may be at the top."

Not 1 in 200.

[As the result of "Engineer's" letter, we have been inundated with letters for transmission to our correspondent, as well as with letters intended for publication in these columns. Many of the applications are backed by copies of most excellent testimonials, and some are from men who had already answered "Engineer's" advertisement. Practically all of those open to our perusal reveal an intense desire to secure employment, and it has been a painful task to deal with [illegible] correspondence, which shows beyond question that many able and experienced craftsmen are out of work. They have our sincere sympathy. We regret that we cannot afford space to print more than a few of the letters.—Eds. Elec. Rev.]

Civil Service Examinations.

Referring to Mr. F. E. Price's letter published in your issue of July 7th, it may also be of interest to your readers to know that "personal qualities" as an examination subject was included by the Civil Service Commission as long ago as 1912, when what I believe to be the first examination for assistant engineerships in the Post Office Engineering Department, following the reclassification of the engineering staff, was held. In that case the maximum number of marks obtainable for personal qualities was 600 out of a total for eight subjects of 2,100. In the examination held the following year the proportion was increased to 800 out of a total for the same subjects of 2,300. Fifty per cent. was required for a pass.

H. Kingsbury.

London, *July 18th*, 1922.

British Orders for German Products.

In your issue of April 7th last I read with surprise, not to say indignation, that the Corporation of Dundee had accepted a German tender for electric cables, and that Edinburgh Corporation had accepted another German tender for rails. I wonder if the gentlemen who accepted these tenders realise the untold harm that the accepting of foreign tenders for the home market does to our export trade.

As a representative in Brazil of an engineering firm, I feel very strongly about this matter, as these orders for the supply of material to the home market are at once used for propaganda work here in South America, with dire results to British export trade.

To a man residing abroad, reading the papers from home that inform him that there are one million men unemployed at home, it is impossible to understand why, when public bodies have need of material, they cannot order this material from home manufacturers, and thus employ at least some of the unemployed, so that our people may be self-supporting and not exist on charity doles from the Government.

I wonder how much money per week the Edinburgh and Dundee Corporations are paying out to the unemployed, and if the small amount saved by accepting these German tenders would be sufficient to meet the case. We poor men abroad who are doing our utmost to secure orders for home, and are up against fierce competition from Continental firms, have the satisfaction of getting stabbed in the back by corporations like Dundee and Edinburgh awarding contracts to our worst competitors.

If the Labour Party would take these matters up instead of indulging in useless strikes, it would be to the benefit of everyone, more especially to the unemployed.

An Engineering Representative.

Brazil, *June 26th*, 1922.

Wireless Valve Sets.

[illegible] doubt existing with regard to the above, and we think it would be as well, in the interest of the public, if the correct facts were stated.

There are a number of valve sets being made by small firms [illegible] possibility that after having purchased these sets they will not be allowed to use them when broadcasting begins? Are these sets on the market infringing any patents, and would the purchaser be liable to have his apparatus confiscated? Why are the larger manufacturers sending round their representatives to sell wireless apparatus, who state that they are making valve sets, but for some mysterious reason they cannot sell them at the moment? What are really the patentable details in a valve set?

We think if these few points could be made clear to the general public, they would then be in a position to judge whether they are wise in purchasing sets at the moment.

Walsall Electrical Co., Ltd.
V. Delebecque.

Walsall, *July 18th*, 1922.

[The valve sets on the market at the moment are apparently suitable for the reception of short-distance messages only; those capable of receiving messages from, say, the Continent are as yet too expensive to find a ready sale amongst amateurs. It must be assumed that the receiving sets already on the market do not infringe patent rights, otherwise they would not be offered for sale. Whether a limited number of manufacturers only will be permitted to produce such apparatus is not known; that is presumably one of the matters to be settled by the Post Office authorities when deciding the conditions on which broadcasting will be allowed. The whole thing seems to have been excellently stage-managed and advertised—but nothing practical has been done yet. Manufacturers will obviously not commence to produce receiving apparatus in any quantity until the broadcasting stations have been established.—Eds. Elec. Rev.].

Power to Supply Electricity.

A company in our town known as the ———— Gas and Electrical Co. a little while ago reserved the power to prevent any electricity supply entering the district other than that furnished by themselves. This company had been in operation for some time, but had never generated any electrical energy either for themselves or for consumers. This supply was discontinued some few months ago. Now we have a local brewery supplying consumers, their mains in a great many instances crossing the main roads; furthermore, they are conscripting sales for electrical accessories. We being the only electrical contractors, should like the satisfaction of knowing whether their supply is legal, and if we could not have the same method of supplying. We hope you will consider this as a fair appeal to safeguard the contractor and also consumers. In conclusion, we should like to say that this brewery was approached by us a short while ago with a view to their supplying us at their voltage, but we were promptly refused on the grounds of insufficient power, and yet these people continue to take on additional consumers; can you advise us on the matter? Possibly some of your readers may have been in the same plight, and would perhaps give us the benefit of their experience.

One Who is Losing Private Plant Jobs.

July 19th, 1922.

[The brewery company appears to be acting quite legally, as, we understand; there is no authority in existence which possesses statutory powers to supply electricity in the district. It is open to our correspondents to commence a similar business, and to carry overhead mains across the roads, provided that the regulations are complied with; and if the plant capacity does not exceed 50 kW, there is no need to notify the Electricity Commissioners that the supply is being given. Where the supply is "unauthorised," as in the case of the brewery company, there is no obligation to supply anyone; the company can choose its customers, and charge any price that the consumers agree to pay.—Eds. Elec. Rev.]

[A number of letters have been unavoidably crowded out this week.—Eds. Elec. Rev.]

United States Electric Vehicle Market.—Conditions in the electric vehicle market showed little change last month. One of the most significant developments during that month was the appearance of a full-page advertisement in the *New York Times* announcing reductions of from 35 to 40 per cent. in the prices of one of the most popular makes of electric trucks; the manufacturer's agent in New York informed *Reuter's Trade Service* representative that the advertisement was the first of a series. Another electric truck manufacturing company has also started an advertising campaign in the daily Press, using smaller space. One truck manufacturing concern reports that its sales during the first five months of this year showed an increase of 600 per cent., as compared with the corresponding period of 1921. Insurance companies recently granted a further reduction of 15 per cent. in premiums for public liability and collision risks covering electric trucks, so that the rates are now 25 per cent. below the premium for gasoline-driven vehicles. Twenty electric trucks and passenger cars, valued at $35,791, were exported from the United States during April.

LEGAL.

Marconi's Wireless Telegraph Co., Ltd., v. Mullard Radio Valve Co., Ltd.

In the Chancery Division, on July 19th, this action came on for hearing before Mr. Justice P. O. Lawrence. The plaintiff company claimed an injunction to restrain the defendants from infringing their Letters Patent Nos. 28,412 of 1913 and 126,658, and for the delivery up of the articles made in alleged infringement of the Letters Patent, and also for damages.

It appeared that the plaintiff company were the owners of the Letters Patent No. 28,413 of 1913, granted to the company and Mr. Henry Joseph Round for an invention of "improvements in receivers for use in wireless telegraphy," and also of Letters Patent granted to Michael Perì and Jacques Biguet for the invention of "improvements in or relating to vacuum tubes." The plaintiffs alleged that the Letters Patent were valid and subsisting, and they complained in particular of the sale by the defendants on or about July 8th, 1921, of "2R valves" constructed in accordance with the invention described in the complete specification of the Letters Patent of 1913, and in all the claiming clauses of the complete specification of the Letters Patent numbered 126,658.

Defendants denied the alleged infringement. They admitted that they sold and manufactured considerable numbers of thermionic valves, but they alleged that in part such manufacture and sale was by them as agents or contractors for His Majesty's Government, and in particular the Admiralty, on written authorisation in that behalf, and they denied that these valves constituted an infringement of either of the Letters Patent, and they relied on the provisions of Section 29 of the Patents and Designs Acts, 1907-1919. Defendants further alleged that the Letters Patent in question were and had been at all material times invalid.

Mr. J. Hunter Gray, K.C., Mr. Trevor Watson, and Mr. J. Whitehead appeared for the plaintiffs, and Sir Duncan Kerly, Mr. Moritz, and Mr. Courtney Terrell for the defendants.

Mr. Hunter Gray explained to the Court the function of the thermionic valve in wireless telegraphy, and experiments were conducted enabling his Lordship to judge the value of the device.

Mr. J. S. Vincent Pletts, M.I.E.E., Fellow of the Chartered Institute of Patent Agents, was the first witness called in support of the paintiffs' case. His evidence related to the technicalities of the construction of valves as showing the inventions registered by Letters Patent were unexplored ground up to the time those patents were granted. He said he knew of no valve which was in use now except the Round valve, which was cheap and robust. The defendant company's valve came completely within the plaintiffs' patent.

On July 20th Mr. Pletts was cross-examined by Sir Duncan Kerly. He explained the extent, in his view, of the invention by Mr. Round, and what, in fact, this invention actually consisted of. He said the advantages of Mr. Round's cylindrical construction were that it protected the glass from the electrons; it enabled one to control the flow of the electrons; it protected the space charge from external charges; and it also gave the shortest and broadest path between the electrodes, *viz.*, from the filament to the anode. Witness said he agreed that the claim was limited to boxing-in the grid by enclosing it only electrically all round, not mechanically all round. Round's general idea was to cut the line between the glass and the filament so as to prevent the electrons from getting to the glass. He did not agree that Mr. Round's specification was confined only to preventing the electrons getting to the glass. He did not agree that Mr. Round's to protect the space charge from the influence produced on it by the electrification of the glass. He agreed that whether a vacuum tube constructed with a grid and plate surrounding the filament gave a satisfactory or good characteristic curve depended, *inter alia*, on the dimensions and positioning of the parts. He admitted that in the case of the defendants' valves if the plate were taken away, the glass would be exposed to the electrons. It was the common practice in physical experiments in investigating electron currents to have the anode arranged as a cylindrical plate round the cathode.

The hearing was adjourned until July 25th.

The King *v.* The Electricity Commissioners (*ex parte* The Ealing Borough Council).

As briefly stated in our last issue, on July 19th the Court of Appeal, consisting of Lords Justices Bankes, Warrington, and Atkin, delivered judgment in this case, in which the Commissioners showed cause against a rule *nisi* of a *mandamus* directed to them calling upon them to give their approval to the provisional agreement entered into between the Ealing Borough Council and the Hammersmith Borough Council for a supply of electricity.

Lord Justice Bankes, in giving judgment, said this was an application by the Ealing Corporation to the High Court asking the Court to exercise what he thought was a very important branch of its jurisdiction. It was, perhaps, unnecessary to say that the issue of the writ was a matter of discretion, and not of right. The complaint in this case was that the Commissioners had acted in excess of the jurisdiction conferred upon them by the Electricity (Supply) Act, 1919. Applying the test of what had been ordered by the late Lord Justice Farwell in the case of the King *v.* the Board of Education (*ex parte* the Managers of the Oxford Street School, Swansea) it was contended that the Commissioners had acted on a mistaken assumption of jurisdiction, and the question was whether, in the circumstances of the case, that charge had been made out. For that purpose it became necessary to consider the provisions of the Act, its general objects, and the means by which those objects were arrived at. The general object of the Act was to consolidate large areas for the supply of electricity, and to place such areas under certain electricity authorities. In the selection and formation of those areas conflicting interests might, no doubt, have to be dealt with, and some considerable time might elapse before a scheme could be brought out. It was obvious that in the proper exercise by the Commissioners of their jurisdiction existing local authorities might have to submit to what was an immediate disadvantage in a matter which the Commissioners believed to be to the ultimate advantage of the larger scheme they had in view.

Having read Section 7, Sub-sections I and II of the Act, the Lord Justice proceeding, said that not only had the Commissioners to formulate a policy, but they had then to hold an inquiry and make an order, which, however, did not become operative until it had been confirmed by the Board of Trade and approved by both Houses of Parliament. For that reason the Legislature had made certain transitory provisions to cover the period until a scheme could be fully approved and come into force. His Lordship then read Section 19 of the Act, which he said was really the relevant section in the case. He then reviewed the facts of the case as set out in our issue of June 2nd (p. 766) leading up to the application of the Ealing Borough Council for a rule *nisi*. He said that it had been urged, on behalf of the Commissioners, that Parliament intended them to have a much wider authority; that they had the right to formulate their policy as to the consolidation of areas; that much time would probably be required in order to bring that policy into effect; and that although mutual assistance might be necessary, such assistance could only be given subject to their approval. Their right to refuse the assistance must be allowed if the policy suggested cut across the line of policy they had proposed to adopt.

In his judgment the words of the section must include the jurisdiction claimed on behalf of the Electricity Commissioners, and although it might work harshly in a particular case, when once it was established that the refusal had been made *bona-fide* he thought the complainants must submit. For these reasons he thought that cause had been shown and that the rule must be discharged.

The other members of the Court delivered judgment to the same effect.

Contravention of Electricity Regulations.

In the Justiciary Appeal Court, Edinburgh (before Lords Ormidale, Hunter, and Ashmore) last week, an important case, involving alleged contravention of electricity regulations was decided. The appeal was lodged by Andrew Fotheringham, H.M. Inspector of Factories, 250, St. Vincent Street, Glasgow, against Babcock & Wilcox, Ltd., Renfrew, against whom a charge of contravening the electricity regulations made under the Factory and Workshops Act (1901 to 1911) was brought at Paisley and dismissed by the Sheriff-Substitute. It appeared that the firm was constructing a new pipe shop in which an electric overhead crane was being erected. John Young, employed by the respondents as an engineer's labourer, was sitting on the end carriage of the crane drilling a hole with a ratchet. Over the place where he was working, at a distance of 4 ft. 3 in. above the frame, were three live electric trolley wires carrying a 440-volt three-phase alternating current. These wires were not protected in any way. They were necessarily bare, although capable of being protected. In the afternoon of December 22nd Young was found dead hanging by his two hands on the live wires above the platform of the crane near where he had been working. He had no electrical knowledge, but had been warned by the electrician under whose instructions he was working that it was dangerous to come in contact with them. The contravention charged against the respondents was that they failed to provide and use portable insulating stands, screens, boots, gloves, or other suitable means, in consequence of which neglect Young was killed.

On the assumption that the regulations applied, the Sheriff-Substitute held, looking to the circumstances of the case, to the nature of the work upon which Young was engaged, to the fact that he had been warned that the wires were dangerous if he came in contact with them, and to the fact that he could proceed to and return from the spot where he was working with safety if he used reasonable care, that the respondents were not guilty of a breach of the regulations, because, in his opinion, it was not necessary adequately to prevent danger that the means specified in the regulations should, in the circumstances, have been provided and used by the respondents. The prosecutor (H.M. Inspector) appealed,

and it was argued on his behalf that the fact that Young had been killed showed the need for the protection of these wires, of the danger of which he had been warned.

The Judiciary Appeal Court sustained the appeal, holding that the Sheriff-Substitute ought to have found the charge proved on the ground that the necessity for protection had been demonstrated by the death of Young, and that the regulation was intended to secure the safety, not only of careful workmen, but of workmen from inadvertence or carelessness.

The Attorney-General and the Birkdale District Electric Supply Co., *v.* Mayor and Corporation of Southport

In the Chancery Division, on Monday (July 24th) Mr. Justice Eve gave judgment in the action brought by the Attorney-General and the Birkdale District Electric Supply Co. against the Corporation of Southport to restrain the latter from infringing the plaintiffs' rights in connection with the supply of electric power in the Birkdale district. (The hearing was reported in the E.R., July 14th, p. 49.)

His Lordship, in giving judgment, said that on April 1st, 1912, the boundary of the borough of Southport was altered by statute so as to include the urban district of Birkdale. At that date the Birkdale District Electric Supply Co., Ltd., by virtue of an indenture dated December 31st, 1901, was the transferee of the powers, duties, and liabilities conferred and imposed on the Birkdale Urban District Council by an electric lighting order of 1898. It was also lessee for a term of 99 years from February 2nd, 1901, of an electrical generating station in Birkdale, and by virtue of a second indenture dated December 31st, 1901, was under contract to generate within the urban district of Birkdale all electrical energy required for public and private lighting under the Electric Lighting Order, 1898, and for working any electric tramways owned by the Council in the same district.

At the same date, April 1st, 1912, it was generating and supplying electricity within the urban district for lighting the town hall, fire station, library, and other public buildings, 17 public lamps in the neighbourhood of the town hall, and the lamps on the standards along the tramway route, and for working the tramways belonging to the Urban District Council, and then in lease to the Southport Tramways Co., Ltd., for a term of 35 years from January 1st, 1902. By the lease the Tramway Co. was prohibited from taking electrical energy from any other source. The conditions regulating the supply of electrical energy for working the tramways and lighting the lamps on the standards along the route was contained in an agreement of November 7th, 1902, made between the relators and the Tramway Co. In the second indenture of December 31st, 1901, was contained a covenant of the District Council that it would not, so long as the powers, duties, liabilities, and works authorised by the Electric Light Order of 1898 were vested in the relators, apply for any Provisional Order under the Electric Lighting Acts or consent to the grant of an Order to any person or company in respect of the area of supply mentioned in the Order, or to the supply of electrical energy by any company, corporation, body, or person within such area of supply, and by the Order extending the boundary of Southport, it was provided that all contracts and agreements subsisting at the commencement of the Order entered into or made by the Urban Council in relation exclusively to any part of the added area should continue as if the Southport Corporation had been a party thereto. When, therefore, the borough boundary was extended to include Birkdale the only result so far as the relators were concerned was to substitute a reference to the Borough Corporation for any reference to the Urban Council in the Lighting Order of 1898, and in the indentures of December 31st, 1901, and it was not contended on behalf of the Corporation that under the Extension Order of 1911, or otherwise, it acquired any right to supply electricity in competition with the relators. The real contest between the parties turned upon the true construction of the word "supply" in the phrase "to supply electrical energy." The tramways in Birkdale were in a continuous line with those in the borough of Southport. From the time of the extension and until quite recently the Corporation provided power for driving the cars up to the old borough boundary, and the relators provided it for driving them beyond that point. In February, 1918, the Tramways Co. surrendered to the Corporation, *inter alia*, its lease of the tramways in the old Birkdale district, and thereupon the Corporation became owner of the whole length of the tramways. The effect of the surrender was to put an end to the agreement of November 7th, 1902, between the relators and the Tramway Co., and accordingly a fresh agreement, dated October 3rd, 1918, was entered into between the relators and the Corporation, which, in effect, reproduced as from March 1st, 1918, the conditions *mutatis mutandis* of the earlier agreement except that instead of being determinable on the expiration of the leasehold interest it might be put an end to at any time by three months' notice from either party. On August 10th, 1921, the Corporation gave three months' notice to terminate this agreement, and it ended at midnight on November 10th. Thereafter the cars were, and since had been, propelled along the whole length of the line by power generated and provided by the Corporation. The relators asserted that the Corporation in these circumstances were acting in breach of the contractual restrictions against assenting to the supply of electrical energy in Birkdale in competition with the relators imposed upon it by the second indenture of December 31st, 1901, and had instituted this action to obtain an injunction to stop further breaches of the agreement and to recover damages for those that had already been committed. The Corporation, on the other hand, denied this, and said that it owned the tramways, and it could not in any sense be said to be supplying electrical energy. It argued that in order to supply energy there must be two parties—one who gave and the other who took. The primary meaning of the verb "to supply" was, his Lordship thought, to give or furnish something which was wanted, and in that sense it could be construed, in the relevant places in which it was used in the Acts and Orders his Lordship had to consider. In that construction there was little, if anything, to distinguish it from the verb "to provide," and in cases where the local authority was itself the undertaker inasmuch as its statutory buyers included "supplies of electricity for public purposes," that was, *inter alia*, for lighting in the street or in places belonging to the local authority—the verb "to supply" was certainly used with reference to a state of facts which did not involve the transfer of electricity from one who gave to another who took, unless it could be said that the local authority as electricity undertaker was to be treated as a separate entity from the same authority as owner or controller of the lamps in streets and places belonging to it. In the case of the West Surrey Water Co. *v.* the Guardians of the Chertsey Union, 1894 (3 Chancery Division, p. 513), Mr. Justice North, in the circumstances involved, in face of the plaintiffs' monopoly of supply, had to consider the meaning of the word "supply" in relation to water under the Public Health Act, 1875, and he attached a construction to it which would appear to exclude all cases where the supplier and the consumer were the same body and where the commodity was provided not to persons in the area who required a supply, but for use by the suppliers for their own purpose. His Lordship thought that the result of this judgment was to impress upon the word "supply" in the Acts and Orders of the nature of the present ones a meaning which compelled him to hold that the plaintiffs had no cause for action, and this being so, he had no alternative but to dismiss this action with costs.

English Electric & Siemens Supplies, Ltd., *v.* Lawrence.

In the Mayor's and City of London Court, on July 20th, the plaintiffs made a claim against Wilfred Lawrence, electrical engineer, of Chelston, Torquay, for £7 17s. 6d. for electrical goods supplied. Defendant, in his affidavit, stated that he handed over his business and entered into a deed of agreement with Mr. Hawkins, of Charterhouse Square, London, on December 7th, 1920. He contended that from that date the business at Torquay belonged to Mr. Hawkins, defendant being the manager. Plaintiffs' goods were supplied in April, 1921. Plaintiffs said they had never heard of Mr. Hawkins being the defendant's trustee. The defendant had the goods. Judgment for the plaintiffs, with costs.

The Lighting Dynamo and Equipment Co. *v.* Green.

At Marylebone County Court, on Monday, before Judge Scully, plaintiffs, of 6-7, Warwick Mews, Warwick Place, W., sued S. Green, of 1, Formosa Street, Warwick Avenue W., for £11 9s. in connection with the wiring of a shop and back room and for extras supplied.

The case for the plaintiffs was that an estimate for the work at £12 was submitted to defendant in August, 1920. It was a verbal estimate, and there was nothing in writing. Defendant accepted the estimate, but when the work was carried out defendant refused to pay for it. Plaintiffs also supplied some electric lamps. The contract did not include the cost of effecting a connection with the main. There was a deposit paid.

In reply to the judge, a witness for the plaintiff said he gave the company which was to supply the electricity notice of the work when it was completed.

Defendant said the contract was that the cost of making the connection with the main should be included in it. The only money he was told he would have to pay beyond the contract was £3 deposit for the meter. When the work was finished he was told by plaintiffs that they were going to leave it to the suppliers of the electricity to make the connection, but when he came into communication with them on the subject they told him the connection would cost him £30. There were no electricity consumers on either side of his house. Later, plaintiffs wanted payment for the fixtures, and he told them he did not want the fixtures.

In cross-examination defendant said he thought the suppliers of the electricity might want something—£5 or so—but he did not think they would require £30.

Judge Scully said it was very embarrassing to have to decide the case on inadequate evidence. The person who submitted the estimate and made the contract was not called on behalf of the plaintiffs, and neither party had produced a representative from the electricity company which was to give the supply; he must, therefore, give judgment for the defendant, with costs.

BUSINESS NOTES.

Bankruptcy Proceedings.—F. A. Jennings, consulting engineer, 25, Victoria Street, London, S.W.—Receiving order made July 19th on a creditor's petition. First meeting July 31st; public examination, September 19th; both at Carey Street, W.C.

R. Springer, electrical engineer and contractor, 253, Plymouth Grove, Manchester.—First meeting August 4th; public examination August 18th, at the Court House, Manchester.

E. G. Rowe (Davies & Rowe), electrical engineer, 52, Eleanor Street, and 119, Dunraven Street, Tonypandy.—First meeting August 2nd; public examination August 18th, at the Court House of Pontypridd.

F. Nicholls, electrical and motor engineer, 19, South Street, Scarborough (trading in partnership with Mrs. M. Parks as The Scarborough Motor and Accessories Supply Co.).—Trustee (Mr. D. S. Mackay) released March 17th.

J. W. Gladwin, electrical engineer, 81, Burcot Road, Meersbrook, Sheffield.—Trustee (Mr. C. Turner) released February 27th.

H. E. Carr, electrician, Carlisle Street, Goole.—Trustee (Mr. C. R. Townend) released April 11th.

Company Liquidations.—Stuart & Moore, Ltd.—Meeting of creditors August 8th at the offices. Claims to the liquidator (Mr. J. J. Ure).

Hudson's Electrical Engineering Co., Ltd.—Meeting August 26th at 99, Albion Street, Leeds, to hear an account of the winding-up from the liquidator, Mr. W. Emmerson.

Imperia Co., Ltd.—Meeting August 29th at 16, Kennedy Street, Manchester, to hear an account of the winding-up from the liquidator, Mr. A. F. Kearns.

Ilford Dry Battery Co., Ltd.—Meeting August 22nd at 31-4, Basinghall Street, London, E.C., to hear an account of the winding-up from the liquidator, Mr. G. W. Roberts.

Tredegars, Ltd.—With reference to the report under this heading in our issue of July 7th, Messrs. Cecil Hodges & Co., Ltd., ask us to state that they are not the firm of Hodges and Co., who appear as creditors for £130 in the liquidation of Tredegars, Ltd. The latter company owed them nothing at the time of the liquidation.

Aabada Trust, Ltd.—Winding up voluntarily, with Mr. H. E. Harwood, 73-75, Albion Street, Leeds, as liquidator.

Conner Magneto and Ignition Co., Ltd.—Meeting of creditors August 8th at 31, Copthall Avenue, London, E.C.2. Liquidator: Mr. A. L. Wallis. Particulars to be sent in by date named.

Dissolutions of Partnership.—Cables & Electrical Supplies, merchants and manufacturers of electrical materials, Mica House, Offord Street, London, N.1.—Messrs. A. Bergl and J. F. Schofield have dissolved partnership. Mr. Bergl will attend to debts, &c., and continue the business at the same address.

H. F. Knowler & Co., agricultural, electrical, and general engineers, &c., Kingsnorth, Ashford, Kent.—Messrs. H. F. Knowler and W. R. and A. S. Cooper have dissolved partnership by the bankruptcy of H. F. Knowler and with the mutual consent of W. R. and A. S. Cooper, who will attend to debts, &c.

Deed of Assignment.—J. B. Phillips and E. J. Phillips (Phillips & Co., electrical engineers, 41, St. John's Road, Clapham Junction, London, S.W.).—Creditors' claims must be received by the trustee, Mr. W. A. J. Osborne, Balfour House, London, E.C., by August 2nd.

Trade Announcements.—Premises have been opened by Messrs. Johnson & Watts, electricians, at 180, Snargate Street, Dover.

The Western Electric Co., Ltd., has appointed Messrs. Lionel Robinson & Co. sole selling agents for London, Middlesex, and Surrey, for its "B. A. G." diffusers. A range of samples is on view at the company's showroom at 3, Staple Inn, London, W.C.1, and catalogues are now being sent out to the trade.

Messrs. W. Liley & Co., who removed early in the year to 62, Hope Street, Liverpool, where they have a showroom, state that communications are still being addressed to their former premises. Correspondents are asked to take note of the change, and of the fact that no alteration has taken place in proprietorship or in either their telephone or telegraph numbers.

We are informed that Mr. G. W. Matthews has ceased to hold the appointment of joint managing director of Messrs. Cesco, Ltd., wholesale electrical engineers, 8, Westgate Street, Cardiff, and Mr. A. H. Smith has been elected sole managing director.

Catalogues and Lists.—Western Electric Co., Ltd., 60 and 62, Finsbury Pavement, E.C.2.—An illustrated catalogue of "B. A. G." "diffusers," of many patterns, for gasfilled lamps.

The London Electric Firm, Brighton Road, Croydon.—An illustrated leaflet giving particulars of suspended electric lanterns installed at Hove.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A well-illustrated brochure giving a simple explanation of the "Relay" system, showing and describing the parts in very full detail.

Ironclad Switchgear Co., Ltd., Monton Lane, Eccles, Manchester. An illustrated and priced catalogue of switch and fuse gear, including power station switchboards and distribution boards.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Catalogue Section K (13th edition), a comprehensive price list of telephone apparatus, fire alarms, water-level indicators, &c. Each item is illustrated, and views are given of a number of telephone installations. Also a card—"Reasons Why" No. 1, advertising "Excel" lampholders.

Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, E.—List 111, describing the "Chad" battery for operating "wireless" valves.

Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—A series of leaflets giving a few "Auto Suggestions," *i.e.*, particulars of small devices for automobiles, including electric horns, Boyce "Moto-Meters," "Autoreelites," &c.

The Lawrence Patent Water Softener and Sterilizer Co., Ltd., Parliament Mansions, Victoria Street, S.W.1.—A leaflet dealing with the treatment of boiler feed water.

The Horstmann Gear Co., Ltd., Newbridge Works, Bath.—An illustrated catalogue of time switches of various types.

Correction.—Owing to a printer's error in the arrangement of the advertisement, in our last issue, of Superlamp, Ltd., making an "Electric Lamp Offer," the prices of different lamps were mixed up. The advertisement is correctly printed in this issue.

New Belgian Companies.—There has been formed at Ondenval, Belgium, the Société Anonyme Lumière et Force Motrice for the production of electric light and power.

At Liége (24, Rue de Visé) F. Lambin and A. De Gueldre have constituted themselves a company for the carrying on of an engineering works and the undertaking of electric installations.

Joseph Herzé et Cie. is the style of a company formed at Liége for the sale, repair, and installation of electrical material of all kinds.

Brazilian Railway Electrification.—It is stated that the arrival at Rio de Janeiro of the president of the Compagnie Générale d'Electricité bears relation to the contract which the Government of Brazil is negotiating at present in order to provide for the electrification of the Central Railway of Brazil.

Outings.—In spite of rather unsettled weather, a very enjoyable day was spent on Saturday last by the indoor and outdoor staff of Messrs. Francis Polden and Co., Ltd., the London electrical contractors. A party of about 60 travelled in two charabancs to Brighton—the journey being enlivened by endeavours to follow up the weather changes by manipulation of the hoods of the vehicles. An excellent lunch awaited the party at the Clarence Hotel, Brighton, in the course of which an opportunity was taken of making two presentations to the head of the firm, Mr. Francis Polden—a silver rose bowl from the outdoor staff and a pair of silver-mounted brushes from the office staff. The spirit of fraternity between the management and the staff was very apparent, and this was given expression to by Messrs. Revell and Campbell, and, vociferously, by the assembled company. Mr. Polden thanked the staff for the gifts, and spoke of the firm's continued progress. He said that it was his aim to retain everybody with the company in spite of trade depression, and he was glad to say that so far it had not been necessary to "stand off" anybody. Mr. Oswald (co. director), in proposing the health of "The Staff, Indoor and Outside," also paid tribute to the excellent relations existing between all members of the firm, and Mr. Gill (secretary) responded. After lunch the individual members of the party were left to their own devices, and the weather behaved itself well for three or four hours continuously. The departure from Brighton was made at 5.30 p.m., and a diversion from the route was made for tea at Hurstpierpoint. The arrangements were in the hands of Messrs. Gill and Revell, and were another proof of the value of good business organisation.

For Sale.—By direction of the Disposal Board, Mr. Charles D. Phillips will sell a large quantity of plant and machinery, including boilers, water-softening plant, electric motors, generating sets, &c., at H.M. Factory, Stratton Works, Swindon, on August 16th and 17th. On August 15th and following days, Messrs. Bradshaw, Brown & Co. will sell by auction wireless material, electrical equipment, &c., at the Royal Dockyard, Woolwich. (See our advertisement pages to-day.)

Catalogues Wanted.—The Dublin United Tramways Co. (1896), Ltd., 112, Marlborough Street, Dublin, is desirous of obtaining current issues of catalogues and price lists to replace those lost by the destruction of its Sackville Street offices.

Glow Lamp Works for Poland.—It is reported from Berlin that a Polish-Dutch lamp company has been formed at Warsaw with a share capital of 100,000,000 Polish marks and with the co-operation of the Dutch Philips' Glow Lamp Co.

The American Strikes.—Mr. Samuel Gompers, the president of the American Federation of Labour, has issued a statement inviting the Government to urge the miners and railway workers on strike, and their respective employers, to open direct negotiations. The Government, the Labour leader says, has threatened a great deal, but has had little to say about the rights of the workers. "Labour," the statement declares, "invites the Government to bring about a conference between the workers and employers. Labour will enter the conference in absolute good faith, and unless the employers are absolute autocrats, the strikes can quickly be adjusted."—*Reuter.*

Book Notices.—"The Home Radio: How to make and use it." By A. Hyatt Verrill (105 pp.; 61 diagrams). London: Harper & Bros. Price 3s. 6d. net.—It is stated in the preface that this work is not intended as a scientific treatise on radio telephony, but as an aid to those who wish to make or use wireless telephone instruments and "who are not interested in, or do not care to learn, the technicalities of practical electricity as applied to wireless work." The author goes further and considers that this ignorance is perhaps an advantage. Of course absolute lack of acquaintance with the subject is inconceivable, the author therefore outlines the theory and practice of "wireless" in a non-technical manner. A list is given of the tools and material required, and this looks rather formidable. Then the construction of instruments and components is dealt with, but parts of this section are often rendered superfluous by the author's concluding by saying that, after all, it is better to purchase the part in question either on account of the cost and difficulty of constructing it, or its inefficiency when home-made. Both sending and receiving sets are described in concise and simple terms. The little work will certainly be of assistance to amateurs, but we think that only the purchase and assembly of the parts described will give satisfaction.

"Maintenance and Repair of Electrical Measuring Instruments." By H. G. Yarrill (78 pp.; 7 plates). London: Percival Marshall & Co. Price 2s. 6d. net.—The author, who has had considerable experience in this class of work, devotes the first five chapters of his book to the classification of instruments under the headings:—Moving coil; moving iron; hot-wire; dynamometer; and electrostatic. Principles and construction are fully and concisely dealt with and peculiarities explained. The sixth chapter is devoted to the installation and maintenance of instruments in service. Chapter VII. deals with the cause and remedy of common defects, and the final chapter deals with repairing generally. The explanations given are simple, but, naturally, in such a small volume, somewhat compressed.

"Report on Water Power," being the report of a Commission of Inquiry into the Resources and Industries of Ireland (50 pp.; 5 plates). Dublin: The Commission (87, Grafton Street). Price 2s. 6d. net.—This report gives estimates of the power probably to be derived from the rivers Shannon, Erne, Bann, and Liffey, as well as a number of smaller water-power resources. It is admitted that, with the exception of the Shannon, only short-period gaugings were available to aid the Commission in its work. Previous inquiries into the subject are reviewed, and the establishment of discharge-gauging stations, &c., is recommended. The Commission has had recourse, to a great extent, to the proceedings of the Board of Trade Sub-Committee which reported on the subject a short time ago.

Publications of the Massachusetts Institute of Technology. Serial Nos. 28 and 29. Boston (Mass): The Institute.—The first of these two publications contains three short treatises:—"A Simple Harmonic Analyser," "Electromechanical Device for Rapid Schedule Harmonic Analysis of Complex Waves," and "Alignment Chart for Circular and Hyperbolic Functions of a Complex Argument in Rectangular Co-ordinates." The second describes a mechanical frequency meter of telephonic range (from the *Journal* of the Franklin Institute).

"Lexique Technique Anglais-Français," by G. Malgorn (216 pp.). Paris: Gauthier-Villars et Cie. Price 10 fr.—This is a work which will inevitably be of greater utility to the French engineer or industrialist than to the English, as only the French equivalent of English terms is given, although to firms who have to write to French customers it may be of value. The dictionary is termed "technical," but its scope is such as to usurp, to some extent, the functions of the general English-French lexicon. As is to be expected, some of the translations are open to question—"faculty," for instance, is given as "*force mécanique*"—a somewhat strained rendering, but nevertheless the items generally are very detailed and explicit. It is interesting to note how far France is indebted to the English language for its technical terms, even where they have been bodily, literally, and clumsily translated into French.

"*Proceedings* of the Institution of Railway Signal Engineers (Inc.), 1921." (350 pp.). Manchester: H. Rawson & Co. Price (to non-members) 7s. 6d.—In addition to the annual report and statement of accounts, and lists of members, this volume contains the papers read, with discussions on these, during the year. Included among these are "Some Problems of Automatic Train Control," by W. J. Thorrowgood; "Some Fundamental Calculations of a.c. Track Circuit," by D. C. Gall; "Magnetic Storms," by W. J. Thorrowgood; "Some Problems of Track Circuit Lay-out," by W. C. Ackfield; and "Light Signals," by W. J. Sadler.

Manual of Electrical Undertakings and Directory of Officials, 1922. Vol. 25. London: Electrical Press, Ltd. 30s. net.—This valuable—practically indispensable—work has now reached its twenty-fifth year. It is not a volume to review in the ordinary way; in the main all that one can do is to indicate the nature of the contents, and it is so well-known among those who have occasion to use such a work that even that need hardly be indicated here. However, for the benefit of those who make a regular practice of purchasing the new volumes, we announce that the 25th is now out; and for the information of those who usually have not gone further than to borrow somebody else's copy and ought to buy one for themselves, we may say briefly what it contains. Its contents comprise financial, technical, commercial, and general information (including names of officials) relating to 2,760 electrical undertakings. The aggregate capital issued by electrical companies registered in Great Britain, in shares, debentures, and loans, together with municipal electrical borrowings, is shown to stand now at £601,000,000, as against £541,860,000 in the previous year. The rates of dividend and interest paid by electrical companies for the past 20 years are recorded. There is a review and statistical analysis of the progress of the year, and the information in different sections relates to electricity supply and traction, telegraph and telephone, manufacturing and miscellaneous concerns. A section is devoted to Colonial and British possessions, and there are directories of officials, of members of Electric Lighting and Tramway Committees, and of electrical contractors, and there is an index to undertakings. All kinds of subjects are included in the review of the year's progress—water-power, wireless matters, the Electric Supply Bill, and so forth; there are various maps and other features such as the volume has made a speciality of for many years.

"Experiments with the Slide-wire Bridge," by David Robertson, D.Sc., M.I.E.E. (pp. 86+8). Chelmsford: Crompton & Co., Ltd. Price 3s. net.—As the preface states, this work has been written to illustrate the possibilities of the slide-wire bridge, and particularly that form of it developed by the author and made by Messrs. Crompton. Altogether 21 separate operations are described, and under each head details are given of several methods. The bridge, it is shown, can be applied to the measurement of resistance, especially in connection with fault-tracing; the measurement of conductivity; measurement of temperature by the resistance thermometer; and the calibration of dial boxes, ammeters, and voltmeters. Every experiment is illustrated diagrammatically, and the method of explanation adopted leaves little room for error.

"Science Abstracts." Vol. 25. Part 6. Section A.—Physics, and Section B.—Electrical Engineering. London: E. & F. N. Spon, Ltd. (for the Institution of Electrical Engineers). Price 2s. 6d. per part.

The Bureau International de L'Union Télégraphique has published a new list, in alphabetical order, of the call signs of wireless telegraph stations (7th edition); the price of the document is 6 fr. (Swiss), and it is obtainable from the Bureau at Berne.

"Elements of Radio Telephony," by W. C. Ballard, junr., M.E., pp. x+132; figs. 51. London: McGraw-Hill Publishing Co., Ltd. Price 7s. 6d. net.

"The Mechanical Handling and Storing of Material," by G. F. Zimmer, A.M.Inst.C.E., pp. xx +804; figs. 1,143. London: Crosby Lockwood & Son. Price £3 3s. net.

"The 'Union d'Electricité' and the Gennevilliers" (48 pp.; 53 figs.; and 5 special plans), translated by C. M. Popp from the original French of Ernest Mercier. Paris: *La Revue Industrielle*.—This English edition has been further improved by the addition of later photographs.

L'Oyonnithe Moulded Insulation.—The moulded insulation manufactured by the Société Anonyme L'Oyonnithe, of Paris, whose sole agent for the United Kingdom is Mr. S. Evling, of 2, Falcon Square, E.C.1, is particularly attractive on account of the perfection of moulding obtained, and the reliability of the finished article. Four different qualities of material are used, depending chiefly on the temperature which the moulding has to withstand. Tests carried out by the Laboratoire Central d'Electricité, France, in April, 1922, show that the insulation resistance and dielectric strength of the various materials are satisfactory, and the "Permanite" quality will withstand a temperature of 200 deg. C. without cracking or melting. These moulded pieces find a wide field of application for lampholders, adaptors, wall plugs, switch handles, insulating pieces for internal telephone and telegraph construction, magneto construction, terminal boxes, wall blocks, fuse-bases, &c., and for electro-medical apparatus, where the strength of material and finish are so important. Even the most complicated mouldings with embedded metal parts for the internal construction of electrical apparatus are turned out with accuracy and high finish from drawings or patterns.

Waste Through Rust and Corrosion.—We are informed that a proposal is on foot to form an Association of Manufacturers of Non-Corrodible and Anti-Corrosive Products with the object of creating new and increased demands for the products and processes of its members. This is in view of the recently-published estimate of Sir Robert Hadfield that the ravages of rust and corrosion represent an annual wastage of more than £500,000,000. Particulars can be obtained from Mr. W. R. Douglas Shaw, c/o The Royal Society of Arts, 18, John Street, Adelphi, London, W.C.2.

The Engineering Trade Position.—Mr. Douglas Vickers, M.P., in his speech at the annual meeting of Vickers, Ltd., at Sheffield on July 19th, said that 1921 was a year of troubles, disappointments, falling prices and diminishing trade for practically all the engineering concerns in the country. The only exceptions known to him were the textile machine trade, in which they were not interested, and the electrical trades. At the present time, with seven months of 1922 gone, there was no change for the better. If they did not know that trade must recover in the end and that every month brought them nearer to that revival, they would say that recovery was as far off as ever. The electrical trade still showed best, though orders did not come in as fast as work went out; there were very few inquiries for ships or steel products or railway material, carriages, and wagons; motor cars, on the other hand, were selling quite well. They were still waiting for armament orders, though their reduced designing staffs were very busy with new designs which they had been asked to get out, and which they must undertake if they were to retain that trade in the future.

There had been many conjectures as to the cause of the present bad trade, and few were satisfactory. The condition of Russia and the impoverished Central European States seemed inadequate as an explanation as far as engineering was concerned; the chief causes must be at home. "The customers for engineering products, ships, machinery, &c., are on strike. These goods are purchased almost entirely on capital account and paid for either out of profits retained in the business or by sums raised by new subscription. Excessive taxation has almost put a stop to the former, and as to the latter the investment of new money in plant at prices that are still high as compared with past years offers little attraction to the investor who can get a return from trust securities that compares not very unfavourably with what he used to expect on ordinary shares before the war. In fact, the investor has held off and will continue to hold off until there is some change in feeling. For the moment the outlook for the engineering trade is still gloomy, but there are points which indicate that the skies may clear. In the first place, the abundance of money is raising the prices of trust investments and bringing down the return that can be obtained from them, which must add to the relative attractions of industrial shares; secondly, there is a feeling spreading that things are improving, and if this feeling becomes general they will improve." . . . "There is now plenty of money available for public loans and little for permanent investment in new construction or industrial enterprises. The market would readily supply large sums to our Dominions and Colonies if in certain cases the home Government would support loans by guarantees. Our old Dominions and Crown Colonies are still an ample field for development, while the newer acquisitions must have large sums spent upon them to become remunerative, or even only self-supporting units of the Empire. If development loans with a Government guarantee were spent in the usual proportions in this country, trade would revive, unemployment would be reduced, and the direct savings in the cost to the Government of unemployment could hardly fail to cover any eventual charge due to the guarantee, while the indirect advantages and the saving in local taxation would be far greater. Britain Overseas would again render great service to the mother country if they began development at once on a large scale. They would gain by their increased resources, and we here would be helped, now by the revival of trade, and in the future we should have the benefit of the newly-established customers for our goods of all kinds."

Belgian Electrical Signalling Apparatus.—Hitherto Belgium has been mainly dependent on foreign countries for railway electrical signalling apparatus. The Société des Ateliers de Constructions Electriques de Charleroi has, however, recently established special works for its manufacture at Ruysbroeck, near Brussels, where already a large number of orders are in hand in connection with the electrification of the Belgium State railways.

Holidays.—The works of the Electric Construction Co., Ltd., will be closed from August 5th to August 13th inclusive. The offices will re-open on August 9th.

The works and offices of Messrs. Allen West & Co., Ltd., Brighton, will be closed (save for urgent correspondence matters) from August 5th to 13th (inclusive) for the summer holidays.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Blancol. No. 425,468. Class 50.—Oil intended for use to prevent or minimise the evaporation of electrolyte in secondary cells. Price's Co., Ltd., Belmont Works, Battersea, S.W. July 12th, 1922.

Magnome. No. 423,547. Class 13.—Electrical goods of ordinary metal. Frank B. Cox, 65, Fleet Street, Liverpool, July 19th, 1922.

Design No. 425,369. Class 13.—Water, gas, and electrical fittings of ordinary metal. Samuel Booth & Co., Ltd., Cheapside Works, Cheapside, Birmingham. July 19th, 1922.

Leofurite. No. 425,102. All articles in Class 5. Leeds Electrical Construction Co., Ltd., Charmouth Street, Leeds. July 19th, 1922.

Liliput. No. 416,919. Class 6.—Dynamos and electric fans. J. Stone & Co., Ltd., Abinger Street, Deptford, London, S.E. July 19th, 1922.

G. L. Garbe Lahmeyer (lettering and design). No. 419,672. Class 6.—Dynamos and electric motors. Deutsche Elektrizitätswerke zu Aachen, Garbe Lahmeyer & Co., Aix-la-Chapelle, Germany. Address for service: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C. July 19th, 1922.

Ackante. No. 424,692. Class 6.—Electrical machines. Justus Eck and Sergius Brook, trading in co-partnership, 4-12, Palmer Street, London, S.W. July 19th, 1922.

German Requests for British Posters.—The F.B.I. *Bulletin* publishes the following warning to members:—"The attention of the Federation has been drawn to certain communications which have been received from Germany asking for copies of propaganda posters issued at exhibitions and trade fairs in this country. The reason given for this request is that the posters are to be used as illustrations to a volume dealing with exhibition literature and advertisements. Investigations made show that there is grave doubt as to the purpose for which such posters, stamps, &c., are likely to be used, and any members receiving requests of this kind are asked to apply to the F.B.I. in order that the *bonâ fides* of the inquirers may be looked into."

Indian Imports.—Official figures issued by the Department of Statistics record that for the month of May the imports of manufactured articles showed decreases under machinery and millwork, Rs. 15 lakhs; railway plant and rolling stock, Rs. 63 lakhs; electrical goods, Rs. 26 lakhs, while metals recorded an increase of Rs. 66 lakhs.

New French Company.—There has been launched at Paris (10, Rue de Tilsitt) L'Electrotechnique, S.A., with the object of planning and carrying out electro-technical installations. Its capital is 170,000 fr.

LIGHTING AND POWER NOTES.

Australia.—New South Wales.—The Minister for Public Works has announced that a Bill is to be presented to Parliament next session providing for the installation of electric lighting systems to serve the towns of Moss Vale, Bowral, and Mittagong, and the erection of a transmission line from the Port Kembla power house. The estimated cost of the transmission line, including sub-stations, transformers, and switchgear, which will connect with the existing line at Avon Dam, is £32,000. Moss Vale already has a supply system, but the generating station will be closed. The distribution system for Bowral is estimated to cost £6,900, while the outlay at Mittagong is set down at £4,800.—*Tenders.*

Corowa (N.S.W.).—The Municipal Council has decided to convert its system of supply from d.c. to a.c. The estimated cost of the change over is £30,000.

Bath.—Year's Working.—The annual report on the working of the electricity undertaking for the past year shows a total income of £52,866, as compared with £45,495 in the previous year. Working expenses amounted to £40,029 (£38,070), leaving a gross profit of £12,837 (£7,425). After deducting loan charges, &c., there was a net loss of £1,504. In 1920-21 there was a deficit of £1,971.

Bexhill.—Year's Working.—The report of the borough electrical engineer (Mr. C. A. Frost) for the year ended March 31st, 1922, shows that the total revenue of the undertaking was £29,180, as against £24,698 in the previous year. The working expenditure was £18,960, as compared with £17,237, leaving a gross profit of £10,145 (£7,460). Capital charges absorbed £7,014 (£5,601), making the final result a net profit of £3,131 (£1,859). A total of 883,364 units was sold, being slightly higher than in the previous year, and the highest figure since the inception of the undertaking. During the year a 500-kW Belliss-Dick, Kerr set was put into commission.

Chislehurst.—Increased Charge Opposed.—The Urban Council is opposing an application by the Chislehurst Electricity Co. for permission to increase its charge for electricity from 10d. to 1s. per unit.

Continental. France.—The French official journal has just published the text of the law of July, 1922, authorising the erection of networks for the transmission of energy at high pressure, and modifying the law of June 15th, 1906, concerning the distribution of energy. The new law provides that if the State itself does not take the initiative, it can compel producers, and, if necessary, distributors of energy, the Départements, communes, and public services in the same district which are interested in some form in the transmission of electrical energy, to constitute, under the direction of the State, and, in that case with the financial co-operation of the State, a special collective organisation for the construction and [illegible] of a network of high-pressure transmission lines intended particularly to connect the generating works between [illegible] and with transformer sub-stations from which [illegible]

lines will start. If some of the producers or distributors of energy, whose co-operation is considered by the State to be indispensable for the realisation of a collective organisation of this nature or for its normal development afterwards, should refuse their co-operation, the State can (after the advice of the Committee d'Electricité) be substituted for them either by the purchase of their installations or by way of expropriation. The law further provides for the fixing in the annual Budget of the total amount of capital which the Minister for Public Works will be authorised to expend on the execution of works in accordance with this law.

According to the *Journée Industrielle*, the Bill authorising the construction of h.p. systems for the transmission of electrical energy in France has been adopted by the Senate. The object of the Bill is to provide for irregularities or shortage of water supply at various seasons. An annual saving in fuel after 1937 of 9,000,000 tons is anticipated as a result of the completion of present schemes. The cost of construction of the stations and systems is put at 15 milliard fr., a third of which will be supplied by the State.

Darlington.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £7,230 for two additional feeder cables.

Dungarvan.—Public Lighting.—The Urban Council has accepted the tender of the Dungarvan Electric Lighting Co. to carry out the lighting of the town at a total cost of £276 for the coming winter. The Gas Co. refused to tender on the ground that the state of the country was too uncertain.

Dunmurry (Co. Antrim).—New Company.—The Dunmurry Electric Power and Lighting Co. has been registered. Dunmurry is about four miles from Belfast, and possesses several large linen mills and factories.

Electricity District.—North-East Midlands.—The Electricity Commissioners are to hold a first inquiry at the Town Hall, Sheffield, on October 17th next with reference to the delimitation of the above-named district and to consider the scheme submitted by the Sheffield Corporation for the constitution of a Joint Electricity Authority for the area.

Edinburgh.—Price Reductions.—The Electricity Committee has recommended that the charge for electricity for lighting be reduced from 5d. to 4½d. per unit. A reduction in the charges for power, cooking, and heating is also recommended.

Gelligaer.—Extension of Supply.—The District Council is extending its area of electricity supply to Trelewis.

Greenmount (Bury).—Electricity Supply.—The Lancashire Electric Power Co. is canvassing the Greenmount district (near Bury) with a view to that neighbourhood being supplied with electricity, and the Tottington District Council has resolved that the company be asked to canvass the Bury Road portion of its area also.

Grimsby.—Year's Working.—The report of the borough electrical engineer (Lt.-Col. W. A. Vignoles, D.S.O.) for the year 1921-22 states that the gross revenue was £82,747, as compared with £67,415 in the previous year. The working costs amounted to £54,174, as against £51,525, leaving a gross balance of £28,413 (£15,890). The net result, after payment of capital charges, was a profit of £4,867, which was disposed of as follows:—Debit balance from the previous year, £2,654; motors purchased for hire, £756; reserved for purchase of cooking apparatus for hire, £1,000; transferred to reserve, £457. The total number of units sold was 5,272,929, as against 4,038,766, the increase being mainly due to larger sales of electricity for power purposes. The report mentions that a rateable-value system for private houses and a maximum-demand system for other premises were instituted on April 1st, the additional charge being 1½d. per unit.

Heywood.—Year's Working.—The annual report of the manager (Mr. H. C. Day) on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £20,024, as compared with £19,547 in 1920-21. Working costs and capital charges absorbed £21,071, leaving a net loss of £1,047. In the previous year there was a surplus of £829. The number of units generated was 2,246,253—a reduction on that of the previous year of 5 per cent. The production cost per unit rose from 1.53d. to 2.07d.

Kells (Co. Meath).—Borrowing Powers Refused.—The Local Government Department, Irish Free State Provisional Government, has declined to sanction the proposal of the Urban Council to raise a loan for an electricity scheme, on the ground that, there being no industrial concerns in the town, the annual revenue account would be less than the amount estimated.

Kilmarnock.—Loan Sanctioned.—The Electricity Commissioners have authorised the Town Council to borrow £200,000 for electricity purposes.

Llandrindod Wells.—Proposed Purchase of Undertaking. The Municipal Council has, on the recommendation of its consulting engineer, opened negotiations with the Llandrindod Wells Electric Light and Power Distribution Co., with a view to purchasing the company's electricity undertaking.

London.—Stoke Newington.—The Borough Council has received a letter from Hackney suggesting the amalgamation of the electricity undertakings of the two boroughs, but has replied that it is of opinion that no useful purpose would be served by such a union.

Mynyddislwyn.—Extension of Supply.—The Urban Council has obtained an Order giving it power to supply electricity to the Oakfield area of the district.

Newport (Mon.).—Deferred Payment System.—The Corporation has decided, at the request of house-owners, to wire houses on the deferred-payment system.

New Zealand.—Taurang.—According to *The Commonwealth Engineer*, the engineer to the Borough Council has prepared a report on a further extension of the electricity supply at an estimated cost of £75,000. The proposal is to supplement the Omanawa falls plant with another station on the Wairoa river, having an ultimate capacity of 3,500 h.p.

Rochdale.—Loan Sanctioned.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £27,294 for mains and services.

Skipton.—Suspension of Sinking Fund.—The Urban Council is applying to the Electricity Commissioners for sanction to suspend sinking fund contributions for a period of five years.

Special Electricity Orders.—Confirmation.—The following Special Orders made by the Electricity Commissioners have been confirmed by the Minister of Transport:—Caerphilly; Newport (Mon.) (Extension).

Stockton-on-Tees.—Change of System.—The Town Council is adopting the a.c. system for supplying large consumers, and it is intended eventually to change over the whole system to a.c.

Walsall.—Year's Working.—The accounts of the municipal electricity supply undertaking (manager: Mr. H. A. Howie) for the year ended March 31st last record a total revenue from all sources of £84,234, as compared with £96,062 in the previous year. The working expenditure was £58,665, as against £74,379, leaving a gross surplus of £25,569 (£21,683). After the payment of capital charges, &c., a sum of £1,110 was carried to appropriation account; in the previous year the equivalent figure was £1,614. The energy sold decreased from the "record" attained in 1920-21 of 8,397,868 to 8,095,885 units; the maximum simultaneous load, however, rose from 3,600 to 4,050 kW.

Winchcombe.—Water-power Scheme.—A company has been formed for the purpose of providing electricity for the town. Power will be obtained by placing a turbine in the river Isbourne, supplemented by a gas or oil engine. The estimated cost of the scheme is £4,000.

Wimbledon.—Loan.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to borrow £25,000 for the installation of a new 3,000-kW turbo-alternator.

TRAMWAY AND RAILWAY NOTES.

Australia.—Electric Tramcar Requirements of Melbourne.—The Melbourne and Metropolitan Tramways Board (673, Bourke Street, Melbourne) has decided that its future rolling stock will be constructed partly in the Board's own workshops and partly by contract. It is anticipated that in order to provide for new services and for the conversion of the cable tramways, additions will have to be made to the rolling stock at the rate of between 50 and 60 cars annually for several years. Provision will be made in the new workshops for constructing and equipping up to 30 of these cars, and tenders will be invited periodically for the balance. It is probable that the Board will invite tenders within the next few months for the construction of about 60 single-truck electric tramcars—delivery to be spread over two years. The attention of car-building firms to this policy is invited.

China.—Kowloon.—The Government has sanctioned the construction of tramways in the town. About eight miles of track will be laid at first. It is anticipated that eventually from 20 to 30 miles of track will be put down.

London.—Underground Railways.—Twenty years ago 84 trains served Ealing daily. The new services now provided by the District Railway and Central London Railway extension provide Ealing Broadway with no less than 228 trains direct to and from the City and West End. The new extension line of the Central London Railway has brought considerable relief to the District Railway during the evening peak traffic period, as it is beginning to be discovered that the Central London route is quicker, though the fares by either route are the same.

Underground Train Derailed.—Traffic on the District Railway was suspended between Whitechapel and Aldgate last Monday night owing to the derailment of a train running from Whitechapel to Ealing. The line was cleared early the next morning.

L.C.C. and the Bexley Tramways.—The L.C.C.'s existing "through-running" agreement with the Bexley Urban District Council expired on July 25th, and the L.C.C. has six months in which to decide upon the purchase of the Bexley system. In the meantime a temporary arrangement has been made to ensure the continuance of through-running.

Accidents.—A crowded tramcar overturned on July 21st on a hill near the Welsh Harp, Hendon, and 30 passengers were injured, several seriously. It appears that the car was following a steam lorry and ran into it, but it is not clear whether collision between the vehicles occurred before or after the derailment of the tramcar. The driver of the latter stated that one of the men on the lorry put out his hand as if to indicate that the lorry was turning, and he (the driver) immediately applied his brakes, causing the car to leave the rails. The men on the lorry denied that either of them put out his hand.

A tramcar left the rails at Highbury Corner on July 24th and ran into another car. The runaway car was carrying a number of passengers, but only one was injured.

Shipley.—Track Renewals.—The Bradford Corporation has entered into an agreement with the District Council for the reconstruction of the Nab Wood section of the Bradford city tramways, which comes within the Council's area. The Council will pay the cost of the renewals and the Corporation will pay increased rent for the use of the track and undertake repairs and maintenance of the tramway.

St. Helens.—Year's Working.—The accounts of the municipal tramway undertaking (manager: Mr. L. C. F. Bellamy) for the year ended March 31st last show a total income from all sources of £89,772, as compared with £109,813 in the previous year. Working expenses totalled £66,332, as against £77,930, leaving a gross profit of £23,440 (£31,883). The result, after payment of capital charges, was a net profit of £12,889, comparing with a profit of £45,546 in the previous year. The number of passengers carried fell from 11,037,318 to 8,600,917, and the car-mileage from 1,002,861 to 841,307.

TELEGRAPH AND TELEPHONE NOTES.

China.—Wireless Telephony.—A system enabling telephone subscribers of Peking and Tientsin to talk to each other by wireless from their house or office telephones, the conversation taking place over wire lines to the central office and then by wireless between the two cities—a distance of over 80 miles—has been installed by the China Electric Co., and successful tests made. The equipment is the product of an American company. It is believed that this is the longest wireless telephone service open to public use in the world.—*Eastern Engineering.*

Holland.—Wireless Broadcasting.—The broadcasting of wireless messages from the Dutch station at The Hague was about to be discontinued owing to the lack of funds. The *Daily Mail*, of London, has, however, entered into an arrangement with the Nederlands Radio-industrie whereby the broadcasting will not only be maintained, but will be developed on wider lines. Transmission will take place under the new arrangement every Thursday and Sunday between 7 and 8 p.m. (summer time); the range is to be extended from 500 to 2,000 miles, the power being 1,500 watts and the wave-length 1,050 metres. The call sign of The Hague station is "P. C. G. G." No fewer than 88 business firms and private people have arranged to repeat the messages and music received by means of "loud speakers" in London and the provinces for the benefit of those who do not possess receiving apparatus of their own.

Indo-China.—New Wireless Station.—The Compagnie Générale de Télégraphie sans Fil is building a big wireless station at Phuto, near Saigon. The station will be started in September. It will communicate directly with the stations at Sainte Assise and Tananarise. The energy needed will be supplied by the Energie Electrique de l'Indo-Chine, which company is now building near Saigon a generating station of 3,000-kW capacity.—*Eastern Engineering.*

South Africa. — Wireless Telegraphy.—General Smuts made a statement on the wireless position in the Union House of Assembly on July 19th. The Government was, the Premier said, in possession of three schemes, namely, Marconi's, Elwell's, and the British Post Office's. The Government, General Smuts concluded, had not yet taken a final decision, but at present the arguments were strongly in favour of the Marconi offer.—*Morning Post.*

Sweden.—Operators' Strike.—The girl telephone operators at Stockholm and Gothenburg struck work on July 21st, owing to the refusal of the Telegraph and Telephone Board to accept the girls' demands for a joint wage agreement. In Stockholm about 2,000 girls are involved, and the local service is practically paralysed, but the inter-urban traffic is not affected.

A later message says that the strike of the girl operators continues, but has failed in its purpose, as owing to the assistance rendered by volunteers, the service is being carried on in an almost normal manner.—*Reuter's Trade Service* (Stockholm).

Switzerland.—Long-distance Telephony.—*The Times* Geneva correspondent states that a new direct telephone line has been established between Zermatt and Brig. The trials have been satisfactory, and it will be possible to telephone every day from Zermatt to London after 6 p.m.

The Telephone Service.—New Automatic Exchange.—The new automatic telephone exchange at Fleetwood was opened on July 15th. It is conducted on the relay system.—*Daily Dispatch.*

Underground Cables.—The work of laying underground telephone cables from Newcastle northwards to Catcleugh, where a junction will be made with the Scottish section, was begun on July 20th; it will cost £500,000.—*The Times.*

U.S.A.—Wireless Broadcasting.—New York City is to have its own station, for which the sum of £10,000 has been allocated. The aerial is to be erected on the roof of the Municipal Building, and the installation is to be begun almost immediately. This is an enterprise which will doubtless be imitated by other municipalities, and suggests one way of solving the broadcasting problem.—*Daily Mail.*

Wireless Telegraphy.—Underground Transmission.—The use wireless might be put to in coal mines was demonstrated in the Blue John Mine, Castleton, Derbyshire, on July 16th by members of the Sheffield Wireless Society. From a depth of about 300 ft. they succeeded in sending a message to Hope, about three miles away.—*Daily Mail.*

Broadcasting.—The *Daily Mail* announces that the P.M.G. met representatives of the wireless companies on July 25th to discuss with them broadcasting schemes, the Bill now before Parliament, and the restriction of the importation of foreign receiving sets. The companies interested are divided into two groups, and are, it is said, to receive half the revenue from licences for receiving sets which the Post Office issues at 10s. each.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—October 17th. Postmaster-General's Department. Automatic c.b. telephone equipment, with all associated equipment, including material for use at subscribers' premises. (Sched. 39 and 40.) (July 7th.)

September 27th. Telephone apparatus and parts. (Sched. 561.) (July 14th.)

Brisbane.—September 20th. Postmaster-General's Department. Supply and delivery of switchboard apparatus and parts. (Sched. No. 559.)*

Victorian Electricity Commission.—Ten surface feed-water heaters; 6 surface vapour condensers; 12 feed-water evaporators. Specifications £2 2s. Particulars from Agent-General for Victoria, Melbourne Place, Strand, W.C.2.

September 13th. Tramways Board. Twenty-seven straight air-brake equipments for single-truck tramcars.—*Reuter's Trade Service* (Melbourne).

Belgium.—Brussels.—August 2nd. Supply and installation of rotary converters, switchboards, and other accessories for Grand-Saint-Pierre, Alost-Nord, and Denderleeun. M. Foulon, Administrateur des Voies et Travaux, 17, Rue de Louvain, Brussels.*

August 8th. Military Sanatorium, Marchin. Internal-combustion engine for the electricity generating plant. Commandant des Batiments Militaires de Liége-Rive Droite, 22, Rue des Bonnes Villes, Liége.

Bishop's Castle.—August 5th. Installation of electric lighting in the Parish Church. (July 21st.)

Bulgaria.—August 5th. State Railways. Electric hand-drilling machine and spare parts. Direction Générale des Chemins de Fer Bulgars, Sofia. Further particulars may be obtained from Mr. Dempster, Room 50, Department of Overseas Trade, 35, Queen Street, S.W.1.

Edinburgh. — August 3rd. Parish Council. Various works (including electrical) at Seafield Poorhouse, Leith. Schedules from Mr. J. M. Johnston, architect, 47, Charlotte Street, Leith. Tenders to Mr. R. T. French, Parish Council Chambers.

August 4th. District Board of Control. Repairs and renewals (including electrical work)-at Bangour Village Asylum, after military occupation. Specifications and schedule from Mr. James D. Gibson, surveyor, 60, Frederick Street, Edinburgh. Tenders to Mr. R. T. French, clerk, Board of Control, Castle Terrace, Edinburgh.

France. — Paris. August 2nd. Two electrically-driven travelling bridges for the sub-stations of St. Germain-en-Laye and Chatou. Service Electrique, 43, Rue de Rome, Paris.

Calais.—Municipal Authorities. Installation of heating by low-pressure steam or water at the new Hôtel de Ville. Particulars from the Mairie, Service des Bâtiments Municipaux, or the architect in charge of the works, 10, Quai de l'Escaut, Calais.—*Reuter's Trade Service* (Paris).

Horsham.—July 31st. Urban District Council. Cables. (July 21st.)

Holland. — RAUWERDERHEM. — Low-pressure network and house connections. Specifications (Gld. 12.50) from the office of the Provinciaal Electriciteitsbedrijf in Friesland, Emmakade, N.Z., 57, Leeuwarden.

Manchester. — August 8th. Tramways Department. Supply of permanent-way special track work. Specifications and forms of tender from Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester. (Deposit £1 1s., returnable.)

New Zealand.—October 24th. Mangahao Power Scheme. Copper wire. November 21st. Battery booster-transformer. Specifications may be obtained from the office of the High Commissioner.—*Reuter's Trade Service* (Wellington).

October 3rd. Mangahao Power Scheme. Power-house and sub-station transformers; travelling electric cranes; ventilating fans; goods lift; and 110,000-V insulators.*

Oxford.—August 15th. Oxford Electric Co., Ltd. One 1,000-kW turbo-alternator and condensing plant; and one 500-kW conversion plant (3,000 V, 3-phase, to 1,100 V, d.c.), complete with switchgear. (July 21st.)

Plymouth.—August 4th. Electricity Department. Transporter runway travelling trolley hoist. (July 14th.)

Rhondda.—Urban District Council. Two 3-in. and two 6-in. vertical-spindle centrifugal pumps, together with electric motors. Also two cast-iron tanks in connection with the pumps. This does not include work of putting in position. Specifications, plans, and forms of tender (deposit of £1 1s.) from Mr. E. Taylor, engineer and surveyor, Rhondda Urban District Council Offices, Pentre, Rhondda.

South Africa.—GRAHAMSTOWN.—September 1st. Electric lighting plant and equipment, comprising steel poles, overhead wiring, house services, fuses, transformer switches, meters, street lamps, &c. Consulting engineer: Prof. W. Buchanan, 75, Louis Botha Avenue, Houghton Estate, Johannesburg.*

Tasmania.—HOBART.—City Council. 750-kW rotary converter and transformer and 550-volt, d.c. switchboard panel. Tenders are returnable at Hobart on October 2nd next, and particulars, which have been posted, are due to arrive at the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2, about the middle of August.

Warrington.—August 14th. Electricity and Tramways Committee. High and low-pressure paper and lead-covered cable, and earthenware conduits. (See this issue.)

Wimbledon.—August 31st. Electricity Committee. One 3,000-kW turbo-alternator, condensing plant, and accessories. (See this issue.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—VICTORIAN RAILWAYS.

Three-phase 440-V motors and auto-starters, 7½ h.p. (£72 each); and 5 h.p. (£56 each).—Sweden and Australia:—Thomas Bros.

Three-phase, 440-V motors, 35 h.p. (£137 each); 3-h.p. (£26 each).—Elder, Smith & Co., Ltd.—*Tenders.*

NEW SOUTH WALES.—Postmaster-General's Department.

30,730 condensers, 2 m.f. (2s. 10½d. each).—British General Electric Co., Ltd.

Switchboard cable: 4,066 ft. 51-pair (£660); 2,896 ft. 21-pair (£222); 7,206 ft. 10-pair (£456).—Automatic Telephones (Australasia), Ltd.—*Tenders.*

Bradford.—Electricity Committee.

Supply and erection of a steel roof over the ash hopper at No. 4 boiler house, Valley Road station; and the supply and erection of steelwork in connection with alterations to the Sunbridge Road sub-station.—Henry Barrett & Sons, Ltd., Bradford.

Tramways Committee.

Supply of 20 tons of cast-iron brake shoes and the purchase of the same quantity of scrap cast-iron brake shoes (£147 10s.).—Pease & Partners, Ltd.

Cardiff.—City Coal Committee.

Supply of 15,400 tons of washed duff and 2,400 tons of washed peas, for the Electricity Department.—Powell Duffryn Co.

Hertfordshire.—County Council.

Electric lighting, bells, and telephones at Ware Park Asylum (£4,894).—Steele & Co.

London.—FULHAM.—Electricity and Lighting Committee 3,500 yd. of 1 sq. in. h.p. cable:—

New Gutta-Percha Co.	£1,610
Watshams, Ltd.	1,460
Callender's Cable & Construction Co., Ltd.	1,298
Union Cable Co.	1,284
Siemens Bros. & Co., Ltd.	1,270
Western Electric Co., Ltd.	1,265
W. T. Glover & Co., Ltd.	1,265
British Insulated & Helsby Cables, Ltd.	1,254
Johnson & Phillips, Ltd.	1,253
W. T. Henley's Telegraph Works Co., Ltd. (accepted)	**1,237**
Hackbridge Cable Co., Ltd.	1,218
Enfield Edswan Cable Works, Ltd.	1,202
Pirelli, Ltd.	1,187
Electrical Supplies, Ltd. (Dutch)	1,177

Messrs. Henley's tender was accepted on account of uniformity with the rest of the system and for other reasons.

One 1,500-kW Scott-connected transformer for interchange system:—

Fuller Electrical and Manufacturing Co., Ltd.	£910
British Electric Transformer Co., Ltd. (accepted)	**1,174**
Hackbridge Electric Construction Co., Ltd.	1,206
Ferranti, Ltd.	1,269
English Electric Co., Ltd.	1,280
Brush Electrical Engineering Co., Ltd.	1,282
Johnson & Phillips, Ltd.	1,296
Metropolitan-Vickers Electrical Co., Ltd.	1,346

SHOREDITCH.—Lighting Committee.

One mile 1 sq. in. single l.p. cable (£1,160); 1 mile 640 yd. 1.5 sq. in single l.p. cable (£1,700 per mile).—Union Cable Co., Ltd.

ST. MARYLEBONE.—Electric Supply Committee. High-pressure steam exhaust and feed-water mains, &c.

Babcock & Wilcox, Ltd. (recommended)	£1,911
Stewart & Lloyds, Ltd.	1,914
Aston & Co., Ltd.	2,244

Leigh (Lancs.).—Electricity Committee.

Supply of slack for six months, ending December 31st next, at 14s. per ton, at Committee's wharf.—John Speakman & Sons, Ltd.

Supply of 1,950 yd. of cable (£516).—Callender's Cable & Construction Co., Ltd.

Supply, &c., of coal elevator and bunkers (£893).—E. Bennis & Co., Ltd.

NOTES.

The Proposed Visit to Gennevilliers Power Station.—At a meeting held last week, the Executive Council of the I.M.E.A. considered the proposal that was put forward at the annual general meeting of the association that a visit to Gennevilliers should be organised, and we were gratified to learn that the Council decided not to embark upon a separate scheme, but to recommend the members of the Association to avail themselves of the excursion which is being arranged by the ELECTRICAL REVIEW. Without doubt, this decision will materially increase the number of our party, and will enable us to proceed at once to draw up a definite programme and complete the arrangements.

The outlines of the provisional scheme are as follows:—To leave London for Paris on September 22nd, visit the 200,000-kW power station at Gennevilliers and other notable engineering works, and return to London on September 25th. An extended tour will be organised for the benefit of those who can spare the time to visit other districts. The excursion is open to all engineers, and others interested in the industry, and readers who contemplate taking part in it are invited to send in their names as early as possible.

The Jubilee of the Eastern Telegraph Companies.—On Monday last, a banquet and fête were held in the gardens of the Royal Botanic Society, to celebrate the fiftieth anniversary of the incorporation of the Eastern Associated Companies. The Duke of York was the principal guest at the banquet, which was presided over by Sir John Denison-Pender, G.B.E., K.C.M.G., chairman of the principal companies forming the Associated group, and there was a large gathering of distinguished guests. The staffs of the companies had already presented to the chairman, in recognition of his life-long services to submarine telegraphy and those associated therewith, a volume containing the signatures of nearly 8,000 subscribers, and they have permanently endowed a bed in St. Bartholomew's Hospital in memory of the chairman's late wife, which was dedicated on July 20th. At the banquet a further presentation was made, consisting of the reproduction in platinum, set with brilliants, of the stars of the distinguished orders to which Sir John belongs.

The gardens were exquisitely illuminated by many thousands of fairy lamps, and marquees provided shelter in case of rain, but fortunately the weather, after a rainy morning, became fair and warm, and the guests were able to roam at will from one attraction to another. The programme included music by the band of the Coldstream Guards and by the Margaret Holloway Ladies' Orchestra, dancing by Mlle. Karsavina (and by the guests), an excellent variety entertainment in an *al fresco* theatre, an open-air kinema, the Margaret Morris dancers, exhibition lawn tennis by artificial light, and performances by a thought-reader, a cartoonist and palmists, as well as clock golf and a magnificent firework display. Refreshments were provided at numerous buffets, and every care was taken to minister to the comfort of the guests. One of the most interesting items, even to the non-technical, was an admirable exhibition of sections of cables, cable-handling apparatus, cable-jointing and repairs, historic documents, and both ancient and modern sending and receiving apparatus, the modern types being in operation. Altogether the function was most enjoyable and successful, nearly 5,000 people being present.

Appointments Vacant.—City electrical engineer and manager for Dundee Corporation (£800—£50—£1,000); shift engineer (£262), for Eccles Corporation; line foreman (£300), for the Government of British Guiana; four switchboard attendants (75s. per week) for Edinburgh Electricity Department; foreman platelayer for Yarmouth Corporation Tramways; and sub-station attendant for Whitechapel. (See our advertisement pages to-day.)

Wireless on Aircraft.—A half-yearly report on the progress of civil aviation—the sixth of the series—covering the winter period from October 1st, 1921, to March 31st, 1922, has been issued by the Air Ministry as a White Paper.

At the suggestion of the Handley Page Co. a system has been introduced at Croydon Aerodrome for locating aircraft by sound and informing pilots of their position in relation to the aerodrome when arriving in bad weather. This system is effective within a radius of about 10 miles from the aerodrome. The officer in charge of the control tower at Croydon determines the direction of the aircraft by means of a sound locator, and informs the pilot by wireless telephony in which sector of a circle surrounding the aerodrome he is flying.

Regulations are to be introduced for the compulsory carriage of wireless apparatus by British passenger and goods aircraft. Meanwhile all British aircraft (with the exception of two small machines) operating on the air routes between England and the Continent under the subsidy scheme, are already equipped with wireless telephone apparatus. The French air transport companies have agreed that all their larger passenger-carrying aircraft on the London-Paris service shall be so equipped by the middle of August this year, and the Dutch authorities are making similar arrangements.

Further experience has been gained in the combination of line and wireless telephony, and experiments have been carried out to ascertain how far telephone calls by passengers *en route* between London and Paris would be utilised. Two private calls were allowed during each flight, but the demand for their use was not sufficient to justify, at present, the permanent adoption of this scheme.

The arrangements mentioned in the last report for opening the English section of the London-Paris route for night flying consist of aerial route lights at Tatsfield Hill and Cranbrook and an automatic illuminated ground sign, which will be situated at Penshurst emergency landing ground. These various lights will operate for a year without attention. In addition, an automatic wind indicator for night flying has been completed at Croydon, while the progress made with searchlights and other apparatus designed to simplify night landing has placed the Croydon and Lympne aerodromes in a position to cope with night services at short notice.

An aerial route light, similar to those used in England, is to be erected in Egypt, and this will make possible the collection of data regarding atmospheric absorption, ranges of lights, and climatic effects necessary for the provision of night flying facilities over desert areas.

The daily Press announces that to facilitate the use of wireless telephony on aircraft, according to a report issued on July 19th by the Directorate of British Civil Aviation, Great Britain, France, and Belgium have prepared a vocabulary of standard phrases in English, French, and Dutch. Each phrase and word is numbered for the benefit of operators unacquainted with languages other than their own. With this code the only parts of a foreign language a pilot or ground wireless operator need know to carry on a conversation are the numerals, the code consisting simply of the figures 1 to 85, each figure representing a phrase dealing with such matters as weather, illness, time, and position. For example, the operator at an air station who hears "70" knows to "Arrange for a doctor." The code number "44" is a request for weather conditions, and "48" conveys the news "The sun is shining."

Industrial Research.—The July report of the British Electrical and Allied Industries Research Association covers the activities of the Association over the last quarter. It has been found advisable to set up two new Committees whose work will co-ordinate that of some of the existing Committees. The first will consider the classification of the heat-resisting properties of electrical materials, and a system of nomenclature and test methods for them; the second will deal with the testing of the electric strength of insulating materials. The programme of the latter Committee also includes research on the testing of sheet materials with disk electrodes, with a view to ascertaining the limitations, best test conditions, and probable errors of the method.

Samples of varnished fabrics are being prepared by co-operating manufacturers under controlled working conditions, with a view to the investigation of the technical problems involved in their improvement. Co-operating paper manufacturers are also devoting special attention to their product for electrical purposes, made to the specifications of properties and test methods set out in the report already published. The working temperature of papers is also receiving attention from the Association. A report on the completed research upon hard composite insulating materials is now available.

Much new work is being done by the Association upon oils for insulating purposes. A report has been prepared giving reasons for the Association's preference for sphere gaps for oil tests. Further research, however, is in hand to determine the relative merits of the horizontal and vertical arrangements of sphere gaps. The experiments upon the improvement and maintenance of electric strength by centrifugal separation of the oils, whilst still incomplete, show the method to hold much promise. Advantage has been taken of the presence in this country of Mr. Evert Norlin, of the Government Testing Institute of Sweden, to ascertain the Continental and American opinion of sludge and tar-value determinations.

Tables and an accompanying report are now in preparation showing the experimental conclusions arrived at concerning the safe loading of British standard cables up to 11,000 volts. A satisfactory method has been found of applying results obtained on single-core cables to three-core cables. Other reports on cables are due shortly. The researches for determining under working conditions the elastic modulus and other physical properties of wires and cables of a variety of metals in ordinary use have been completed. Work on improvements in the construction of wood poles for overhead lines is now in hand.

It is unfortunate that the preparation of experimental apparatus designed for the investigation of switching and arcing phenomena has been delayed by industrial troubles, but pressure-recording apparatus and a continuously operating high-speed camera with an aperture of F 2.6 have been devised. The work on the relief of gaseous explosion pressures (in mining apparatus) through flanged joints has yielded some unexpected results, and the investigations are to be extended to cover other methods of pressure relief.

The National Physical Laboratory has developed apparatus for measuring small losses by current leakage, and by its aid new results for mica have been obtained; certain preliminary work at low voltages has also been done on varnished cloths. Research on this subject has necessitated the development of a wattmeter for use at high voltages, and the Laboratory has obtained satisfactory results with this up to 10,000 volts. For the measurement of dielectric losses at high frequency, the Braun tube is being developed by Prof. MacGregor-Morris with some success.

A Large Motor.—A new reversible electric motor developing 18,000 h.p., built by the Société des Ateliers de Constructions Electriques de Charleroi, and intended for the operation of a large blooming mill, has lately been put in operation at the works of the Société des Forges de la Providence, at Charleroi.

The Use of Small Water Powers.—Numerous widely-scattered small water powers exist in the United States which have remained unutilised up to the present time because of the expense of developing the power, operating the plant and transmitting the energy to a market. These economic obstacles can be removed to a great extent by installing automatic induction-generator stations and tying them in with a larger station or system. Recently a practical application of this suggestion was made by the Tayford Co., Inc., near Lee, Mass., where two induction generator stations are interconnected with the Lee and Pittsfield electric service systems.

A watershed with a total area of about 15 sq. miles is utilised, the two generating plants operating under gross heads of 437 ft. and 68 ft. The high-head station contains three 350-h.p. Pelton waterwheels, coupled to General Electric induction generators, each rated at 300 h.p., 600 r.p.m. (synchronous speed), three-phase, 2,300 volts, 60 cycles. The rotors are of the squirrel-cage type. To guard against a runaway speed in case of lost excitation a governor acts on the deflector of the water jets, limiting the speed to a few per cent. above the synchronous value when the line is de-energised. As a result no severe jolts are caused when the line is re-energised. The necessary exciting current is furnished by synchronous steam-turbine units in the Pittsfield Electric Co.'s Silver Lake plant, which is tied to the Lee asynchronous stations by a trunk line.

The low-head station contains two 200-h.p. turbines directly connected to induction generators.

In normal operation the load on the induction-generator is the only governor desired, and at any time the load being carried determines its speed, so long as the circuit on which it floats is closed. It has been found that with a synchronous speed of 600 r.p.m. and a full-load speed of 585 r.p.m. the motor will generate its full rating at a little below 615 r.p.m.

At synchronous speed and with theoretically no power produced or consumed, about 17.5 amp. excitation current was required. This current increased at a decreasing rate as the machine output grew larger. The power factor therefore increased with the load.

Although provision is made to control and read the load conditions of the low-head station at the high-head plant, there is no co-ordination of operation between these induction-generator stations and the steam station with which they are connected electrically. The steam-station operator can always ascertain if the induction-generator stations are on the line by the exciting current which they draw.

The two induction-generator plants are being successfully operated with two mechanics and a general supervisor, who is called upon when necessary. The total labour cost is $2,500 per year.—*Electrical World.*

Legal.—Electrical Repairing Co. *v.* Clark.—The plaintiffs, of Lydney, Forest of Dean, brought an action in the Newnham County Court, on July 19th, against F. Clark, of Woolaston, people's warden of the local parish church, to recover £140 18s., being the cost of installing electric light in the church. After the case had been commenced the vicar and the other churchwardens were joined with Mr. Clark as defendants to the action, and eventually the judge referred the claim to an expert to determine what amount he should give judgment for.

Wireless Broadcasting.—The Electrical Contractors' Association (Inc.) is taking a keen interest in wireless broadcasting on behalf of its members. The Association thinks that the business of selling and equipping receiving stations should remain in technical hands if complaints and disappointments are to be avoided. There is at present a strong committee of the Council investigating the whole subject from the electrical contractors' point of view.

The British Association.—The Leeds University Court has decided to confer the honorary degree of Doctor of Science upon a number of eminent foreign scientists who are attending the B.A. meeting at Hull in September next.

British Engineering Standards Association.—The Association held its fourth annual general meeting on July 13th at the Institution of Civil Engineers, when the chairman, Sir Archibald Denny, Bart., presented his annual report and reviewed the position. The meeting was well attended, and the chairman's report again showed great expansion in the work. There are now nearly 2,000 engineers who give their time and experience to this national institution. Last year just under £17,000 was expended, towards which industry in spite of the depression in trade contributed £9,300, the remainder coming from the Government, the India Office, and the Governments of the Dominions overseas. The chairman felt that the Association should not have to live quite so much from hand to mouth, and should be able to build up a small reserve. The Association has issued 72 new and revised specifications during the year, and the sales of the publications have reached 39,000, in addition to a very large number of aircraft specifications distributed on behalf of the Air Ministry. It cannot be too emphatically urged that contributions to this organisation should be considered as a sound business investment, from which an adequate return is expected and indeed obtained.

Electricity on the Farm.—A good deal of interest is being taken just now in the use of electricity on farms and for agricultural purposes generally, and in this connection it is encouraging to note from information supplied by the British Electrical Development Association that the Fife Electric Power Co., Ltd., Dunfermline, of which Mr. J. S. Thompson is the manager, has on its books at the present time the names of some 34 farms, all of which use electricity for lighting; 23 of them also use electricity for power purposes, and 17 use it for domestic uses other than lighting. The company has so far not been able to do anything in the way of electric ploughing and such like operations, but the following list of farms supplied by the company show their average annual consumption of electricity in kWh :—

	Power.	Lighting.	Other Domestic Uses.	Totals.
1	651	322	58	1,031
2	680	519	3,211	4,410
3	83	583	184	850
4	935	658	1,020	2,613
5	249	276	—	525
6	—	367	1,020	1,387
7	1,073	146	216	1,435
8	248	433	—	681
9	673	425	492	1,590
10	—	455	—	455
11	—	72	—	72
12	—	414	—	414
13	2,014	630	3,824	6,468
14	650	294	—	944
15	—	323	—	323
16	—	160	—	160
17	662	368	715	1,745
18	3,256	85	—	3,341
19	—	125	—	125
20	655	622	2,276	3,553
21	425	1,263	865	2,553
22	700	378	—	1,078
23	—	252	—	252
24	723	293	1,124	2,140
25	—	127	135	262
26	56	303	—	359
27	1,405	1,310	—	2,715
28	31	509	555	1,095
29	490	456	190	1,136
30	—	153	117	270
31	407	527	—	934
32	225	231	—	456
33	—	476	—	476
34	675	323	1,394	2,392

Fatality.—An inquest was held at Hartlepool on July 14th on Robert Summers, aged 19, an apprentice fitter, of Francis Street, who was fatally injured at the brass foundry of Messrs. Richardsons, Westgarth & Co. Jonathan Emerson, an apprentice millwright, stated that he and deceased were working on the girders supporting an electric travelling crane. Witness accidentally dropped his hammer and descended to recover it. While he was down Summers walked from the crane platform to the driver's carriage, and shouted to witness to put the switch in. Witness did so, and Summers drove the crane to the stops and back again for a couple of yards. Summers then told him to pull the switch out. Witness did so and shut the doors. He returned to the girder, and had been working about 15 minutes when Summers asked if the switch was off. Witness replied in the affirmative, and deceased thereupon got on top of the cage and seized one of the control wires. A flash ran along the wires towards witness, and there was a crackling noise. Summers slipped off the top of the cage and remained hanging with one hand for a second or so. The wire broke and he fell on to his head.

In reply to questions, Emerson said he was quite confident he pulled out the proper switch, but he could not offer any explanation as to how the switch came to be in afterwards. He said he did not notice anyone about at the time. Andrew McDonald, foreman brass moulder, said that immediately after the accident he noticed that the switch was in. He then pulled it out. The jury returned a verdict of "Accidental death," and suggested stricter supervision over the switches, adding: "We are not sure whether this boy (Emerson) pulled out the wrong switch or someone else interfered with it."

Electric Railway Signal Lamps.—An interesting article in the July issue of the *General Electric Review* describes the development and application of miniature Mazda lamps for railway signal lighting to replace the oil burner in existing signal lanterns. These incandescent lamps will be operated in most cases from battery circuits; and in order to conserve batteries the lamps will be automatically lighted only on the approach of trains and extinguished when the trains have passed. Results obtained from actual installations over several years show that these electric lamps will effect material economy in maintenance and cost of inspection and replacement; and with the development of new designs of lanterns to replace existing oil signal lanterns as they wear out, the useful illumination will be increased from 15 to 60 or 70 per cent. of the total light flux.

A Directional Hot-wire Anemometer.—Mr. A. Bailey describes, in report No. 777, January, 1922, of the Aeronautical Research Committee (C.1 Accessories—Instruments. 78—T. 1,679), a novel form of hot-wire anemometer, which has been devised to assist in an investigation on ventilation problems, and has been found very useful in determining both the speed and direction of movement of streams of air. The instrument will measure air speeds between about 6 in./sec. and 15 to 20 ft./sec., but this range may be altered to include higher speeds. The principle of the instrument, so far as the measurement of air speed is concerned, is the usual one, *i.e.*, a piece of platinum wire is heated by passing an electric current through it, and the resistance of the wire is measured by means of a Wheatstone bridge. In order to obtain direction, advantage was taken of the shielding effect of a circular rod placed in an air stream parallel to the hot platinum wire, and in the same plane, and mounted in such a manner that it could be moved across the field in front of the hot wire. The result proved very satisfactory. Of the two principal methods used in hot-wire anemometry, that in which a constant current is passed through the wire and the resistance of the wire determined by the out-of-balance deflection of the galvanometer is the one which has been used for the present experiments. The instrument was calibrated for both speed and direction in the 3-ft. wind channel at the National Physical Laboratory. There is a very sharp rise in the temperature of the hot wire when the manganin wire passes in front of it and the direction of the moving stream of air can be determined to one or two degrees. In a steady wind, such as is found in the wind channels, it would not be necessary to take a large number of readings, as the reading of the galvanometer is very steady and the point of maximum temperature can easily be determined, but in general use the wind would not be so steady, and the best method of using the instrument is to obtain curves, taking the mean reading of the moving galvanometer needle at each position; the horizontal portion of the curve then gives the speed of the wind and the position of the peak gives the direction. The instrument as described is suitable for speeds up to about 15 or 20 ft./sec., but it is possible that it can be easily adapted for higher speeds by covering the anemometer head with a perforated tube. Further experiments have been made in this direction, but owing to the pressure of other work, there has not been time to carry the investigation far. The tube does not interfere with the sense of direction of the instrument.

Electric Vehicle Committee of Great Britain.—At the meeting of the Electric Vehicle Committee of Great Britain, held at the Institution of Electrical Engineers on July 13th, Mr. J. A. Priestley, cleansing superintendent of the Sheffield Corporation, was elected chairman of the Committee, and Mr. W. H. L. Watson, of Electricars, Ltd., and Mr. W. Worby Beaumont were elected vice-chairmen. Mr. E. E. Hoadley was re-elected hon. secretary, and Mr. J. Christie hon. treasurer. A cordial vote of thanks was passed to Mr. F. Ayton, the retiring chairman, for his long services on behalf of the Committee.

Result of Engineers' Ballot.—The pooled vote of the engineering trade unions upon the question of a wage reduction of 16s. 6d. per week in three instalments showed a majority of 26,963 against acceptance, the actual figures being 43,937 for and 70,900 against the proposal. The position was to be discussed yesterday (Thursday) afternoon by representatives of the unions and the employers. (As stated in our last issue, the membership of the A.E.U. alone is 394,000, and five other unions participated in the ballot.)

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Herts. County Council has appointed Mr. JAMES DOBBIN, of Hertford, as temporary electrical engineer at the Ware Park Sanatorium, to superintend the installation of the electric lighting, steam-heating plant, &c.

Mr. ALBERT TAYLOR, for 18 years on the Mansfield Corporation electricity staff, who is leaving to take up a position in Australia, has been presented by his colleagues with a silver cigarette case.

Mr. W. J. LLEWELLYN, who is retiring on pension from the position of engineering inspector for the Newport area of the Post Office, after being 46 years in the service, was presented by his colleagues with a timepiece equipped with Westminster chimes. Mr. Llewellyn has been closely identified with the development of the telephone service in South Wales, and was also associated with early experiments in wireless.

Dr. F. G. COTTRELL has been appointed director of the U.S.A. Fixed Nitrogen Research Laboratory in succession to Dr. R. C. Tolman.

Under the arrangement now existing between the Falkirk Iron Co., Ltd., and the Hotpoint Electric Appliance Co., Ltd., Mr. F. H. HOWELL, who has been the electrical representative for the Falkirk Iron Co., Ltd., has been appointed London sales manager for the Hotpoint Co. His address is 21, Berners Street, W., from whence he will control the sales of both companies' electric cooking and heating appliances.

The St. Marylebone Electricity Supply Committee recommends that the salaries of the principal officers of the department be increased as follows:—Mr. C. H. Smyth, chief engineer, to £1,500; Mr. F. B. Leonard, chief assistant engineer, to £900; Mr. F. Selley, mains and sales engineer, to £750; and Mr. W. Harper, chief clerk and accountant, to £700. These increases will put the officials on a level with those of similar undertakings.

NEW COMPANIES REGISTERED.

Electrical Instruments (Leeds), Ltd. (183,192).—Private company. Registered July 18th. Capital, £1,500 in £1 shares. To acquire the business of electrical instrument makers carried on by A. L. Hill, C. F. Randles and G. E. T. Randles at Cross Fountain Street, Guildford Street, Leeds, as the "Electrical Instrument and Magneto Co." The permanent directors are: A. L. Hill, Sheepfield Cottage, Stockeld, Wetherby; C. F. Randles, Pool Bank, near Leeds (manager, Crossley Gas Engines, Leeds office); G. E. T. Randles, "The Bungalow," Lyshamn House, Lower Wortley, Leeds. Secretary: G. E. T. Randles. Registered office: 5, Cross Fountain Street, Leeds.

Wireless Telephones, Ltd. (183,182).—Private company. Registered July 17th. Capital, £1,000 in £1 shares. To carry on the business of advisers, experts, consultants, contractors and the like in connection with wireless telephony and telegraphy, and to undertake and carry out partial or entire installations, &c. The permanent directors are: F. Duxbury (chairman), "Whyte Garth," Curzon Avenue, Birstall, Leicester; T. A. Robins, 351, Humberstone Road, Leicester. Qualification: 10 shares. Registered office: 8, King Street, Leicester.

Sound Amplifiers, Ltd. (183,128).—Private company. Registered July 14th. Capital, £2,500 in £1 shares. To take over all the interest of A. Marr in inventions for improvements relating to the concentration and amplification of sound waves and the like, to acquire from him the patent rights of the said inventions for Great Britain and Ireland and any British Colony or Dependency and the Channel Islands and the Isle of Man, and to carry on the business of engineering and electrical specialists, electrical apparatus and appliance manufacturers, &c. The permanent directors are: A. Marr, 23, Reynold Road, Longsight, Manchester; J. C. Crofts, Willowcroft, Trafford Road, Alderley Edge; E. B. Rowley, 7, Manley Road, Whalley Range, Manchester; R. S. Ashworth, Bank House, Bury. Qualification: £250. Acting secretary: H. Ison. Registered office: 37, Cross Street, Manchester.

Claremont Johnson & Co., Ltd. (183,228).—Private company. Registered July 19th. Capital, £4,000 in £1 shares. Importers and manufacturers of electrical appliances, &c., and to adopt an agreement with G. W. Johnson and L. Cohen. The first directors are: D. Cohen (permanent chairman), 67, High Street, Stoke Newington, N.16; G. W. Johnson, 99, Maidstone Road, New Southgate, N.11; L. Cohen, 19, Brooke Road, Stoke Newington, N.; W. J. Hodge, 72, Sandford Road, Bromley, Kent. Qualification: £200. Remuneration: £30 each per annum (chairman, £60). Registered by G. Fletcher Jones, 13, Old Jewry Chambers, E.C.

Ashley Wireless Telephone Co., Ltd. (183,106)—Registered July 14th. Capital, £50,000 in £1 shares. To take over the business of wireless telephone and telegraph engineers and manufacturers of wireless apparatus lately carried on by W. A. Brooke and W. A. McKillop at 69, Renshaw Street, Liverpool, and at Cable Street Works, Liverpool, as "Ashley Radio." The minimum cash subscription is seven shares. The first directors are: E. C. Marston, 42, Kennedy Street, Manchester (shipping agent and director E. C. Marston & Co., Ltd.); W. A. McKillop, 14, Asser Road, Clubmoor, Liverpool, electrical engineer; W. A. Brooke, 14, Asser Road, Clubmoor, Liverpool, wireless engineer; D. Walker, Doroote, Cressington, near Liverpool, manufacturer's agent. Secretary: F. E. Thornley. Registered office: 69, Renshaw Street, Liverpool.

Midland Motor Factors, Ltd. (183,151).—Private company. Registered July 15th. Capital, £5,000 in £1 shares. To carry on the business of electricians, mechanical engineers, suppliers of electricity, manufacturers of and dealers in electric, petrol, and steam motor cars, iron and brass founders, &c. The first directors are: T. H. Wathes, The Oaks, West Hill Road, Leicester, electrician; W. C. Turner, 70, Upperton Road, Leicester, electrician (both directors of T. H. Wathes, Ltd.). Qualification: £250. Remuneration as fixed by the company. Registered office: Adjoining Barclay's Bank Buildings, 17, High Cross Street, Leicester.

Broadheath and District Manufacturers' Association, Ltd. (183,226). Registered July 19th as a company limited by guarantee, not having a share capital. To promote, develop and protect the interests of the trades in which the members for the time being are concerned in all their various branches; to assist members with advice and legal assistance when required with regard to assessment of their works for Parliamentary, parochial and other taxation, and to contest principles upon which such taxation is levied or attempted to be levied, &c. The first members are: J. A. Kearns, Orrish Meres, Brooklands (managing director, H. W. Kearns & Co., Ltd.); J. P. Wood, Strathcyre, Manchester Road, West Timperley (director, Castleton Steam Packing Co., Ltd.); K. Ord-Mackenzie, Pitlundie, Albert Square, Bowdon (director, Charles S. Madan & Co., Ltd.); T. E. Leigh, Krahnholm, Hale Road, Hale (director, Cook & Co., Manchester, Ltd.); G. E. Rigby, Arnside, Ansdell, Lytham, St. Annes (director, Ruby Cycle Co., Ltd.); H. Naylor, Carnarine, Heald Road, Bowdon (governing director, Record Electrical Co., Ltd.). Hon. secretary and treasurer: K. Ord-Mackenzie. Registered office: Vorte Works, Broadheath, near Manchester.

General Wireless, Ltd. (183,261).—Private company. Registered July 20th. Capital, £100 in £1 shares. To sell, purchase, let on hire, manufacture, fit, install and maintain wireless telegraphic and telephonic apparatus, &c. The subscribers (each with one share) are: P. J. Ashton, 72, High Street, Bromley, Kent, secretary; R. Sawford, 86, Audley Road, Hendon, N.W.4, motor engineer. The subscribers are to appoint the first directors. Solicitors: Mye, Moreton & Co., 12, Serjeants' Inn, Temple, E.C.4.

R. J. Richardson & Co. (London), Ltd. (183,124).—Private company. Registered July 14th. Capital £3,000 in £1 shares. To accept an agreement with R. J. Richardson and to carry on the business of manufacturers of and dealers in vulcanised fibre, ebonite and insulating materials, mechanical, electrical and general engineers, &c. The first directors are: R. J. Richardson, The Homestead, Heming Road, Edgware; H. Griffiths, 37, Royston Avenue, South Chingford, Essex; J. E. Lines, 62, Chandos Crescent, Edgware. Secretary: W. T. Asher. Registered office: 10, Northampton Square, E.C.1.

Radio Equipment Co., Ltd. (183,242).—Private company. Registered July 19th. Capital, £100 in £1 shares. To carry on the business of manufacturers, importers and exporters of and dealers in all kinds of wireless, radio and electrical appliances, &c. The subscribers (each with one share) are: W. J. Hawkins, 329, High Holborn, W.C.1, merchant; P. J. White, 329, High Holborn, W.C.1, merchant. W. J. Hawkins signs as director and secretary. No qualification necessary. Registered office: 427, Bank Chambers, High Holborn, W.C.

Radiophones, Ltd. (183,125).—Private company. Registered July 14th. Capital, £5,000 in £1 shares. To carry on the business of electricians, manufacturers of generators, accumulators, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, traction, motive power or other purposes, &c. The subscribers (each with one share) are: F. S. Bennett, Granville Chambers, Granville Place, W.1, engineer; A. N. Mobbs, Gorse Hill, Hook Heath, Woking, company director. The subscribers are to appoint the first directors. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.

Stockport Lamp Co., Ltd. (183,305).—Private company. Registered July 21st. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, manufacturers of electrical accessories, &c. The first directors are: J. Higginson, Buckland, Washway Road, Ashton-on-Mersey, Cheshire; J. A. Charlton, Woodlands, Willbraham Road, Alexandra Park, Manchester. Qualification: 10 shares. Registered office: Bank of England Chambers, Tib Lane, Manchester.

Semple, Ltd. (12,301).—Private company. Registered in Edinburgh July 14th. Capital, £700 in 650 ordinary shares of £1 each and 700 deferred of 1s. each. To carry on the business of engineers (consulting, mechanical, electrical, marine, automobile, heating, ventilating and general) ironmongers, &c. The subscribers (each with one share) are: P. Ross, 76, St. Andrew's Drive, Pollockshields, Glasgow, engineer; D. R. MacDonald, Cumbrae View, Millport, engineer. R. Semple is managing director. Qualification: 50 shares. Registered office: 101, St. Vincent Street, Glasgow.

Andrew Hutcheson, Ltd. (12,302).—Private company. Registered in Edinburgh July 14th. Capital, £10,000 in £1 shares. To carry on the business of electrical engineers, contractors, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus and machinery, fittings, &c. The first directors are: A. Hutcheson, 104, West Campbell Street, Glasgow, electrical engineer; J. Hutcheson, 104, West Campbell Street, Glasgow, electrical engineer; J. Grindlay, Glasgow, electrical engineer; J. Y. Hutcheson, Glasgow, electrical engineer; J. Mare, Glasgow, chartered accountant; J. S. Paul, Glasgow, solicitor. Qualification: 100 shares. Registered office: 104, West Campbell Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Calcutta Electric Supply Corporation, Ltd. (50,882).—Return dated May 23rd, 1922. Capital, £4,000,000 in 1,645,000 ordinary and 1,355,000 preference shares of £1 each. £800,000 ordinary and 665,000 preference shares taken up. £1,350,000 paid on 800,000 ordinary and 550,000 preference. £55,000 considered as paid on 55,000 preference. Mortgages and charges at date of return, £559,100; since registered, trust deed to secure £500,000 second debentures, dated June 26th, 1922. A trust deed dated June 26th, 1922, to secure £500,000 second debentures, has been registered. The deed constitutes a specific charge on various properties in India, and a floating charge on the company's general assets, including uncalled capital, subject to a trust deed dated November 17th, 1920. The trustees for the debenture holders are the Metropolitan Trust Co., Ltd., of Gresham House, Old Broad Street, E.C. The debentures are being issued at 96 per cent. No other commission or discount is being paid or given.

Hardy & Nash, Ltd.—Mortgage on land and premises in Cromer dated July 8th, 1922, to secure £1,000. Holder: H. Bullen, Cromer.

Teignmouth Electric Lighting Co., Ltd.—Particulars of £3,500 debentures authorised July 6th, 1922; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

E.S. Co., Ltd.—Particulars of £20,000 debentures authorised July 12th, 1922; whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital subject to first mortgage debentures for £12,000.

Porlock and District Electric Supply Co., Ltd.—Second debenture dated June 30th, 1922, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: O. L. C. Healey, New Place, Porlock, Somerset.

Associated Electric Traders, Ltd.—Particulars of £6,000 debentures authorised May 22nd, 1922; present issue £2,000, charged on the company's undertaking and property, present and future, including uncalled capital.

Accumulators of Woking, Ltd.—Debenture dated July 7th, 1922, to secure £10,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: L. C. Rawlence, 90, Sackville Street, Piccadilly, W.

National Electric Construction Co., Ltd. (53,364).—Capital, £125,000 in £1 shares. Return dated May 11th, 1922. 170,000 shares issued, £75,471 10s. paid, £49,125 10s. per share paid. Mortgages and charges, £75,000.

Jarrow and District Electric Traction Co., Ltd. (78,680). Capital, £40,000 in £1 shares. Return dated May 10th, 1922. 39,934 shares issued, £39,934 paid. Mortgages and charges, £1,700.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—Return dated May 4th, 1922. Capital, £100,000 in £1 shares. 62,800 shares taken up, £62,800 paid. Mortgages and charges, £74,310.

Rhondda Tramways Electric Supply Co., Ltd. (94,470).—Return dated June 1st, 1922. Capital, £100 in £1 shares. Seven shares taken up. £7 paid. Mortgages and charges, £54,000.

Bastian Meter Co., Ltd.—Return dated April 26th, 1922. Capital, £20,235 10s. in 68,942 ordinary shares of 5s. each and 3,000 preference shares of £1 each. 2,011 preference and 39,672 ordinary shares taken up. £3,082 10s. paid (including £3 10s. paid on forfeited shares) on 4,272 ordinary and 2,011 preference. £8,850 considered as paid on the remaining 35,400 ordinary. Mortgages and charges, nil.

Urban Electric Supply Co., Ltd. (57,986).—Capital, £640,000 in 512,000 ordinary shares of £3 each, 50,000 cumulative preference shares of £5 each, and 150,000 preference shares of £1 each. Return dated April 11th, 1922. 80,000 ordinary and 50,000 cumulative preference shares issued. £400,000 paid. Mortgages and charges, £424,947.

Cleveland and Durham Electric Power Co., Ltd. (89,539).—Capital, £700,000 in £1 shares (350,000 preference and 350,000 ordinary). Return dated May 24th, 1922. 333,705 preference and 157,600 ordinary taken up. £411,003 paid on 331,935 preference and 79,068 ordinary. £80,302 considered as paid on 1,770 preference and 78,532 ordinary. Mortgages and charges, £384,900.

R. J. Rodd, Ltd.—Deposit on July 11th, 1922, of deeds of freehold land and premises at Walton-on-Thames, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Allies Electric Lamp Repairing Co., Ltd. (138,125).—Return dated January 13th, 1922. Capital, £55,000 in £1 shares. 32,425 shares taken up and paid for in full. Mortgages and charges, £6,000.

Farad Electrical Co., Ltd.—W. C. Whitehead, of 27, Oberstein Road, Clapham Junction, S.W., ceased to act as receiver or manager on June 24th, 1922.

CITY NOTES.

Anglo-Portuguese Telephone Co., Ltd.

The report for the year ended December 31st, 1921, states that the average rate of exchange for the year (taken on the last day of each month)) was 6¼d. per escudo, in comparison with 12⅝d. for 1920. The rate prevailing at the close of the year was 5 7/32d., as against 6¼d. at the end of 1920. The floating assets and liabilities in Portugal at the close of the year have been converted into sterling at the rate of 5 7/32d. per escudo. The capital expenditure for the year amounted to £81,534, in comparison with £121,367 for 1920. The item of "New capital issues expenses £19,930," appearing in the last balance sheet, has been written off against the reserve fund of £25,000. To the balance of this fund there has been added the exchange fluctuation fund of £10,000, and the general reserve now stands at £15,070. The profit and loss account shows a gross income of £70,695, and an expenditure of £50,410, leaving a gross profit of £20,285, as against £6,024 for 1920. In neither case has any provision been made for depreciation. After payment of income tax, £3,282, and providing for debenture interest and sinking fund, £6,850, the amount for disposal (less £213 debit balance brought forward) is £9,940, which it is proposed to carry forward. The year's revenue receipts and expenses have been converted into sterling at the monthly average of 6¼d. per escudo. Expressed in currency—the true measure of comparison—the gross income from subscriptions, sales, &c., was Es. 2,757,466 (against Es. 797,832 in 1920), the expenses in Portugal were Es. 1,583,771 (against Es. 737,074), and the trading profits Es. 1,173,695 (against Es. 60,758). The following table shows the extreme fluctuations in the sterling value of the escudo (nominally 53¼d.) in each of the last eight years; also the yearly average (taking the price on the last day of each month) and the rate prevailing on the last day of the year:—

	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.
Highest	47⅛	38	36	32⅝	34⅛	35⅝	19⅛	8⅜
Lowest	33	33⅜	30⅛	29[11]	28	19	5⅝	4⅜
Average	42.6	35⅝	31[1]	31.1	30⅜	28[1].6	12⅝	6⅛
At December 31st	36⅝	34[1]	31.5	30⅝	34⅛	20[1].	6⅝	5[3]/[2]

In addition to the increase in the company's rates authorised by the Portuguese Government on February 21st, 1921, and reported to the shareholders at the last general meeting, a further substantial increase was authorised by Decree dated June 29th, 1922. Unfortunately the advantages of the increased subscription rates are largely offset by further increases in wages. The company's relations with the Government and the public have been maintained on a friendly footing. Unfortunately, however, the political and industrial conditions in Portugal do not show any improvement. Captain Hubert Holden Jackson, who had been a director since 1899 has, for personal reasons, been obliged to resign his seat on the board. To fill the vacancy thus created Mr. P. B. Lawson has been appointed a director.

English Electric Co., of Australia, Ltd.

The report submitted at the annual meeting held at Sydney on June 15th showed that expenditure on the new workshops at Clyde was almost completed. "Unfortunately these new workshops have been built and equipped at the top of a boom in prices, but this will not affect the earning capacity of a plant which is superior to anything in the Southern Hemisphere." The company has a considerable amount of work in hand. Some large contracts, carrying profits, should be completed during the current year. The investments, with the exception of a small holding in Automatic Telephones (Australasia), Ltd., represent the company's shareholdings in Standard-Waygood, Ltd., Weymouth's, Ltd., and Lift Inspection & Insurance, Ltd., all affiliated concerns, yielding good returns. A bonus has been paid, amounting to 10 per cent. on the company's issued capital, in the shape of shares in Weymouth's, Ltd., to shareholders subscribing their quota of the new issue of 47,520 shares. This issue brought the capital of the company up to £285,120, and provision has been made for a dividend on 118,100 shares which debenture holders may elect to subscribe in exchange for their debentures.

The profit earned by Standard-Waygood, Ltd., has not been brought into the year's figures, but is carried forward. This company (Standard-Waygood, Ltd.), the shares in which are practically all held by the English Electric Co. of Australia, Ltd., has been used to purchase the 100,000 "A" ordinary shares which have been surrendered and will be cancelled. The cost, £10,000, forms a goodwill item in the books of Standard-Waygood, Ltd., and, at this figure, the goodwill is not over-valued. It is the only item of that description among this company's assets. The amount brought forward from last year was £30,310, less bonus distributed to subscribers of new issue £23,760, leaving £6,550. The profit for 1921-22 was £46,543, making £53,093, out of which a dividend at the rate of 10 per cent. per annum was recommended, payable 1s. per share after the meeting, and 1s. per share on December 15th, 1922.

[Accompanying our copy of the directors' report is a pamphlet giving a number of photographic reproductions of the various departments of the new works, also of the stator of the first turbo-alternator constructed in Australia (3,500 h.p.), transformers, switchboards, &c.]

Cordoba Light, Power and Traction Co.

The report for the year to March 31st, 1922, states that the accounts have been drawn in accordance with the scheme of arrangement sanctioned by the the Court last February. The balance brought forward was £106,208. Against this, in accordance with the scheme, there has been debited £69,300, being 5½ years' arrears of dividend to March 31st, 1921, less tax, on the preference shares. These arrears have been satisfied by the issue of ordinary shares of the company. £5,000 has been transferred to share capital redemption fund, leaving £31,908, which has been applied towards reduction of discounts on renewal on December 1st, 1920, and recent conversion of promissory notes, and meeting other expenses of capital reorganisation. The accounts for the year, after providing for administration expenses and charging £56,750 for interest on debenture stock and promissory notes, £9,126 for loss on exchange, and £8,000 for taxes, show a credit balance of £54,669, less £9,038 set aside for debenture stock redemption, leaving £45,630. Dividend on cumulative preference shares in respect of half-year to September 30th, 1921 (after deduction of tax), satisfied by issue of ordinary shares, absorbed £6,300; dividend on cumulative preference shares in respect of half-year to March 31st, 1922 (after deduction of tax), paid in cash, £13,324; set aside for redemption of preference and ordinary share capital, £5,000; applied in writing off balance at March 31st, 1922, of discounts arising from conversion of promissory notes and other expenses of scheme of reorganisation, £15,304, leaving to be carried forward £5,701. Since the date of the accounts there has been issued further £150,000 six per cent. debenture stock, carrying interest from April 1st, 1922.—*Financial Times.*

Spanish Companies.

The payment of the following dividends is announced:—Sociedad Electrica de los Almadenes (Alicante), 25 per cent. to the shares numbered 4,001 to 6,000. Electricas Reunidas de Zaragoza, 15 per cent. (75 pesetas per share). Compañia Hispano-Americana de Electricidad, 9 per cent., or 45 pesetas per share. Siemens-Schuckert Industria Electrica, S.A., 36 pesetas per share. Electrica de Guadalajara, S.A., 6 per cent.

Tranvia Electrico de Aviles.—An issue of 3,000 bonds bearing 7 per cent. interest and repayable in 10 years has been made by this company, a preference being reserved to the existing shareholders *pro rata* with the shares held.

Tranvias de Zaragoza.—The liquidators have decided to proceed to a distribution of a first dividend of 10 per cent. without waiting for the result of the negotiations for the realisation of the residue of the assets, as the present circumstances, and especially the failure of an Italian bank, counsel the provisional suspension of the realisation.

Tranvias Electricos de Tenerife.—An extraordinary meeting of this company was held to sanction the payment of the arrear interest on its bonds, coupons 26 to 37, or those from

January 1st, 1917, to July 1st, 1922, being authorised to be liquidated.

Tranvias de Gijon.—This company has issued 1,100 6 per cent. bonds, redeemable in 25½ years, the issue price being 475 pesetas per 500-peseta bond.

Sociedad Española del Acumulador Tudor. An extraordinary meeting on May 31st sanctioned the distribution of a dividend of 10 per cent., or 50 pesetas per share, or, less tax, 46.15 pesetas.

An Italian Company.

Società Generale Italiana Edison di Elettricità.—The report of this company for the year 1921 shows that the company has keenly felt the effects of the drought. To supplement the serious lack of power unexampled since the starting of the company, resort had to be had to steam-generated current to the extent of 32,000,000 kWh, with the natural serious effect on the balance on the working. To guard against the possible recurrence of similar happenings, it had been decided to install a new reserve steam plant of 10,000 kW capacity. The accounts show an active balance of 12,810,700 lire, allowing of the distribution of a dividend of 32 lire per share. The capital of the company is 180,000,000 lire.

Prospectuses.—*Auckland Electric Power Board* (5½ per cent. Loan).—The list was opened on Monday in an issue of £350,000 in debentures to bearer of £100 each, the price being £100 per debenture. This loan, which is the first portion of the board's first debenture issue of £600,000, is issued to provide funds in connection with the purchase from the Auckland City Council of the lands, buildings, plant, machinery, transmission lines, stores and other material owned and utilised by the Council for the purposes of its Electricity Department, as specified in the sale agreement set out in the Schedule to the Auckland Electric Power Board Act, 1921, and to continue the undertaking as a going concern.

County of London Electric Supply Co., Ltd.—The subscription list was opened on Monday in this company's issue of 500,000 six per cent. cumulative preference shares of £1 each at par and 500,000 ordinary shares of £1 each at 22s. 6d. per share. The purpose of the issue, as our readers are aware is the erection of the Barking generating station (capacity 100,000 kW in the first instance).

Launceston and District Electric Supply Co., Ltd.—The revenue during 1921 was £3,045, as against £2,347 for 1920; the working expenses were £1,497, against £1,512, leaving a gross profit of £1,547. After paying debenture and preference interest, the net profit was £1,131, plus £110 brought forward, making £1,241. As the amount of dividend permissible under clause B of the Launceston Electricity (Temporary Increase of Charges) Order would be only fifteen-sixteenths per cent., it would be so small (£60) that it is proposed that the sum be reserved to add to future dividends. £350 is to be put to depreciation, £150 to reserve, £214 is to be written off the cost of the Provisional Order, and £467 is to be carried forward. The new sawdust plant is giving entire satisfaction. The number of consumers has increased from 320 to 362, and the lamps connected from 12,506 to 13,774.

City of London Electric Lighting Co., Ltd.—The following dividends are announced for the half-year ended June:—At the rate of 6 per cent. per annum on the first preference shares; at the rate of 8 per cent. per annum on the second preference; and 1s. per share (at the rate of 10 per cent. per annum) on the ordinary shares; all less tax at 5s. 6d. in the £.

Charing Cross, West End & City Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1922, at the rate of 5s. per share.

Rushden and District Electric Supply Co., Ltd.—Interim dividend for the year of 3½ per cent. on the share capital.

Northampton Electric Light and Power Co., Ltd.—Interim dividends for the year of 4 per cent. on the ordinary "B" shares and 2½ per cent. on the 5 per cent. preference "B" shares.

Chatham and District Light Railway Co.—Interim dividend of 5 per cent. per annum, less tax, on the ordinary shares.

Veritys, Ltd.—The financial Press states that no interim dividend is being paid on the preference shares.

County of London Electric Supply Co., Ltd.—Interim dividend on ordinary shares for the half-year ended June 30th, at 6 per cent. per annum, less tax, as compared with 5 per cent. last year.

Hong-Kong Tramways Co.—According to the *Financial Times*, the directors have declared an interim dividend on account of 1922 of 1s. per share.

Liverpool Overhead Railway Co.—The directors announce that they are unable to declare an interim dividend on either the preference or ordinary shares.

National Gas Engine Co., Ltd.—Interim dividend on the ordinary shares at the rate of 7½ per cent., less tax.

Brompton & Kensington Electricity Supply Co., Ltd.—Interim dividend at the rate of 9 per cent. per annum, less tax, on the ordinary shares for the half-year.

Hadfields, Ltd.—Interim dividend of 6d. per share, free of tax, on the ordinary shares.

Chelsea Electricity Supply Co., Ltd.—Interim dividend of 8 per cent. per annum, less tax, on the ordinary shares for the half-year.

Lanarkshire Tramways Co.—Interim dividend of 5 per cent. per annum, less tax, for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

The general trend of markets in the Stock Exchange is distinctly good. In spite of the near approach of the holidays, money is flowing into the investment departments, and although the price of the War Loan remains within close touch of par, the demand for sound stock is sufficiently insistent to make itself felt in other securities of which there is less ample supply.

The County of London Electric Supply Company secured immediate success on Monday morning with its issue of half a million ordinary shares at 22s. 6d., and the same amount of 6 per cent. preference shares offered at a pound. The lists were kept open until Wednesday in this week for applications from the company's shareholders, which seems to be an eminently reasonable and fair proceeding, although from the public no further subscriptions were received after eleven o'clock on Monday morning. Allotment letters are expected to be posted with the promptitude for which the company is well-known, and there can be little doubt that a premium will be established, from the start, upon both classes of shares. As showing the appreciation of the public for good investments, it is interesting to mention that the demand for the company's 6 per cent. preference is said to have been almost as great as that for the ordinary shares.

Bengal Telephone new scrip started off at 3¼ premium on the opening of the market on Tuesday. So great was the rush of stags to sell, that one firm in the Stock Exchange bought £100,000 within a couple of hours. The price consequently gave way to 2 premiums. It is fairly safe to prophesy that this premium will be doubled before long.

The Metropolitan Electric Company's increased dividend was followed by a rise in that of the Chelsea Company, and the difficulty of buying good shares in this section is more than ever pronounced. Chelseas rose 5s. to 6. The County's interim dividend is raised from 5 per cent. to 6 per cent. These results encourage the expectation that for the full twelve months something better may be achieved than the dividends paid for 1921. The County of London ordinary shares at 1¼ are 1/16 down, on selling by those who wish to take up the new shares, but the preference remain at 1.1/16.

Edison Swans have fallen to 3s. 9d., but General Electrics are better at 19s. 6d. on the assumption that the company has seen the worst of its recent troubles, and that the current year is likely to prove a more profitable period than that just ended, for which 5 per cent. dividend was paid. English Electrics hold their rise, and Cromptons remain a good market at 15s. Speaking generally, there is not a great deal doing in the shares of the manufacturing concerns.

The new 4½ per cent. debenture stocks of the City and South London and of the London Electric Railways have both risen to 2 premium over the issue price of 94. This is a rather amusing sequel to the slight indignation expressed at the time that the issues were made, when the price asked was politely derided as being too high. The stock is now firmly in the hands of investors, and, having regard to other stocks of similar nature, it is reasonable to assume that they will go quietly to the neighbourhood of par. The only deterrent is the possibility of new issues, and there are whispers of a substantial amount to be offered in the near future. Underground Electric income bonds have recovered the 2 points shed last week, but the ordinary shares of £10 receded to 45s. There seems to have been a big block of the latter recently for sale; possibly the whole line of shares has not yet got into permanent hands.

This week has seen the official jubilee celebration of the Eastern Telegraph Co. and its associated undertakings. Most of the papers have contained articles in connection with the event, and the directors of the group will feel that they have earned, by their able handling of the interests under their charge, the encomiums laid before the companies and the industry which they have created. From the Stock Exchange point of view, the only price-change is a rise of 5s. in Western Telegraph. Elsewhere in this market, Great Northerns are 10s. up to 29.

The American cable list is steady. This is more than can be said of Marconi shares. The price of the parent Marconis dwindled to 2¼ on renewed uneasiness with regard to the forthcoming dividend announcement. This was expected to be made public at the end of July, but Stock Exchange gossip says that the date is more likely to be somewhere about the middle of August. Doubts are beginning to arise whether the company will pay even 5 per cent. as the final dividend for the year, which would make 10 per cent. altogether. It is impossible, however, to estimate what is likely to be announced, and those who bought the shares for the longer shot are probably content to hold them in the face of whatever the immediate dividend declaration may prove to be. Marconi Marines have given way to 26s., and the rest of the list is heavy.

Brazilian Tractions hardened to 52, and Mexico Tramways 6 per cent. bonds at 45½ are again 3 to the good. There is still no definite news with regard to Mexico, but hopes are beginning to revive on much the same lines as those which, for the last few years, have occasioned spasms of strength in the Utility companies' bonds. British Columbia Railway issues are dull, the preferred stock giving way sharply upon a little offering of stock.

Yorkshire Electric Power 5½ per cent. debenture stock has improved to 102, upon investment inquiry being directed to this issue by reason of the security which backs the stock. Interest is payable on April 1st and October 1st, and the stock is secured as a first charge on the company's property and assets. It is redeemable in 1944 or earlier, upon six months' notice being given, at 100, and the profits for 1921, before payment of interest on mortgages, debenture stock and loans, came to a little over one hundred thousand pounds.

New issues are steady, and it is a matter for some surprise that the recent improvement in India Government stocks has not been followed by sympathetic advances in the prices of Calcutta Electric second debenture, Indian Electric Supply and Madras Electric debenture stocks, a trio which deserves consideration from the investor who is not afraid of Indian securities that offer a good return upon the money.

The iron and engineering sections show no particular change, though news from the North would seem to imply that some of the companies are beginning to turn the corner of adversity. Rubber shares show little alteration. Here, again, the tendency is a shade more hopeful than it has been, timid optimism building upon the hope that the expected legislation on the part of the Dutch Government, for restriction of rubber output in the Netherlands East Indies, may shortly become an accomplished fact.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price July 25, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary...	8	8	7½	—	6 4 2
do. do. do. 4½ Pref. ...	4½	4½	3¾	—	5 16 2
Chelsea	6	6	6	+ ¼	5 0 0
City of London	14	14	2	—	7 0 0
do. do. 6 per cent. Pref....	6	6	22/6	—	5 6 8
County of London	8	8	1½	— 1/16	6 8 0
do. do. 6 per cent. Pref....	6	6	1 1/16	—	5 13 0
Kensington Ordinary	9	10	7⅛	—	7 0 7
London Electric	2½	5	2⅝	—	5 14 0
do. do. 6 per cent. Pref....	6	6	5	—	6 0 0
Metropolitan	7	7	6⅝	—	6 13 4
do. 4½ per cent. Pref....	4½	4½	3¾	—	5 16 2
St. James' and Pall Mall	12	12	8½	—	6 17 2
South London	7	7	3¾	—	8 0 0
South Metropolitan Pref.	7	7	1 3/8	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 18 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104xd	—	5 15 5
do. Def.	1½	34/6	28⅝	—	7 7 6
Chile Telephone	6	6	6 1/16	—	4 17 0
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	186xd	—	5 8 1
Eastern Tel. Ord.	10	10	186¼xd	—	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 4 7
do. do. Pref.	6	6	11¼	—	5 6 8
Great Northern Tel.	24	22	29	+ ½	7 11 8
Indo-European	10	10	86½	—	6 17 0
Marconi	25	15	2⅛	— 1/16	7 1 2
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	7⅛	—	*5 12 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	1⅜	+ ⅛	*5 5 3
Home Rails.					
Central London Ord. Assented ...	4	1	68	—	5 17 8
Metropolitan	1½	2½	48	—	4 13 9
do District	Nil	1	89	—	2 11 8
Underground Electric Ordinary ...	Nil	Nil	2½	— ⅛	Nil
do. do. "A" ...	Nil	Nil	6/6	—	Nil
do. do. Income ...	2	4	81½	+2	*4 18 2
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref. ...	5½	12½	8½	—	7 17 2
do. do. 2nd Pref.... ...	Nil	5½	8⅝	—	7 2 0
do. do. 5 per cent. Deb. ...	5	5	81½	—	6 4 3
Brazil Tractions...	Nil	Nil	52	+1	7 13 10
British Columbia Elec. Rly. Pcs.	5	5	76	—4	6 10 9
do. do. Preferred ...	5	93/-	68½	—1	*6 15 0
do. do. Deferred ...	3	124/-	75⅝	—	*8 4 6
do. do. Deb.... ...	4½	4½	78	—	5 9 0
Mexico Trams. 5 per cent. Bonds ...	Nil	Nil	7 1/16	—	
do. do. 6 per cent. Bonds ...	Nil	Nil	45½	+3	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	62	—	Nil
do. 1st Bonds	Nil	5	68½	—	7 6 0
Manufacturing Companies.					
Babcock & Wilcox	15	16	8	—	5 6 8
British Aluminium Ord.	10	10	18/8	—	—
British Insulated Ord.	15	15	2⅛	—	7 1 2
Callenders	15	15	2 3/16	+ 1/16	6 16 4
do. 6½ Pref.	6½	6½	1 1/16	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/8	— 1/16	Nil
do do. 5 per cent. Deb. ...	5	5	64	—	7 16 4
Electric Construction	10	10	12	—	8 0 0
English Electric	8	8	17/6	—	5 14 8
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	19/9	+1/6	5 1 3
Henley	15	15	2⅜	—	6 13 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1⅛	—	—
Met.-Vickers Pref.	8	8	2⅜	—	6 11 2
Siemens Ord.	10	10	1⅞	—	*7 12 4
Telegraph Con.	20	20	26xd	—	*4 12 2

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 26th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per lb.	8d.	...
a Ammoniac, Sal ... ... per ton	£63	...
a Ammonia, Muriate (large crystal) ,,	£62	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£30	...
a Copper Sulphate ... ... ,,	£27	10s. dec.
a Potash, Chlorate ... ... per lb.	5d. to 5½d.	...
a ,, Perchlorate ... ... ,,	7¾d.	...
a Shellac ... ... per cwt.	£18 5s.	10s. dec.
a Sulphur, Sublimed Flowers ... ,,	£12	...
a ,, Lump ... ... ,,	£11	...
a Soda, Chlorate ... ... per lb.	3½d.	...
a ,, Crystals ... ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5½d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton	£120	...
b ,, Wire ... ... per lb.	1/9 to 2/6	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£150	£3 inc.
Grade II ... ... ,, ,,	£108	£2 inc.
Grade III ... ... ,, ,,	£62	£1 inc.
c Brass (rolled metal 2' to 12' basis) per lb.	9¾d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ... ,,	9¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£94	...
c ,, Sheet ... ... ,,	£94	...
c ,, Rod ... ... ,,	£94	...
d ,, (Electrolytic) Bars ... ... ,,	£71 10s.	5s. dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£81 10s.	5s. dec.
d ,, ,, H.C. Wire per lb.	10½d.	½d. inc.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
n German Silver Wire ... ... ,,	2/6	...
h Gutta-percha, fine ... ... ,,	12/6	...
h India-rubber, Para fine ... ... ,,	9¾d.	½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	90/-	...
i ,, Wire, galv. No. 8, P.O. qual. ... ,,	£25	...
g Lead, English Pig ... ... ,,	£27	£1 5s. inc.
g Mercury ... ... per bot.	£11 5s. to £12 10s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 30/- & up.	...
p Phosphor Bronze, plain castings ... ,,	1/1	...
p ,, drawn bars and rods ... ,,	1/8	...
p ,, rolled strip & sheet ... ,,	1/2½	...
p ,, wire ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£19 10s.	...
d Silicium Bronze Wire ... ... per lb.	1/1	...
r Steel, Magnet, in bars ... ... ,,	1/-	...
n Tin, Block (English) ... ... per ton	£160	£6 15 to £7 10 ... fine
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Telephone "Pages."—In one of the first-class hotels in Boston, Mass., the loud-speaking telephone is being used instead of page boys. The manager of the hotel declares, says the *Evening News*, that the system gives more efficient service. There is no longer a number of noisy boys running through the main dining rooms shouting the names of the guests wanted on the telephone. Instead, the voice of the telephone operator is being sent to various parts of the hotel through devices from the telephone switchboard. The operator calls into the transmitter beside the switchboard that a guest is wanted, and her tones are carried out into the hotel by amplifying apparatus.

Sound Ranging.—Many parts of the American coast are badly charted. Hitherto sounding has been done with the Kelvin machine, in which the pressure of the water compresses the air in a sensitised tube and wets it along a graduated scale. But during the war it was found that with the hydrophones employed to detect submarine activities the depth of water could be judged by the time taken to receive the echo of a sound signal. This discovery has now been developed into a system which enables a depth to be measured within a few feet.

Col. Theodore Roosevelt, the Assistant Secretary of the Navy, announced recently that successful tests had been made during a voyage of the United States destroyer *Stewart* from Newport News, Virginia, to Gibraltar.

The British Admiralty recently announced that a vessel had been equipped to take observations by the same means in this country.

THE NERVES OF THE NATIONS.

The Romance of the Submarine Cable.

By ROLAND BELFORT.

(*Concluded from page 77.*)

"*Girdling the Earth.*"—We of the present generation have no conception of the immense excitement and acrimonious discussions that accompanied the plucky attempt of the pioneers to lay the first Atlantic cable. Inexhaustible their patience in the face of exasperating delays, superb their pluck when confronted by successive disasters that would have unnerved most men. The feasibility of this grandiose scheme was contemptuously denied by many eminent scientists, French and English. Press campaigns raged for and against the project. Prominent financiers pronounced it absolutely impracticable from the financio-commercial standpoint. Numerous romantic and exciting episodes marked each stage of this epochal enterprise. After endless disasters, terrible losses, and crushing disappointments, John Pender and his supporters succeeded in establishing cable communication across the Atlantic on a commercial basis, thereby conferring substantial benefits on all classes of the community on both sides of the Atlantic. Then these hardy pioneers, seeking fresh cable worlds to conquer, secured financial support and turned their attention to other regions—the Mediterranean, the Red Sea, the Indian Ocean, the Far East, our Australian colonies, South America, South Africa, West Africa, and other countries. From their historic headquarters in Old Broad Street—long before their installation at Electra House, Finsbury—the Eastern pioneers literally materialised Shakespeare's dream of "girdling the earth in forty minutes." Incidentally, they made London the centre of the world's nervous system; a vast distributor of telegraphic news from all quarters, thus giving this country a pre-eminence in that department which has yielded inestimable results, moral and material. Happily, the companies have prospered, while organising an enterprise of Imperial importance—an indispensable factor in every manifestation of international activity. Today they are reaping the harvest of the financial, administrative, scientific, and diplomatic ability displayed through fifty years of persistent effort, handicapped by a succession of serious obstacles.

Famous Foreign Cable Pioneers.—Among foreign cable pioneers, besides Cyrus Field, Gisborne, and Morse, we find Julius Reuter and Baron d'Erlanger, who, with other Continental capitalists, founded the first French Atlantic cable company. But, capitulating to what Napoleon called "the cavalry of St. George," they soon sold their enterprise to Sir John Pender's group, whose policy was "beneficent monopoly." This surrender terminated a series of exciting conflicts between the rivals; cables were mysteriously broken; exasperating delays occurred, sensational polemics raged between the Press of Paris and London. Not long did Sir John remain the autocrat of the Atlantic. For the Direct United States Cable Co. was formed by Julius Beer and certain other prominent financiers. This company never developed any conspicuous strength; misfortune overtook it, and it was finally absorbed by the stronger combination controlled by the indefatigable Pender. Again the latter dominated Atlantic cabling.

Romance of the "P. Q."—But this field of action was far too attractive to escape the ambitious attentions of financiers and promoters. About 1878 Count Arthur Dillon, a French cavalry officer of Irish origin, conceived the patriotic idea that France could and should control her own cables. With admirable patience he acquired the necessary scientific, mechanical, and administrative knowledge and got into close touch with manufacturers, managers, and even operators. Soon the cable had no secrets for Dillon. A man of commanding presence and charming manners, endowed with a persuasive tongue and fortified by a splendid college and military training, he achieved a reputation as a promoter destined to succeed. He then turned his attention to the financial aspect of the cable question, and secured the co-operation of Pouyer Quertier, a powerful financier and cotton magnate who had been French Minister of Finance, and was also an influential factor in Paris banking enterprise. Pouyer Quertier, with Dillon, proposed to lay two cables from Brest to New York. When everything was ready to the last detail the human element suddenly appeared and ruined all Dillon's plans. For Pouyer Quertier insisted on having the company floated at an unfavourable moment, from the Bourse standpoint. Having decided to leave Paris to please a charming comedienne in whom he just then took a tender interest, Pouyer Quertier wanted the flotation rushed through in consequence. Dillon was, of course, astonished and disgusted—but powerless. The issue was made and proved a fiasco. But he valiantly kept the threads of the scheme together, and, after two years of anxiety and hard work, had the satisfaction of successfully floating the company with Pouyer Quertier as chairman. One cable was laid and work commenced in 1880 under favourable auspices.

Jay Gould's Ambition.—Then, two years later, the famous American financier, Jay Gould, decided to lay two cables across the Atlantic, and proceeded with characteristic daring. He cabled Messrs. Siemens, London: "Cable estimate for making and laying two Atlantic cables." Promptly that famous firm replied with an estimate of over £1,000,000. With equal celerity Gould cabled: "Make and lay two cables according estimate; £50,000 at your bankers here." These cables were promptly made and laid. For some time it was uncertain whether Jay Gould would join forces with the French company or with the British combination. Finally he elected to work with the latter.

Fatal Human Element.—Here Count Dillon was dogged by bad luck, again due to the introduction of the fatal human element. He sent his traffic manager to New York to treat personally with Jay Gould. The latter had practically accepted a working arrangement with the "P. Q." company, whereby the latter would have secured the use of his Western Union Telegraph Co.'s vast land line system throughout the States, while he himself would dispose of two cables to prolong that system to Europe. But what happened? Dillon's traffic manager, for purely private reasons, did not appear eager to see the negotiations succeed. He may have thought that Dillon's failure would have been his opportunity to succeed him as managing director. Whatever his secret motive, he *mailed* Jay Gould's momentous decision instead of *cabling* it. Naturally, the puissant financier, who expected a quick reply, was too impatient to wait long. He therefore broke off the negotiations and joined the British ring. Had the Dillon-Jay Gould combination materialised, we might probably have never heard of the Commercial Cable Co. For Dillon, its promoter, would have joined forces with Jay Gould and developed, with him, certain ambitious plans, which included four cables across the Atlantic, a big international cable bank, and a double line of cables across the Pacific.

British v. French Diplomacy.—Having absorbed the Jay Gould company, Sir John Pender endeavoured to compel the "P. Q." to joint his ring and accept a joint working arrangement by starting a war of tariffs. Dillon strenuously opposed this amalgamation. Pouyer Quertier, who was having trouble with his cotton enterprises, and needed ready money, finally decided to accept the British offer. Being president, a big shareholder, and possessing enormous influence among

shareholders and in financial circles. "P. Q." was master of the situation. The final negotiations took place in Paris. While Pouyer Quertier was settling the final terms with the Britons at one room of the "P. Q." offices, Dillon was in the next room *laying the foundations of a new Atlantic company* destined to break for ever the British monopoly.

Dillon persuaded two American millionaires, John W. Mackay and James Gordon Bennett, who did not love Jay Gould, to join forces with him for the laying of two Atlantic cables. These were made, laid and opened to the public in record time. Then the new company found itself alone in fighting the four old associated companies —Anglo, Direct, Jay Gould, and French "P. Q." Justice compels me to admit that Sir John Pender did not develop his traditional diplomatic genius in meeting these redoubtable competitors. Dillon, approached for some "friendly understanding," proposed to discuss it through an "Atlantic Cable Committee," composed of Weaver, Sir John's man, Dillon himself, and one or two other members. Endless discussions took place; adjournments and postponements occurred; many months elapsed. Suddenly Sir John Pender awakened to the fact that Dillon was the *Weaver*. For he had woven a web around him that promised to prove disastrous. The more they negotiated the less progress was made. The inevitable happened. War was declared. But too late. Dillon had made such a splendid start for over a year that he was able to say to Pender: "Very good: we fight. Carry the traffic at sixpence and lose money. We shall charge 1s. per word and get public support as the pioneers of this low rate, *undertaking never to raise it above that figure.*" Sir John was, of course, "cornered." He finally accepted the 1s. tariff imposed by his rivals, and no change has since been made. Here it may be noted that Count Dillon not only broke the Atlantic cable monopoly, but also re-secured control of his old company, the "P. Q.," with the assistance of his associates.

To-day, as everybody knows, the Americans practically dominate the Atlantic cable industry. Noteworthy is this significant fact: While the British have *laid* the cables and *worked* them, foreigners have consistently fought for *lower tariffs* across the Atlantic.

Modern Cable Magnates.—Ever since its inception the cable has commanded the services of a succession of brilliant financiers, scientists, and administrators, both British and foreign, as the foregoing details clearly prove. Sir John Pender I. has passed into cable history as the most remarkable of these pioneers. For he combined in his person all the qualifications needed for such a dominating position. He was financier, administrator, diplomatist, and even scientist on occasion. Perhaps his success was due, in the main, to that indomitable pluck and determination which, combined with untiring energy, enabled him to realise his most grandiose schemes. Frequently his time and energy were expended in overcoming the opposition or apathy of those who ought to have better appreciated his enterprise and facilitated his efforts. Notably, certain Colonial Ministers, who were disposed to depreciate the value and potentialities of our Colonial Empire. How often Sir John had to go to the Colonial Office and force, by sheer will power, the Minister in office to permit him to confer upon some colony the inestimable boon of cable communication with the Mother Country! His success led to the curious legend that "Pender carried the Colonial Office in his waistcoat pocket." Sir John, a splendid judge of character and expert in the art of managing men, surrounded himself with some of the keenest, brightest spirits of his time in all departments—Sir Charles Bright, Lord Kelvin, Sir James Anderson, the famous captain of the *Great Eastern*, Alexander Muirhead, Varley, Willoughby Smith—to name only a few. To my mind the importance of Bright's pioneer work was never adequately recognised. Apart from his scientific and technical successes, he was a cable enthusiast, an active propagandist, and the *first subscriber* to the pioneer Atlantic Telegraph Co.

Future of the Eastern.—In his Eastern Telegraph enterprises, Sir John Pender I. mobilised a big brigade of scientists and technicians, resourceful administrators and financial experts, who found ample scope for their ability at home and abroad. Other valuable collaborators in the great work were: Glass, Elliott & Co., the Newalls, the Telegraph Construction and Maintenance Co., of which Sir John was the first chairman; Siemens Brothers, the Silvertown Co., associated with the famous Gray family; and Henley's. These corporations have made, laid, and repaired the majority of the cables now lying beneath the waters of the Seven Seas.

To-day all the original founders of the Eastern Telegraph enterprise have passed away, but their mantles have fallen upon successors who are continuing their far-sighted, progressive policy. The control is now exercised by Sir John Pender II., who sees the enterprise enjoying a prosperity and a *prestige* commensurate with its vast organisation and capacity for beneficent international service. He is, of course, ably seconded in his administration by a number of experts in London, as well as by resident representatives and station managers throughout the world, the latter being well supported by an efficient, zealous staff.

Whatever may be the future reserved for cable enterprise, the Eastern group may be expected to maintain its traditional and pre-eminent position. Sir John Pender II. has revealed many of those qualities of energy, sound judgment, and financial acumen which enabled his father to accomplish his historic work. The popularity enjoyed by Sir John with his staff has just found expression in a handsome volume which they have presented testifying, above 8,000 signatures of men scattered all over the world, to their personal regard and loyalty.

"Electric Heating by Accumulation."—A further contribution to the subject of the title has been published by the E.D.A., supplementing the note in our issue of June 23rd (p. 884). The attention devoted in this country to water-heating and heating by water has over-shadowed the alternative method of accumulating heat for subsequent release by "dry" methods. One appliance for this purpose is the Harrison & Peard heat accumulation stove. This stove consists broadly of a suitably lagged containing body, through which air can be circulated by the opening of dampers, supplemented, if necessary, by the use of fans. Within the body of the stove are situated vessels or reservoirs containing any suitable substances of large heat-storing capacity for a rise of temperature not greatly exceeding the temperature at which heat is required from the appliance. The substance may be water, chemical solutions, or solid substances which liquefy on heating. In a model already made for room warming, acetate of soda has been employed as a heat storage material. When this salt, in the form of crystals, is melted, much heat is absorbed without increase in temperature, and this latent heat of fusion is given off again when the substance recrystallises. The vessels containing the storage substances, or the masses of material employed for that function, are heated up by means of electrical elements placed in or around them. The losses by radiation during the period of charging or storage are comparatively low, and under control, that is to say, the stoves may be designed to give off a portion of the heat input during charging and to store a portion for use during the non-charging period. Heat is released, as above stated, by the operation of dampers, which allow air circulation, which may or may not be assisted by fans, and the heated air of moderate temperature and large volume is discharged at or near ground level, so overcoming the "cold feet" difficulty apt to arise with convective heating, which does not warm the floor until after the air of the room has been heated up and perhaps become stuffy.

The use of the fan also results in a reasonable movement of the air, which, to a great extent, reduces the enervating effect of air warming. Obviously, many modifications under these patents suggest themselves, and it would not be difficult to provide, say for 80 per cent. of the heating effect required in a room by storage convector, and 20 per cent. by a radiant fire element, so producing an apparatus which would satisfy every need of the user and yet enable the supply undertakings to meet extensive demands without embarrassment or the necessity for charging unduly high rates. The whole subject of heating by stored energy is worthy at the present time of the most careful consideration by manufacturers and supply undertakings. A great deal of success has already been achieved in this direction in Switzerland, Italy, and Scandinavia.

CABLES.

By "A STATION ENGINEER."

It is now being generally recognised that armoured cables provide the most efficient means for transmitting electricity. Some years ago, there was a great movement in favour of the solid system, but this has largely died down. The solid system is expensive, and offers far less protection than seems to be the case at first sight. It is liable to damage if the ground be disturbed underneath, a possibility far from uncommon in a busy town. The solid system also retards the escape of heat to an undesirable extent, and this is an important objection now that the heating of cables in the ground is becoming a limiting factor almost as important as the heating of conductors in transformers and running plant generally. The hope that bitumen cables would be entirely free from trouble has been falsified by experience. Far from this being the case, bitumen cable is more liable to faults than plain lead-covered paper-insulated cable, while the solid protection of V.B. cables sometimes interferes in a curious manner with the localisation of faults when they do occur.

The draw-in system has disadvantages even more serious than those of the solid system. Where cables are run at high densities, as is possible with high-pressure supply, the draw-in system provides a blanket of air round the cable which effectually conserves the heat, and renders the cable liable to overheating, if run for long periods under load. Where several ducts are run close together, the draw-in system is particularly liable to over-heating. The liability to gas explosion, the cost of installation, the cost of draw-in boxes, and the fact that these monopolise the street seriously, are further disadvantages which need not be elaborated.

Until recently, round cores had been most favoured for armoured cables, but shaped cores are now coming into vogue. The fact that shaped conductors are appreciably cheaper has something to do with this, but some engineers prefer them even at equal prices. There was a report some time ago that, owing to its smaller outside diameter, the three- or four-cored cable with shaped conductors would carry less current than one with round conductors, but there is some doubt whether this fear is justified. While it is true enough that the shaped cores go into a smaller space, one has to recognise that the extra space with round cores is filled up with insulation which is also a bad conductor of heat. Probably there is little to choose between the two styles of cable from a heating point of view.

The round cores are more convenient for making "Tee" service joints, where these are spliced on to the main cable without cutting the cores. The extra space inside the lead is a distinct advantage when it comes to forcing the cores apart, to enable the "Tee" cable to be spliced on. A closely made up cable with shaped cores gives far less opportunity for making a "Tee" splice, although it is not impossible to a skilful jointer. It is to be noted that shaped-core cables vary in this respect. Some cables are made up with the cores fitted together so closely that no filling-in material whatever is used, and these are particularly awkward for taking off "Tees." Other makers use an appreciable amount of worming to fill up spaces between the cores; this is helpful to the jointer, and the cable is more suitable for distributor work, although the first kind is probably just as good for feeder cables, where no "Tees" are required.

Methods of shaping the cores differ greatly. In one case the cores are made up round in the first case, and are pressed into shape by dies; the cable passes between the dies, and is pressed a few inches at a time. This method seems to harden the copper somewhat, which is undesirable. Other makers pass the round cores between grooved wheels, which force them into triangular shape, the effect being very much the same as in the first case. Other makers use cores made up of very fine strands, which are pressed into triangular shape by grooved wheels without effort, and without any distortion of the strands. This makes an attractive and flexible cable, but it has the serious disadvantage that the fine strands may be burnt and damaged if "Tee" joints are soldered with very hot soldering metal. This disadvantage is worthy of note, and there is no doubt that a good deal depends on the skill of the jointer where such cables are used. In a further design, triangular cores are laid up into triangular shape by the use of strands of special sizes. These cores come from the machine of correct shape, and need no pressing afterwards, and they appear to make a particularly good job.

It would be interesting to have the opinions of various users whether the shaped-conductor cable is as good as, or better than, the round-core type. I suggest the following opinion, which may form a basis for discussion:—

1. For cables pulled into pipes, the shaped conductors are better, being more flexible, and less liable to distortion under the strain of drawing in.

2. For large cables the shaped conductors have advantages over round cores. The smaller diameter makes the cable better for handling.

3. It is an advantage to have a certain amount of worming to fill the spaces between the curved corners of shaped conductors. Conductors made with sharp corners may be made without the filling-in, but these are less satisfactory than those with rounded corners, being more difficult to force apart for jointing purposes, and probably more liable to damage in handling.

4. Small cables, such as those with 0.1 sq. in. conductors and under, are better with round cores.

Protection of Armoured Cables.—Where they are properly laid and jointed with efficient joints, the life of armoured cables may be taken to be indefinitely long so far as internal conditions are concerned. Normal running does not seem to have any bad effect on paper insulation, and so far as can be seen, a cable is as good after twenty years as when laid, provided it has not been over-run.

Cables are far more likely to decay from outside than from within, and it is therefore a proper subject for inquiry, whether the outer protection is sufficiently good. The foremost requirement for an armoured cable is that it should be thoroughly solid with compound; right from the lead to the outside of the serving, every space should be filled with a firm compound, of a flexible and somewhat rubbery nature. Some engineers complain when this compound is sticky, as it gets on to their jointers' fingers. To such, one can only say that it is far better that the jointer should have to wipe his fingers than that the cable should be imperfectly protected. A compound of a sticky nature is just what is wanted. It does not crack, and it keeps water out far better than a mixture of a brittle nature.

It is a distinct advantage to have the armour galvanised, but this often means delay and considerable extra cost. Alternatively, it is worth while to make the serving thicker than the B.E.S.A. specification requires. Some engineers demand a cable laid up with a great deal of special compound, which has its advantages, but the method is not popular with cable makers. They have to provide for such orders a quality of compound quite different from that ordinarily used, and that is both expensive and troublesome.

Possibly a better method is to have the cable wrapped with special compounded Hessian tapes, instead of the ordinary serving. There is no difficulty in doing this, the cost is not excessive, and one may expect that the cable will have a longer life, particularly if the ground be of a nature that attacks cables.

Perhaps our friends the cable makers will give their opinions, which will be welcome. No matter how good a suggestion is, there is not much benefit in it if the manufacturers cannot carry it out.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Elverson Oscilloscope.

We are informed that Messrs. Herbert Kennedy & Co., Ltd., 17, Victoria Street, Westminster, S.W.1, have purchased the undertaking of the Oscilloscope Syndicate, Ltd., and now own the world's rights of the above-named device, which was developed by Mr. A. J. Elverson during the war period. It is a stroboscopic apparatus, by the use of which the apparent speed of a piece of mechanism under examination is reduced to a pre-determined fraction of its actual running speed; or the instrument can be so adapted as to make the mechanism under observation appear to be stationary at any point in the cycle of operation. This "optical gear ratio can be made one to 1,000 if needed. The object to be examined is illuminated by means of a special form of electric lamp controlled by the instrument in such a manner that, instead of emitting continuous light, rapid successive flashes take place at regular intervals in the movement of the part of the machine under examination, so that the effect on the eye is that of a series of photographic impressions. By substituting a microphone and telephonic attachment for the lamp, it is possible to enable the ear to analyse mechanical noises and at the same time the mechanism can be examined optically as well if desired. The device is portable, weighing about 35 lb. complete in a case, and it is capable of dealing with all forms of motion, rectilinear, rotary, cam motions (however intricate), and all problems of vibration.

The "Ace" Lighting Fitting.

The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C.4, has introduced a new design of dust-proof semi-indirect lighting fitting. This is illustrated in fig. 1. The glassware is in one piece—crystal glass treated with a special enamel, fired on the upper surface and

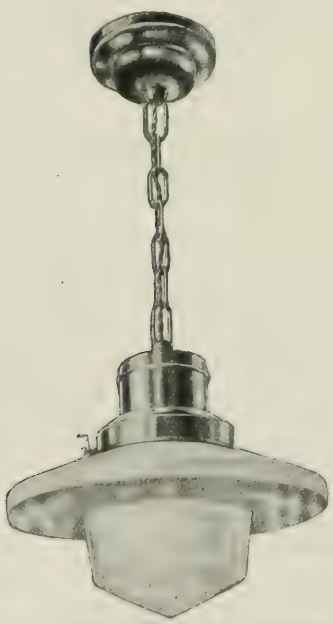


Fig. 1.—The "Ace" Lighting Fitting.

edge, to reflect the light downwards, and on the outer surface of the bowl to diffuse the light and reduce light absorption. Cross reflections are eliminated by the contour of the glass. The fitting is supplied complete with ceiling plate and chain, and, if desired, the bowl can be fitted with an ornamental tassel. It is made in two sizes to take "Mazda" gasfilled lamps of from 100 to 300 W.

The "Little Giant" Rail Drill.

The amount of railway electrification in progress and in prospect makes the apparatus illustrated in fig. 2, of immediate interest. This shows the application of the "Little Giant" drill, manufactured by the Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W. 1, to rail drilling. It will be noticed that the frame does not need bolting, it is simply hooked over the rail to be drilled, the operator holding down the other end by sitting on the seat provided, which brings him into a convenient position to operate the feed. The side spindle construction permits drilling close to the ties without the use of an angle attachment, and the vertical adjusting screw, with guides for the drill, affords ready means for drilling the holes vertically on ordinary tee or deep girder rails. The horizontal rods are of heavy seamless drawn tubing, and the bearing surface of the drill guides is long enough to ensure the true holes which

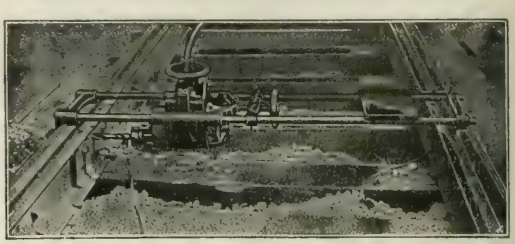


Fig. 2.—The "Little Giant" Rail Drill.

are essential for efficient bonding. The cross-bar carrying the feed nut is fitted on the horizontal rods by means of eye pins, which are easily withdrawn for the rapid removal of the drill from the rail, or for sharpening the drill point. A series of holes in the horizontal rods provides means of accommodating drills of various length. The drill itself can be removed from the frame by taking out four screws; it can then be used as an independent portable tool. The motor is wound for 600 V.

Industrial and Mining-type Switchgear.

The new regulations relating to the installation and use of electricity in coal mines have necessitated the remodelling of mining-type switchgear. Messrs. Ferguson, Pailin, Ltd., Higher Openshaw, Manchester, have therefore developed a range of switchgear which can be employed where regulations 127 and 132 apply. For satisfactory service under the particularly bad conditions that switchgear has to contend with in

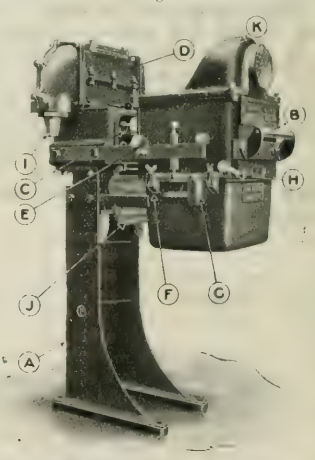


Fig. 3.—Ferguson-Pailin Switchgear.

mines and certain industrial situations, a specially robust pattern of ironclad oil-immersed circuit breaker has been produced. This type of switchgear is of the totally enclosed pattern. It is proof against dust, drippings, and vermin, and is capable of resisting bad atmospheric effects. The design is particularly applicable in outdoor or exposed situations. For use in fiery mines the switchgear is supplied in a special flame-proof patern. All "live" connections in this apparatus are either immersed in oil or in compound so as to render the gear suitable for low-pressure and high pressure systems.

The construction is on the sectional principle, enabling a complete switchboard to be built up from several sections, or a single unit to be employed as required. A typical section arranged for floor mounting is shown in fig. 3. An alternative design for wall mounting is available. The circuit breaker is closed and opened by means of a "free" handle situated at the side and screened by the main body. The free-handle

feature operates throughout the whole of the closing movement, and the breaker will thus trip free of the handle, whether operated automatically or by hand.

The free handle operates through a simple toggle movement fitted with accelerating springs and oil dash pots, so that a very high speed of break is obtained, with sufficient retardation at the end of the stroke to prevent any mechanical shock and consequent damage to the gear. This operating mechanism being completely immersed in the oil is self-lubricated, and is therefore protected from corrosion or undue wear. The gear is supplied in a draw-out or non-draw-out pattern, as required. The various parts of the gear are readily accessible for inspection, cleaning, adjustment, or replacement. This is particularly so in the draw-out pattern. Safety is ensured during any of these operations by means of the interlocking devices. A connection or isolating chamber (C) is provided to permit of the ready removal or replacement of the circuit breaker carriage without interference with the fixed electrical connections. The bus-bar chamber (D) acts as a terminal box for cable ends, or houses the permanent electrical bus-bars in the case of a grouped switchboard. Ample clearances and leakage surfaces have been arranged between all points where differences of potential exist; while all live parts not immersed in oil are embedded in compound as a final safeguard. A complete set of mechanical interlocks, incorporated in the design of the gear, ensures that the correct sequence of operations is followed when the gear is manipulated. A maximum of four trips can be supplied, comprising any combination of low-voltage, overload, earth leakage or trip-coil release; but only one low-voltage release can be fitted to each circuit breaker. All trips are of the solenoid type, and the coils are immersed in insulating compound.

WORKING CONDITIONS IN FACTORIES.

H.M. CHIEF INSPECTOR'S REPORT.

IN his annual report for 1921, which has just been issued,* the late Mr. R. E. Graves, H.M. Chief Inspector of Factories and Workshops remarks, *inter alia*, that, generally speaking, the circumstances existing throughout the period under review were such as to discourage the outlay of money in trade developments or the erection of new works; it is therefore of interest to note such developments as occurred. Amongst the more important mentioned in the reports from inspectors in various parts of the country are developments in rolling-mill plant in Sheffield for the production of tramway rails, &c., one firm having completed the erection of mills of the Mogran type capable of turning out 19,000 tons of finished steel bars and sections per month, while another, engaged in the mass production of tools and cutlery, is erecting its own Siemens steel plant and is installing electric furnaces. It is also reported from Sheffield that a new development in the manufacture of stainless steel is the production of an untarnishable metal of a ductile nature which can be worked cold into intricate shapes and can, therefore, be used for a multitude of purposes for which the original stainless steel is unsuitable owing to its hardness. It is expected that this new metal will, to a large extent, supplant copper and brass for a large variety of articles which require to be kept bright. The introduction of what is described as synthetic silver-nickel is also mentioned. It is said to be untarnishable and closely to resemble the best electro-plate, and that it can be produced at about half the cost of the latter. In the cutlery trade in Sheffield the introduction of grinding by machine methods is on the increase, and one invention is mentioned by means of which 112 table blade blanks can be ground at the same time on a cylindrical electromagnetic device. The only trades mentioned as having been fully employed are the food manufacturing trades generally, and particularly the sugar confectionery section. The only branch of the engineering trade which has been busy is the textile machinery section, which has been fully employed on both home and foreign orders. There is much leeway still to be made up in the home factories in replacing and repairing plant which was run almost to destruction during the war. The introduction of electricity for various industrial purposes continues on a large scale, particularly for driving small motors.

The inspectors have been at some disadvantage in making their reports this year because most of them were new to their districts, owing to the great number of changes which took place on August 1st last, consequent on bringing into operation on that date the reorganisation scheme mentioned in the report for 1920. The scheme was brought into operation with extraordinary smoothness, but the work of the department generally has been hampered by shortage of staff. In response to the demand for economy the authorised staff was reduced from 235 to 211; at the end of the year there were 20 vacancies, 11 of which, however, have been filled during the current year.

* H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1; Cmd. 1705; price 3s. net

Notwithstanding the difficulties which have [illegible] tended with and the depressed state of trade, a [illegible] of useful work was accomplished during the [illegible] the report.

Since its creation in January, 1921, the Engineering [illegible] has proved its usefulness. To each of the inspectors [illegible] been allotted certain particular subjects in which to specialise, and in this way the technical work is divided up and overlapping is avoided. They have been engaged on a number of very useful inquiries, such as those in connection with the manufacture of india-rubber, electric accumulators, &c.

The total number of effective visits paid to factories and workshops and other places under the Acts was fewer by 15,287 than in 1920, but a reduction was to be expected in view of the difficulties involved and the time occupied in making the arrangements for the new divisions and districts. Moreover, it must be remembered that every new code of regulations and order issued adds greatly to the work of the staff.

Notwithstanding the industrial stagnation which has prevailed, the registered factories have increased from 140,064 in 1920 to 142,749, while workshops (including men's workshops) have continued to disappear, there being 4,944 fewer than in 1920. Owing to the division of the district areas during the year certain statistical information previously given is not included in the report under review.

In the chapter on "Safety," Mr. H. J. Wilson, Superintending Inspector, records that during 1921, 92,565 accidents (including 951 fatal ones) were reported, as compared with 138,773 (1,404 fatal) in the previous year. This remarkable drop is almost entirely due to phenomenal inactivity in industry throughout the year, and the prolonged coal miners' strike, which resulted in many large iron mills and blast furnaces being completely closed down for an extended period. Concentrated attention has been given to crane accidents, and investigation has brought to light the important fact that a growing number of users insure their cranes, thus securing the benefit of periodical expert inspection, and defects, the result of wear and tear, are detected before danger arises. It is gratifying to find that electrical overwinding and overrunning devices are being largely adopted.

Two explosions due to ignition of dust were reported during 1921. In the first case, as the machine was almost entirely destroyed, it was difficult to trace the original cause. The most likely explanation seems to be that some foreign material, such as a piece of steel or stone, entered the feed hopper, and grinding against the cast-iron tube, caused sparking, which ignited the cloud of dust present in the screen chamber. Another possibility is that the ignition was due to an electric spark, caused by a static charge set up in the metal parts of the machine as a result of the friction of the driving belts and pulleys. With a view to minimising the risks of such explosions the following, amongst other, recommendations were made:—

All parts of the sieving machines to be effectively earthed.

Magnets to be used for the removal of any scraps of iron or steel from the powder fed into the hoppers.

The second dust explosion is supposed to have been caused by a small piece of flint causing sparking. The firm already had provided magnets in the feed hopper to stop any particles of iron.

In the chapter on "Industrial Diseases" Dr. T. M. Legge, Senior Medical Inspector, reports that the total number of cases of lead poisoning in the electric accumulator industry was 35, none of which proved fatal, as compared with 47, including 2 fatal cases, in 1920.

In the chapter on "Dangerous Trades," Mr. G. Stevenson Taylor, Senior Engineering Inspector, points out that, although the general trade depression has been felt in the electric accumulator, as in other trades and some works have either been idle for a period or working short time, the incidence of lead poisoning has continued high, as mentioned above. In consequence Dr. Bridge and Mr. Price are at present engaged on an inquiry into the conditions existing in the industry with a view to the revision of the existing code. The present regulations were issued in 1903, since when considerable developments have taken place.

As a result of steady pressure by the staff considerable improvements have been made in the conditions in some works. Miss Sanderson (Ashton-under-Lyne) reports that the reduction of lead poisoning cases in one small works, from eight in 1920 to two in 1921, is due entirely to the improvements which have been made, and not to any falling off in output, as this firm has had plenty of orders. On the other hand, in the case of a very small accumulator [illegible] which had been started in most unsuitable premises in West London without proper notification, Mr. Pedlar reports that the financial state of the firm was very low, so that considerable difficulty was experienced in securing [illegible] with the regulations.

Mr. Butler (West London) draws attention to the [illegible] ages of the use of vacuum cleaning appliances for removing lead oxide dust. The result of analysis of the atmosphere where lead burning processes are carried on [illegible] fumes are produced in sufficient quantity to be [illegible] to health, and this is confirmed by statistics of lead poisoning in

accumulator factories, as 31 per cent. of the cases are persons employed in lead burning. Efficient exhaust ventilation is therefore very necessary in connection with this process. Excellent plant has been installed in some works during the past few years, but owing to the state of trade progress has been slow in others.

With regard to electric lighting, Mr. Lloyd Edwards (Woolwich) finds that electric lighting is almost universal in the docks in his district, cluster lamps being mostly used and found satisfactory. Arc lamps are said to be less satisfactory, and complaints have been made that the direct glare from these affects temporarily the eyesight, and thereby increases the danger to persons moving about in certain parts of the docks. Very few contraventions have been discovered with regard to inadequate lighting on ships during loading or unloading, as these processes have not been carried on after dark so much as formerly. As regards the Clyde shipyards, instances are quoted of two or three cases of inefficient lighting between decks on ships.

In the chapter on "Health and Sanitation" Mr. E. A. R. Werner, Superintending Inspector, remarks that many inspectors express surprise at the little interest shown by employers generally in the subject of lighting; thus Mr. Verney (South London): "It is not usual to find an entirely satisfactory system of lighting." Inadequate lighting is provided at such hazardous points as the landings of lifts, and dangerous machines, such as power presses, are found in dark corners. Neglect of window cleaning is still a matter of frequent comment.

As regards artificial illumination, gasfilled electric lamps are now obtainable in smaller sizes than hitherto, and this should help towards better distribution. Screening of intense lighting still needs great attention, but employers are becoming more alive to this necessity. Obsolete means of lighting still persist in many places: Sheffield, Birmingham, and Norwich inspectors report the continued prevalence of batswing gas burners, and Mr. Brothers (Warrington), says workers still have to provide candles for themselves in many fustian-cutting works.

Miss Martindale, Superintending Inspector, reports that a considerable amount remains to be done to improve lighting conditions in basement workrooms. In approximately 78 per cent. of the rooms visited the natural light was insufficient to light the whole room, and in 65 per cent. there was insufficient light for working purposes. One of the most serious disadvantages of underground work-rooms is that in over 60 per cent. of them artificial light is continually necessary. The rental for a basement might be comparatively low, but a high bill for artificial light might more than counteract this advantage. The following types of lighting were observed to be used for artificial lighting:—

Electric metallic filament	... ...	46 per cent.
Electric half-watt type or gasfilled	...	15 ,,
A combination of the two types	...	10 ,,

In 71 per cent. of the workrooms electric light only was used for illuminating purposes, and this illustrates to what a great extent gas is being superseded for this purpose. Several cases were noticed where firms had installed, or were installing, systems of indirect general lighting. In one litho. factory inverted incandescent gas burners were being replaced by electric lamps. These were fitted with opal shades below the lamp and enamelled reflectors above. At the time of visiting the position and candle power of these lamps were being experimented with to determine how to ascertain the best results in the room. It was practically certain, however, that, in addition, local lighting would have to be supplied over the ends of the machines, as it was found that the general lighting was insufficient for the fine work which had to be done on the plates and stones. In a plating works this type of general lighting was also found, in addition to local bench lighting by electric metal-filament lamps. The lighting was not so general as was desirable in this case, on account of the low ceiling—about 8 ft. from ground—and it was found that the opal shades occasionally became broken, due to the same reason.

In the case of a tobacco works it was stated that this system had been installed in the basement, but that the result obtained was not so soft as desired. The firm therefore experimented, and its final arrangement, which was in use at the time of visit, and which produced apparently even light of a soft character, consisted of half-watt type lamps totally enclosed in cubes made of thick grease-proof paper. The usual system, however, of obtaining general lighting was by using half-watt type electric lamps, unshaded, and sometimes fitted with overhead reflectors, at the ceiling level, while local lighting was obtained by small-power electric vacuum lamps with shades at the head level.

Very few cases were noticed where the lighting was considered to be inadequate, and this is doubtless due to the fact that electric light was so largely used. In about 4 per cent. of the workrooms the lighting appeared to be insufficient for the purposes required, and in nearly all these cases gas was used as the illuminant. In many cases glare was present; there seemed to be several causes for it, the most general being the absence of the shade or its shallowness compared with the size of the electric lamp, and to the position of the light in relation to that of the worker.

STEAM RAISING BY ELECTRICITY.

The use of electricity as a steam-raising medium appears at first sight to be commercially impossible, but reflection will show that hydro-electric undertakings, which are compelled to keep running, although the generators may be very lightly loaded, could often profitably employ their surplus energy for the purpose indicated.

In a paper read recently before the Engineering Institute of Canada, Mr. F. T. Kaelin, Chief Engineer, Shawinigan Water & Power Co., reviewed the subject at some length, giving details of what had already been accomplished, and notes on the installation and working of typical electrical steam-raising plant.

The low cost of the steam generator compared with other apparatus for the conversion of electricity into heat, and the wiring and control gear necessary for this equipment, is very much in favour of the electric steam generator. It can be shown that even in extreme cases where the load factor is comparatively high, for instance, in pulp and paper mills, that it is economically possible to turn the power which is used for six days, mainly for pulp grinding, into steam, which is always required in such places, either for manufacturing or heating purposes. It was shown in a recent investigation that the coal-saving during the 52 Sundays and three holidays would easily pay for the installation of the steam generator in less than one year. Power companies would benefit by selling their idle power at low rates to such consumers.

In the electric steam generator all the electric energy is converted into heat energy, the current passing through a metal resistance or through the water itself. The whole process of conversion is therefore governed by ohmic law. One kWh is equivalent to 3,412 B.th.u.; the total heat content of one lb. of steam at an absolute pressure of 150 lb. per sq. in. is 1,193 B.th.u. Assuming a feed-water temperature of 150 deg. F., the total heat to be supplied will be 1,193—(150-32) =1,075 B.th.u. One kWh will, therefore, produce 3,412/1,075 =3.17 lb. of steam, ignoring heat losses. The only losses are those due to radiation and to the discharge of a certain amount of water from the apparatus which carries away accumulated impurities in the feed water. By proper lagging heat losses may be reduced to from 1 to 4 per cent., depending upon the size of the generator. For larger sizes the efficiency may be about 98 per cent. On this basis 1 kWh will produce 3.10 lb. of steam. Under average conditions 1 lb. of soft coal of about 12,000 B.th.u. evaporates about 8 lb. of water; one ton of 2,000 lb. will, therefore, evaporate about 16,000 lb. of water. The electricity required to evaporate the same quantity is equal to 16,000/3.10=5,161 kWh=215 kW-days; in other words, 215 kW in an electric steam generator is equal to one ton of coal per day, burned under average conditions of boiler efficiency. Comparing the capacity of an electric steam boiler with that of a regular boiler in boiler h.p. the following relations are found: one boiler h.p. is defined as equivalent to the evaporation of 34.5 lb. of water, from and at 212 deg. F. per hour, and represents 33,479 B.th.u. per hour; 1 kWh is equal to 3,412 B.th.u., and at an average efficiency of 98 per cent. to 3,342 B.th.u. These figures are almost exactly in the ratio of 10 to 1, therefore an electric steam generator of 1,000 kW capacity is equal to a boiler of 100 boiler h.p.

Considering the construction of electric steam generators, the author states that generators of the metallic resistance type are only suitable for low pressures up to about 500 V, and are therefore not usually adaptable for very large outputs. The steam production is controlled by switching on and off a number of parallel circuits, and the combination of circuits in parallel or series connection. Generators of this type have been built of 1,500-kW capacity; these are of tubular construction, about 20 ft. long and 5.5 ft. in diameter. The space occupied by this type of generator is large compared with the steam generating capacity.

In the water-resistance type of generator the energy passes through steam-tight insulating bushings to a system of stationary electrodes partly submerged in water. This type of generator is known as the "Revel" generator; it has been in use, principally in Italy, Switzerland, and France, for the past 10 years, mostly in self-contained units up to about 700 kW. For any considerable amount of power only a three-phase a.c. system may be considered practical. For small generators, with voltages up to about 2,200, the container itself forms the neutral point of the three-phase system, and is earthed. For larger sizes, especially when the pressure is above 2,200 V up to 12,000 V, it will be advisable to split

up the generator into three single-phase units with three containers, each enclosing one electrode; the three containers again form the neutral point, and are metallically connected and earthed. The regulation of electrical input to suit the steam demand is effected by varying the resistance. The outstanding advantages of this type of generator are its simplicity of construction, compactness, ease of control, and its low cost per kW capacity. The variation of the resistance of water with its degree of purity needs careful consideration. The condensate *is* of very high resistance, but the addition of make-up water, usually drawn from a river, brings its conductivity up to a practical figure. It has been found by experience that the resistance of the water can be controlled over a considerable range by discharging a certain amount of water from the generator; the amount so discharged depends, of course, upon the degree of purity of the water.

Fig. 1 shows a section of an actual 5,000-kW generator. This consists of a cylindrical tank with an extension at the bottom. The upper part is flanged, and to it is bolted a dished cover, which contains three openings for the porcelain bushings insulating the three copper conductors leading to the electrodes. The insulator bushing consists of three parts: two corrugated sleeves, one outside and one inside the tank, and a tube inside these sleeves, which are held together by a shoulder and nut upon the conductor passing through them. The faces of the sleeves are parallel, and are made steam-tight with the usual rubber steam packing. The packing allows a certain adjustment for the difference in the expansion of porcelain and copper. The porcelain sleeves are subjected to considerable pressure, and are made rather heavy for mechanical reasons; they are also made to withstand a working pressure of 6,600 V between phases. The conductors support, through a system of adjustable links, the steel electrodes of curved plates arranged in a circle equidistant from two cylinders, one outside and one inside, forming the neutral point of the three-phase system, the outside one fastened to the generator shell proper and the inside one suspended from the cover, and well secured in a central position. Both these cylinders are electrically connected to the body of the generator and earthed. The arrangement shown is for 1,300 A at 2,200 V, 60 cycles, and for a working steam pressure of 165 lb. per sq. in. The current passes from both sides of the electrode to the inside and outside cylinders, and, to a much smaller extent, from electrode to electrode.

As the path of the current is not sharply defined, the ohmic resistance can only be calculated approximately. If R = ohmic resistance between electrode and earth; d = distance between electrode and ground in inches; A = total area of submerged part of electrode in sq. in; s = resistance in ohms per

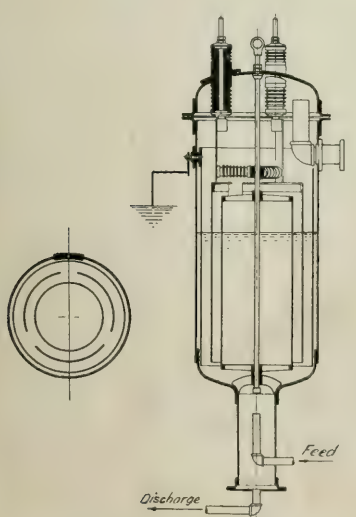


Fig. 1.—Sectional Drawing of a Three-Phase Single-Unit Electric Steam Generator.

cu. in. of water at normal operation; E = voltage to neutral; I = current in amperes; P = power in kW, then a = current density = I/A; R = a/s; s = E/I; A = I/a, and E = d a s.

In the last equation the right-hand side is the product of three variables, the choosing of which is mainly a matter of experience and compromise to secure a satisfactory mechanical arrangement and safe operation. After d and a are chosen s is fixed—this means that for a certain load and water level the specific resistance of the water has to be maintained by adjusting the relative amounts of inflowing and outflowing water. The outside shell of the generator illustrated in fig. 1 is 42 in. in diameter. The length of the cylindrical part is about 70 in., and it is designed to withstand a test pressure of 350 lb. per sq. in. The lower end is provided with an inlet for feed water and an outlet for the discharge and blow-off water. The generator is equipped with the usual water and pressure gauges and safety valves, and the whole is mounted on a steel frame.

The three-tank arrangement affords a very simple and mechanical design, and permits of a more accurate adjustment of the ohmic resistance of one phase to earth. The resistance of a body of water between two concentric cylinders may be integrated and expressed as follows:—

$$R = \frac{s}{2\pi h} \log \frac{r_1}{r_2} = \frac{E}{I}$$

where h is the height of the cylinder; r_1 is the radius of the outside cylinder; and r_2 is the radius of the inside cylinder.

Fig. 2 shows a three-tank installation with a normal power input of 18,000 kW and a working pressure of 155 lb. per sq. in.

The floor space required by these types of steam generator is very small. The 5,000-kW generator, with control apparatus, can easily be placed in an area of 10 ft. by 12 ft., and the 18,000-kW type, equal to 1,800 boiler h.p., with all accessories, needs a floor space of about 15 by 22 ft. and headroom of 25 ft. for easy dismantling.

Operation is extremely simple for the small generator, and where the generators are not worked in parallel with other steam plant the operation can be made automatic by means of a regulating valve actuated by the pressure and controlling the amount of discharge water, thereby changing the water level, which, in turn, governs the power input and the steam production, and at the same time keeps the steam pressure constant. For the electrical control of the steam generator the usual apparatus—disconnecting switches, oil switches, and, preferably, three ammeters—is required. There are other advantages of the electric steam generator over the usual coal-fired boiler, for instance, any interruption in the supply of feed water simply means switching off the power and does not introduce any danger. The usual blow-off valves, &c., are fitted, and in addition other electrical safety devices are provided.

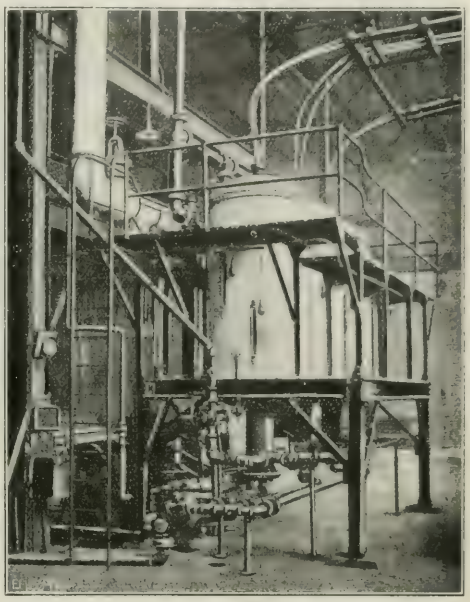


Fig. 2. An 18,000 kW, 6,600 V, Three-Phase, Three-Unit Electric Steam Generator.

The Rutenberg Concession.—M. Pinhas Rutenberg, the Russian who has obtained from the British Government the concession which will give him a monopoly in Palestine for the production of electricity, with the exclusive right for 70 years to utilise the waters of the rivers Jordan and Yarmuk and all their tributaries, arrived in London on July 10th from New York. He is reported to have written to the [illegible] Office promising to pay English firms up to 10 per cent. [illegible] the prices for equipment quoted by firms in the United States.—*Daily Mail.*

THE "DAILY EXPRESS" WOMAN'S EXHIBITION.

The success of an exhibition to the gentler sex possesses some degree of novelty, but the increasing interest of women in scientific housekeeping, as well as affairs outside the home, make the success of such an organisation almost certain. The exhibition at Olympia, arranged by the *Daily Express*, opened on May 12th, and it is to be continued until the 29th. As is usual in every exhibition, the scope implied by the title has been readily interpreted, and the show therefore includes both things of purely feminine interest and those whose attraction is not confined to the one sex.

Several electrical firms have taken advantage of the opportunity, but, so far as we could ascertain, electric cooking (meaning, of course, electric cookers of fair size) has been neglected, saving by a firm of furnishers (Messrs. Oetzmanns), who show a "Magnet Mode" cooker with hot-plates and grills, and the Hotpoint Electric Appliance Co., Ltd., which exhibits, not very conspicuously, a "Tailor" electric cooker of the pattern described in our issue of July 14th. The latter firm has a comprehensive display of domestic electrical apparatus, including irons, percolators, kettles, toasters, &c., the principle feature of which is the thermostatic cut-out device which guards the appliances from destruction by overheating, and prevents waste when it is forgotten to switch off the current. The "Premier" suction cleaner is displayed. This can be fitted with a beating attachment, which is demonstrated, consisting of three light metal bars fitting and revolving in the mouth of the cleaner. These bars are provided with numerous small rubber "teeth" which act on the material being swept. The "Aerobell" washer which, by means of two cups, forces air and water through the fabric of clothes, &c., is also demonstrated. Another exhibit is the "Walker" dish-washer, illustrated in fig. 1, which is a metal cylinder, with water inlet and outlet, containing a basket to hold crockery. The washing is performed by the action of a propeller beneath the basket, operated by a small motor through a gear box. The firm shows, in addition, "Hotpoint-Sheldon" vibro-massage and high-frequency apparatus.

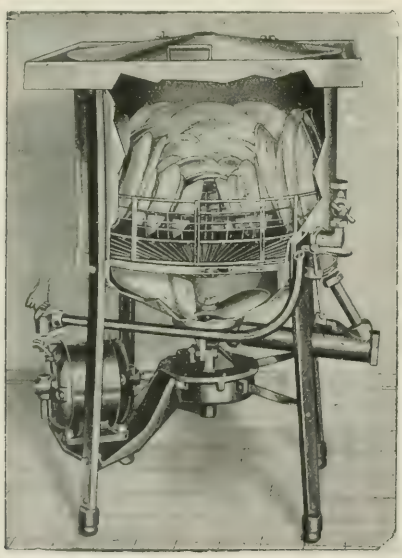


Fig. 1.—The "Walker" Dish-washing Machine.

The Win-Sum Electric Co. has on view and in operation a number of radiators similar to that described in our issue of December 23rd, 1921. This apparatus comprises a silently-running fan in combination with a four-part heating element and a deodorising screen. An adaptation of the device to an ice-box is shown and proved to be very effective. Figs. 2 and 3 show an attractive oak cabinet containing a "Win-Sum" radiator with the controlling switches. The floor is prevented from dessing by means of a bar below the switch dollies until the bar is raised, opening all the switches.

Messrs. Gillespie & Beales exhibit a number of "Nilfisk" suction cleaners (described in our issue of April 15th, 1921), which consist of portable receptacles embodying small electric motors, together with the necessary attachments. Four sizes are shown.

The Radio Communication Co., Ltd., has a ship's wireless receiving equipment in operation, by means of which concerts are given daily to large audiences.

Messrs. Pathe Freres have fitted up a studio equipped with powerful arcs, and they daily take films of dress displays, &c., for exhibition at a free kinema theatre in the building.

Electrical Appliances, Ltd., show many small electrical utensils, kettles, &c., as well as hot-plates and toasters. A speciality is a small hot-plate, really a miniature hot-cupboard,



Fig. 2.—The "Win-Sum" Radiator Cabinet.

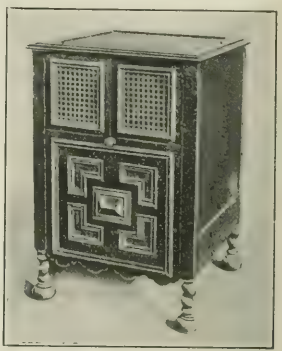


Fig. 3.—The "Win-Sum" Radiator Cabinet.

with top and bottom elements and a grill, by means of which both sides of a piece of bread may be toasted simultaneously. Double boiling rings are also shown; these have separate push-button switch control. Other exhibits upon this stand are a small wireless crystal receiving set with a ten-mile range, and a collection of "violet-ray" apparatus, the curative properties of which are much extolled.

On a stand arranged by the London gas companies appear gas "switches" and a plausible imitation of an electric iron for operation by gas.

A large collection of electro-medical apparatus by the Medical Supply Association, Ltd., the Solus Electrical Co., J. J. Griffin & Sons, and other firms, is displayed on the stand of the Royal Free Hospital. This includes X-ray equipment, high-frequency appliances, radiant heat and light baths, &c. The Anglo-Canadian Trading Corporation, Ltd., also shows a radiant-light bath device, consisting of a wooden frame, upon which tubular carbon-filament lamps are mounted, for fixing in an ordinary bath.

The "Northern" Steel & Hardware Co. demonstrates the "Laundry Queen" electric washing machine and the "Northern" suction cleaner, and also exhibits numerous small appliances, including some fans and irons of German manufacture.

One attractive stand is devoted principally to the display of articles made by the men of St. Dunstan's, and among these are silk lamp shades and carved and decorated table and floor standards for lamps.

The Rawlplug Co., Ltd., has its usual collection of plugs and accessories, showing the applicability of the "Rawlplug" to all kinds of materials.

Numerous social welfare societies and similar organisations hold stands in the exhibition. Among these is the Coal Smoke Abatement Society, whose activities are of particular value to the electrical industry; the Industrial League and Council; the League of Nations Union, &c.

The annexe of Olympia has been attractively laid out as flower gardens, and the B.T.-H. daylight lighting scheme, mentioned on previous occasions, has been retained.

New Spanish Companies.—Under the style of Construcciones Electrotermicas (Sociedad Anonima) a company has been formed at Barcelona for the manufacture of all kinds of electric heating appliances.

Saltos del Rio Ondarroa is the name of a company embodied at Jemein, province of Vizcaya, to develop falls on the Ondarroa River for electrical purposes. Its capital is 1,455,500 pesetas in 500 pesetas shares.

There has been constituted at Madrid the Sociedad Anonima Termo-Electrica Andaluza, with a capital of 12,000,000 pesetas, contributed by Spanish and foreign capitalists, to install a thermo-electric plant at important coal mines in Cordoba to furnish electricity to towns in the provinces of Sevilla and Cordoba.

PHYSICS AND ENGINEERING.

THE second of the series of lectures on the importance of physics in the various industries which are being given under the auspices of the Institute of Physics was delivered by Sir J. ALFRED EWING on July 4th at the Institution of Electrical Engineers. The subject was "Physics in Engineering Practice, with special reference to Thermodynamics," and the chairman, very appropriately, was Sir CHARLES PARSONS, Vice-President of the Institute.

The lecturer introduced his subject by admitting that the routine work of engineering may require little knowledge of underlying principles, but the engineer who would leave the beaten track must take physical science for his constant guide. The impulse towards engineering progress will be given more and more by men who are physicists as well as engineers. Much can be learnt of the fascinating borderline which such men explore from the great "Dictionary of Applied Physics," now being issued under the editorship of Sir Richard Glazebrook.

The study of physics can influence the development of engineering in three main ways. The first is when a knowledge of physics determines the immediate creative work of the engineer—when an invention, using the word in the broadest sense, is made by a man who can bring physical knowledge to bear on the solution of a practical problem; examples are Kelvin's design of instruments, which made ocean telegraphy possible, or Sir Charles Parsons's invention of the steam turbine. Another way is when the physicist makes an advance in the principles of his science, which illuminate the operations of the engineer, systematising what was haphazard and vague. Many of the classical discoveries in thermodynamics come under this head, and a conspicuous example was the settlement, by a committee of physicists, of the electrical standards. It is by such steps that the theory of engineering progresses, and no better example could be given than the work of Osborne Reynolds—experimental and mathematical—on the nature of fluid friction, which formulated the distinction between stream-line and turbulent flow, on the process of lubrication and on the free expansion of a gas. No doubt engineering must always include much that is "rule of thumb," and there is an engineering intuition which is an invaluable possession. But as engineering grows more complex it becomes increasingly important to formulate systematic theory, and the formulation of such theory is little more than physics seen through selective glasses. In the third way progress in physics may affect the progress of engineering without intention on the part of the discoverer. Kelvin's work on the oscillatory discharge, Maxwell's discovery, and Hertz's detection of electromagnetic waves are outstanding examples of progress in physics later adapted—by others than the pioneers—to practical ends.

Sir Alfred Ewing quoted John Hopkinson as an example of a master-mind who had enriched engineering in each of the three ways by which physics can promote that art, since he possessed not only a practical talent, but he could grasp with rare power and precision a scientific principle and develop its consequences with the mastery of the mathematician. Hopkinson's invention of the three-wire system of distribution, his series-parallel control for electric locomotives; but, above all, his formulation of the principle of the magnetic circuit, which reduced dynamo design from chaos to a science—all of these exemplify in one man the various ways in which physics can aid engineering.

In another field, that of thermodynamics, or the science of energetics, in its service to engineering, the name of Kelvin is supreme. In a most graphic and interesting fashion Sir Alfred Ewing traced the growth of this science in its engineering aspect from the days of Watt—himself in the first instance a physicist—who invented the condenser, expansive working, and the indicator; through Carnot, who introduced the idea of the reversible cycle and by implication discovered the second law of thermodynamics without quite knowing the first; Clapeyn, a mathematician as well as engineer, who showed how Carnot's ideas could be applied in practice; Joule, who discovered the first law of thermodynamics; to Kelvin, who, as Sir William Thomson, in 1850 finally solved all doubts and difficulties, showed that the conclusions of Carnot and Joule were in perfect accord, and reared on the basis of both a complete science of energy, which, with amazing generality and power he fertilised all fields of physical action, flooding all with light. On parallel, but equally individual lines, came the work of Clausius and Rankine; all founders and master builders.

It was in their attempts to create a thermodynamical, yet practical, scale of absolute temperature that Joule and Thomson made their famous experiments on the passage of gases through a porous plug. The discovery of a small, outstanding cooling effect and the subsequent application of the theory of regeneration (also used by Stirling in heat-engines and Siemens in furnaces) enabled Linde, Claude and others, by liquefying the most refractory gases, to build up a great industry, in which the constituents of the atmosphere are separated, the oxygen put to various industrial and medical uses, the nitrogen used in the manufacture of fertilisers and valuable products, such as argon and helium, also isolated. From the same fundamental investigations in thermodynamics have arisen the important processes of refrigeration—first suggested by Thomson in 1847—processes which now make a continuous appeal, not only to thermodynamics, but to the results of researches in thermal insulation, convection, radiation, and hygrometry.

Passing briefly over the physical problems concerned with the development of the internal combustion engine—which, by the way, made aviation possible—Sir Alfred Ewing dwelt on the importance to the engineer of a knowledge of the properties of steam, which we owe primarily to the pioneer physical researches of Regnault, later theoretical work on the properties of fluids—the idea of "total heat" and "free energy," and the potential functions of Willard Gibbs—and finally, the remarkable work of Prof. Callendar, whose characteristic equation for steam and experimental tables have been indispensable in formulating a correct theory of the steam turbine. The invention of that machine by Sir Charles Parsons was itself but an attempt to bring Carnot's engines, or, in other words, complete reversibility, impossible in the reciprocating engine, nearer to reality, and it has revolutionised steam engineering.

Most of this splendid work was the achievement of the great Victorians, whom it is now the fashion to disparage in certain quarters. But there are giants still, concluded the lecturer. The present age is witnessing a wonderful efflorescence in physics. These new discoveries and new conceptions will in time also find their places in an ordered scheme, and in their turn will inspire the engineers whose business it will be to minister to generations yet unborn.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

18,238. "Electro-mechanical lamps for velocipedes, &c." A. Levy. July 3rd.

18,245. "Amplification and transmission of sound waves by microphones." Soc. Coupleux Freres. July 3rd. (France, July 7th, 1921.)

18,246. "Sparking plug." H. G. Kardoc. July 3rd.

18,248. "Commutator dynamo-electric machines." P. C. Roshen (Siemens-Schuckertwerke). July 3rd.

18,249. "Vehicle head lamps, &c." H. F. Jzoon and D. Lely and Naamlooze Vennootschap Philips' Gloeilampen fabriken. July 3rd

18,252. "Regulating devices for electric installations." Etablissements De Dion Bouton Soc. Anon. July 3rd. (France, July 5th, 1921.)

18,257. "Safety devices for arresting trolley wire and automatically re-adjusting trolley thereto." E. E. Mathers. July 4th.

18,278. "Electrically-heated furnaces." J. Armstrong. July 4th

18,283. "Electric lamp holders." G. O. Donovan and W. Donovan. July 4th.

18,284. "Electric lamp holders." G. O. Donovan and W. Donovan. July 4th.

18,310. "Arrangement for making connection to electricity meters." Landis and Gyr Akt. Ges. July 4th. (Switzerland, July 5th, 1921.)

18,321. "Unidirectional current-carrying devices." Westinghouse Brake and Saxby Signal Co., Ltd. July 4th. (United States, March 7th.)

18,323. "Wireless telegraphy apparatus." A. H. S. MacGowan. July 4th.

18,327. "Relays." S. M. Day. July 4th

18,328. "Colliery trams, &c." I. Rees. July 4th

18,337. "Illuminated advertising devices." A. Wuillemin. July 4th. (Switzerland, July 4th, 1921.)

18,354. "Thermionic vacuum tubes." H. J. van der Bijl. July 4th.

18,358. "Electrical heating devices." British Thomson-Houston Co., Ltd. (General Electric Co.). July 4th.

18,359. "Loaded signalling conductors." Western Electric Co., Ltd. July 4th. (United States, August 16th, 1921.)

18,379. "Electric controller." W. Schwagermann and Ward Leonard Electric Co. July 4th.

18,380. "Rheostat." A. E. Waller and Ward Leonard Electric Co. July 4th

18,384. "Appliance for attaching shades to bodies of electric light fittings." A. I. Dunkinson and Jones Hirst & Co., Ltd. July 4th

18,414. "Electric transmission systems." A. M. Tozier. July 5th

18,419. "Coin released electricity meters." P. F. E. Major, G. N. Miles and C. C. Smith. July 5th.

18,422. "Sparking plug tester." C. H. Mitchell. July 5th.

18,433. "Printing telegraphs." A. Gordon and Siemens Bros. & Co., Ltd. July 5th.

18,443. "Sparking plugs." E. E. F. Doue. July 5th

18,461. "Electric incandescent lamps and holders therefor." H. Werkmeister. July 5th.

18,480. "Rheostat." L. Kebler and Ward Leonard Electric Co. July 5th

18,485. "Storage battery containers." R. E. Beswick and Fuller's United Electric Works, Ltd. July 5th

18,486. "Electric lamps." Edison Swan Electric Co., Ltd., and P. Freedman. July 5th.

18,500. "Telephonic systems." International Callephone Corporation. July 5th.

18,501. "Control of wireless amplifying apparatus." C. F. Elwell, Ltd., and B. E. G. Mittell. July 5th.

18,505. "Spark gaps for ignition systems of internal-combustion engines." F. R. F. Ramsay. July 6th.

18,507. "Electric battery incandescent lamp set." W. A. Kimpton. July 6th.

18,538. "Electric door bell." T. Hewitt. July 6th

18,549. "Electric switches." H. W. Cox. July 6th.

18,562. "Bayonet holders for electric incandescent lamps." C. F. Ramsford. July 6th.

18,567. "Welding electrode." Elyria Iron & Steel Co. and A. L. White. July 6th.

18,572. "Telephone transmitters." Western Electric Co., Ltd. July 6th (United States, October 3rd, 1921.)

18,580. "High electrical resistances." H. St. G. Anson. July 6th.

18,583. "Means for making selective call signals." Soc. Francaise Radio Electrique. July 6th. (France, August 19th, 1921.)

18,587. "Metallic vapour lamps." P. Eversheim. July 8th. (Germany, July 10th, 1920.)

18,609. "Telephone receivers." S. G. Brown. July 6th

18,613. "Wireless receiving and transmitting sets." G. K. Field. July 6th.

18,615. "Electrolytic anti-corrosion systems." A. S. Gush. July 6th

18,629. "Device for use when setting contact points of magnetos, &c." C. D. G. Franklin. July 7th.

18,643. "Device for carrying armoured electric cables in underground workings." A. Leitch. July 7th.
18,638. "Electric pianos." F. C. Griffen. July 7th.
18,649. "Homopolar motors or generators." H. J. Boardman. July 7th.
18,678. "Crystal detectors for wireless telegraphy, &c." T. W. Hardy and W. G. Moir. July 7th.
18,680. "Wireless receiving sets." F. Collver and A. de Solla. July 7th.
18,692. "Insulating devices for wireless installations." S. L. Forbes. July 7th.
18,693. "Insulating devices for wireless installations." A. Couldwell and S. L. Forbes. July 7th.
18,694. "Electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co.). July 7th.
18,709. "Metallic vapour lamp." P. Ewersheim. July 7th.
18,722. "Electric switches, &c." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. July 7th.
18,733. "Dynamo electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. July 7th.
18,734. "Electric motor converter substations." Metropolitan-Vickers Electrical Co., Ltd., J. W. Ross and C. Ryder. July 7th.
18,734. "Dynamo regulator." F. H. Bullinger and Ward Leonard Electric Co. July 7th.
18,735. "Electric resistance device." A. E. Walker and Ward Leonard Electric Co. July 7th.
18,736. "Automatic controller." F. H. Bullinger and Ward Leonard Electric Co. July 7th.
18,737. "Rheostat." G. W. Camp and Ward Leonard Electric Co. July 7th.
18,738. "Rheostat." L. Kebler and Ward Leonard Electric Co. July 7th.
18,740. "Anodes for forming percompounds." G. Baum. July 7th.
18,742. "Electric measuring instruments." T. Mather. July 8th.
18,748. "Renewal, &c., filaments in thermionic valves." A. H. S. Colebrooke and W. A. Williams. July 8th.
18,763. "Electric resistance switches and motor starters." S. Slack. July 8th.
18,776. "Carbon holders for electric arc lamps." W. S. Gibson, T. Stark and B. Udall. July 8th.
18,792. "Electrically-heated devices." British Thomson-Houston Co., Ltd. (International General Electric Co. Inc.). July 8th.
18,816. "Signalling devices for motor vehicles." M. A. E. Dixon. July 10th.
18,888. "Recording instruments." British Thomson-Houston Co., Ltd. (General Electric Co.). July 10th.
18,893. "Retinoscopic lamp." E. Seymour. July 10th.
18,916. "Apparatus for inspection and control of sparking plugs." Soc. Anon des Aéroplanes G. Voisin. July 10th. (France, July 11th, 1921.)
18,917. "Cathodes of electric discharge tubes." Ges. für Drahtlose Telegraphie. July 10th. (Germany, July 11th, 1921.)
18,919. "Electric signalling." N. P. Hinton. July 10th.
18,922. "Electric signalling." F. E. Pernot. July 10th.
18,928. "Process for electrolysis of zinciferous materials." F. Hansgirg. July 10th.
18,931. "Combined locking apparatus for distributing switch of electric lighting installations for motor cars." Scintilla. July 10th. (Switzerland, July 9th, 1921.)
18,932. "Spring electro-magnet armatures for electrical vibration regulators." Scintilla. July 10th. (Switzerland, July 20th, 1921.)
18,933. "Arrangements for intensifying ignition apparatus spark of magneto ignition." Scintilla. July 10th. (Switzerland, July 23rd, 1921.)
18,935. "Amplifiers." A. Benoit and H. H. Duchesne and J. L. Mathieu. July 10th.
18,948. "Automatic self-cleaning sparking plug." T. J. Spidy and G. Thursby. July 11th.
18,961. "Electric switches for motor vehicles, &c." A. G. Fenn. July 11th.
18,969. "Electrical control gear." R. H. Barbour and J. R. Walton. July 11th.
18,982. "Variable resistance for filament circuits of thermionic valves, &c." F. Akister. July 11th.
18,984. "Oxy-acetylene and electricity burning resisting material." C. Clarke and A. C. Jamieson. July 11th.
18,989. "Electric terminals." H. Rottenburg. July 11th.
19,004. "Thermionic valves, &c." W. J. Polyblank. July 11th.
19,012. "X-ray dose meter." M. A. Codd and X-rays, Ltd. July 11th.
19,021. "Automatic reclosing electric circuit interrupters." Metropolitan-Vickers Electrical Co., Ltd. July 11th. (United States, September 16th, 1921.)
19,024. "Apparatus for producing induced electric currents." R. J. T. Jefferson. July 11th.
19,026. "Method of cooling electric machines." H. Klug. July 11th.
19,030. "Electric switch." J. B. McDowell. July 11th.
19,032. "Thermal switch adaptor or coupling for incandescent electric lamps." F. H. Eeles. July 11th.
19,040. "Telegraph systems." Western Union Telegraph Co. July 11th. (United States, April 28th.)
19,043. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). July 11th.
19,044. "Automatic safety device for electric connections." J. Hoffmann. July 11th.
19,060. "Electrical switching apparatus." Siemens and Halske Akt. Ges. July 11th. (Germany, September 14th, 1921.)
19,063. "Recording of sound records." Metal Recording Disc Co., Inc., and A. E. White. July 11th.
19,086. "Tuning control devices for wireless receiving sets, &c." C. B. Brook. July 12th.
19,089. "Electric lighting systems." W. Brooke. July 12th.
19,110. "Trolleys for electric tramways." F. McLoughlin. July 12th.
19,113. "Triode valve vacuum tubes." A. S. Cachemaille (Westinghouse Electric and Manufacturing Co.). July 12th.
19,115. "Wireless tuning coils." H. W. Headland and Headland and Headland. July 12th.
19,122. "Electric controllers." R. Amberton. July 12th.
19,125. "Ignition systems." M. Mallory. July 12th.
19,126. "Apparatus for testing spark plugs and ignition circuits." S. Cooper. July 12th.
19,142. "Liquid-cooled electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th.
19,143. "Dynamo electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). (July 12th.
19,144. "Electric induction apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.) July 12th.
19,170. "Reception and amplification of radio-telegraphic signals." Ges. für Drahtlose Telegraphie. July 12th. (Germany, July 13th, 1921.)
19,174. "Electrical and thermal insulator and process of manufacture thereof." A. A. Samuel. July 12th. (France, August 1st, 1921.)
19,188. "Electric multiplex communication." T. Oguti. July 12th. (Japan, December 18th, 1921.)
19,196. "Illuminating devices." University of Dayton Society of Mary. July 12th.
19,187. "Illuminating devices." A. E. White (University of Dayton Society of Mary). July 13th.
19,197. "Manufacture of tungsten." E. N. Craig, Duralco, Ltd., and R. E. Pearson. July 12th.
19,244. "Electric switches." S. Milburn. July 13th.
19,251. "Control circuits." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 13th.
19,259. "Substitutes for motor vehicles." M. Evans. July 13th.
19,264. "Sparking plugs." M. Bailly. July 13th.
19,277. "Resistance control devices." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 13th.
19,279. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 13th.
19,284. "Apparatus for recording, reproducing, and obliterating sound waves in telephony, &c." F. H. Smith. July 13th.
19,304. "Coil-holders for wireless telegraphy, &c." H. L. Thomas. July 13th.
19,306. "Electric ignition in explosion motors." E. von Lepel. July 13th. (Germany, July 21st, 1921.)
19,307. "Telephone systems." Siemens and Halske Akt. Ges. July 13th. (Germany, July 13th, 1921.)
19,334 "Coil mountings for wireless telegraphy, &c." A. W. Knight. July 14th.
19,344. "Electric furnaces." F. I. A. T. Soc. Anon. July 14th. (Italy, December 23rd, 1921.)
19,357. "Appliance for heating liquid electrically." C. A. Morton. July 14th.
19,370. "Sparking plugs." E. J. Buckingham. July 14th.
19,433. "Automatic exchange telephone apparatus." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.
19,434. "Automatic exchange telephone apparatus." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.
19,435. "Automatic telephone systems." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.
19,436. "Automatic exchange telephone apparatus." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Ward. July 14th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

34,290. "Diaphragms of sound-recording and reproducing instruments." W. E. Clifton, J. S. Ewart, and Clifotphone, Ltd. June 3rd, 1921. (181,142.)

1921.

3,709. "Wireless telegraph calling or alarm devices." T. D. Parkin. January 31st, 1921. (Cognate application, 24,652/21.) (182,155.)
6,868. "Electrical apparatus for producing at a distance indications of the rotation and direction thereof of rotatable shafting and the like, particularly propeller shafts of ships." Mechans, Ltd., and H. Mechan. March 2nd, 1921. (182,161.)
8,730. "Means for generating continuous electric oscillations." C. S. Agate and P. W. Williams. March 21st, 1921. (182,168.)
9,125. "Electromagnets." Relay Automatic Telephone Co., Ltd., and W. D. Edwards. March 25th, 1921. (182,184.)
9,176. "Holders for electric lamps." G. E. Tate and F. O. Monkhouse. March 24th, 1921. (182,194.)
9,486. "Method and means for regulating the degree of vacuum in X-ray tubes." Sir H. Jackson, A. J. Philpot, and British Scientific Instrument Research Association. March 24th, 1921. (182,195.)
9,522. "Electric dry battery cells." Dr. A. Aron. March 29th, 1920. (160,807.)
9,552. "Wireless telephony." R. Whiddington. March 31st, 1921. (182,218.)
9,634. "Process for producing combined records of optical images and sound vibrations." E. Reisz. September 22nd, 1920. (Patent of addition not granted.) (169,424.)
10,057. "Liquid electric controller." R. F. Baerlocher. April 5th, 1921. (182,227.)
10,181. "High-frequency telephone systems." Ges. für Drahtlose Telegraphie. April 9th, 1920. (161,521.)
11,312. "Telephone repeaters." Western Electric Co., Ltd. (Western Electric Co., Inc.). April 19th, 1921. (182,244.)
11,877. "Means for heating the filaments of thermionic devices." Ges. für Drahtlose Telegraphie. April 24th, 1920. (182,288.)
11,879. "Stethoscopic appliances for detecting faint sounds or for reducing the intensity of transmitted sounds." J. A. Scharf. July 16th, 1920. (166,512.)
11,945. "Electrically-heated vaporizer for internal-combustion engines." F. J. Reed and J. S. Reed. April 26th, 1921. (182,253.)
11,981. "Electro-pneumatic relays for organs and like instruments." J. H. Crompton. April 26th, 1921. (182,254.)
12,174. "Train-control systems and time-element devices for use therewith." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and A. F. Bound. April 28th, 1921. (Addition to 175,739.) (182,259.)
12,240. "Means for mounting and driving dynamo-electric machines used with internal combustion engines." J. White. April 28th, 1921. (Cognate application 24,035/21.) (182,260.)
13,730. "Apparatus for heating forgings and the like by electricity." Pagodoli, Turin & Co. December 22nd, 1920. (173,468.)
14,206. "Sockets for electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). May 21st, 1921. (182,279.)
14,442. "Electro-magnetic long-distance switch." G. Matt. May 24th, 1921. (182,282.)
14,563. "X-ray apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). May 25th, 1921. (182,287.)
17,338. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). June 25th, 1921. (182,315.)
17,676. "Shade-retaining ring for electic lamp sockets." H. H. Bennett. June 29th, 1921. (182,317.)
17,802. "Electrical insulators." G. V. Twiss. June 30th, 1921. (182,321.)
18,860. "Control systems and apparatus for air compressors." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th, 1921. (182,333.)
19,350. "Electrical control systems." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (182,336.)
19,942. "Electric cables." L. R. Lee. July 25th, 1921. (Addition to 164,965.) (182,339.)
19,947. "Electric cables." L. R. Lee. July 25th, 1921. (Addition to 164,965.) (182,340.)
21,108. "Electrically-operated indicators." S. Webb. August 9th, 1921. (182,348.)
21,109. "Electrically-operated indicators." S. Webb. August 9th, 1921. (182,349.)
21,864. "Safety systems for electric networks." Naamlooze Vennootschap Lijn Protecte Maatschappij Tot Exploitatie van Electrotechnische en Andere Octrooien. September 16th, 1920. (169,149.)
23,594. "Miners' electric safety lamps." A. P. Ford. September 5th, 1921. (Patent of addition not granted.) (182,364.)

1922.

2,479. "Ignition devices for internal combustion engines." R. Bosch Akt. Ges. January 20th, 1921. (174,633.)

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THE COLLECTION OF FOREIGN TRADE INFORMATION.

TRADE journals which make special efforts to keep their readers acquainted with the state of affairs in overseas countries should be systematically studied by the members of manufacturers' and traders' staffs who are appointed to collect information likely to help in the expansion of export trade. First, it is important to know what publications to include for the purpose of making a useful search; secondly, the study should be made by a representative who has his (or her) wits about him and who has sufficient imagination, either developed or capable of development, to understand the possibilities of his work. But in our view the right papers and the suitable representative are not more essential than is a thoroughly sound method of recording the material to render it available for ready reference by the departments desiring to make practical use of it.

There are several qualities going to stamp a journal as a suitable one to include in such a collection. One with local and circumscribed interests can hardly be expected to have a vision of world affairs and large requirements. The student will not have to peruse many copies of a given publication in order to know whether he can afford to omit it from his list. There are journals whose foreign trade reputation has long been known, so that they go on the list as a matter of course; each number bears the evidence that, as the result of lengthy experience and organisation, the journal's contents and advertisements have gathered about it a multitude of regular readers of the purchasing or specifying classes in various parts of the world. And this reading connection brings to the editors of such journals much interesting matter for which they are always grateful; indeed, few things are more gratifying to those connected with the trade Press than the cordiality of the relationship between themselves and their foreign correspondents. The ELECTRICAL REVIEW is always delighted when its overseas readers address its editors regarding the problems with which they are confronted in connection with their special operations or undertakings—perhaps more of them will take note of this circumstance!

When we know where to find useful information we have to extract and suitably classify and record it. There are big electrical manufacturing concerns which are not content with the mere blue-pencilling of a paragraph or article, leaving a pile of marked journals to accumulate in the hope that they will receive somebody's attention at a convenient season. They make a practice of having everything cut out and pasted on cards for handy reference and classification, perhaps, say, according to country or kind of product. When they contemplate new activities, say, in Australia, in China, or in France or Italy, they know just where to look for all that has been brought together relating to the position of that market and the character of its requirements. Some of the material thus collected has to be used at once while the news is hot—such, for example, as open contracts calling for the obtaining of specifications and the preparation of tenders: other relates to the cost of living or conditions generally which form an approximate guide in arranging for the accommodation of representatives visiting such fields either temporarily bent on preliminary survey work, or for a period of years as an active business cultivating agent, or again as a constructional employé on a particular

contract; other information includes indications of coming large general and electrical development schemes—matters which may be interesting to-morrow or may not be of practical value until next year or the year after. Whenever required, it can be referred to conveniently and profitably if it is brought together suitably.

We commend the importance of this matter to the notice of manufacturers and their staffs who desire to render their foreign trade intelligence service efficient. The trade Press in various cases regards it as one of its special duties and privileges to assist British foreign trade expansion by the collection and publication of information of the class mentioned, and it invites manufacturing and trading concerns to make full use of what it places at their disposal.

A Proposed "Christian Order of Industry."

Some months ago there came to hand in the ordinary course, just as we receive hundreds of other matters for comment, a prospectus of the National Movement towards a Christian Order of Industry and Commerce, which was about to start operations. Its founders were obviously men of lofty ideals and great ambitions who quailed not before the immensity of the task they had set themselves. We ventured to comment upon the scheme generally, primarily with the desire of encouraging readers to study for themselves the proposition that, other things having failed to produce a perfect industrial atmosphere, much less a state or conscience, it was desirable to concentrate upon the application of the cardinal principles of Christianity as the means by which industrial and commercial life might be purified and uplifted. As we have had very lengthy experience as editors, we were not perturbed to find that our comments were very variously received. They excited suspicion from a writer in a labour paper, and we were both amused and surprised at his suggestion that the "F.B.I." as representing Big Business was behind "this latest move" to force the workers back to the conditions of 1908! We were accused by one correspondent of taking up a patronising attitude toward the movement, yet we were heartily thanked by others who were directly interested in the organisation itself! The letters of several correspondents who desired to give an immediately practical turn to the discussion by exposing some of the immoral practices existing in trade, were published in our pages. Inasmuch as it is always our wish that any matter with which we deal should be considered from every standpoint, we welcomed these very diverse views, while we regretted the existence of the totally unjustifiable suspicion referred to because we know how large a factor mutual suspicion has been in preventing the promotion of mutual co-operation. If we return to the subject now, it is because we still feel that the influence of Christian principles in the industries and business affairs of a Christian people ought to be more thoroughly discussed than it is, though, as we indicated earlier in the year, it is our belief that the leavening influence of Christianity is operating in hundreds of unrecognised ways because it is operating freed from the objectionable restrictions and shibboleths of orthodoxy. We hold no brief for any organisation whatsoever in this matter, whether it be called a "National Movement" or whether regard be had to the suspicion of "F.B.I." influence; but our present comments are induced by the receipt of a re-drafted statement that has been issued by the National Movement. We have compared it with the original document, and find that the early enthusiasm has slightly waned. For instance, it has abandoned men and women from "the professions" from its scope and has eliminated "professional" life from the branches to which Christian principles should be applied by the efforts of the Movement! We read this with perplexed thoughts. Are we past redemption that we should be cast out? or is it that in our ranks saints predominate? Our peace of mind returns as we proceed to find that whereas formerly the Movement desired "to co-operate with men and women of goodwill in the ranks of labour," it now adds "and in other departments of national life, *e.g.*, the scientific and educational," which means that the professional element in life is really worthy, after all, and is expected to swell the rallying throng of workers, rather than to be cast out. How interesting must have been the discussions that led to this re-drafting! There are other additions and emendations which indicate that great latitude must be shown by the movement, inasmuch as "Christian ideals may find expression in widely differing types of industrial polity." There are important contractions of aims which unquestionably were too widely stated in the days of early enthusiasm. It is no longer felt that the Movement can set up a Central Inquiry and Information Bureau, or undertake to advise professionally upon schemes for the applications of Christian principles into modern business, or let its voice be heard in the land influencing legislation toward the end for which it is formed. These changes are all for the better. An ideal is of little value unless it be backed with enthusiasm, but enthusiasm may beget an exaggerated idea of what is reasonably attainable and may overlook the fact that Christian principles can never be imposed by Act of Parliament unless the race be Christian first—and then legislation might be unnecessary. During the war the lack of spiritual ideals was generally blamed as the cause of perverted ambitions which brought about the downfall of Prussian militarism. Our own nation recognised the greater need for such ideals here, and that need was expressed by many who are now silent on the point. When the devil was sick the devil a monk would be, &c. But we have said enough to stimulate interest in the re-statement issued by the Movement, and our readers can, if they so desire, obtain copies of the literature from the Secretary at 24, Great Russell Street, London, W.C.1.

X-ray Protection.

In view of the fact that there is little doubt that the majority of the X-ray installations in this country are deficient from the point of view of safety, and that the conditions under which radium workers have to carry out their duties are often calculated ultimately to lead to detrimental effects on the operators, it is not surprising that the degree of protection offered by the so-called protective appliances used by X-ray and radium workers has excited considerable public attention and anxiety recently.

The subject is of special importance, because the early manifestation of visible injuries to the superficial tissues, which may result in permanent damage, or the derangement of internal organs and changes in the blood, which result from over exposure, is often unrecognised. Moreover, in view of the varying susceptibilities of workers to radiation, even periodic tests upon the blood of the personnel made in order to facilitate the recognition at any early stage of any changes which may occur therein do not always meet with success, inasmuch as in the present state of knowledge it is difficult to decide when small variations from the normal blood-count become significant. It is thus possible for serious damage to be caused to the worker before the presence of any delitescent effects is even suspected.

It is agreed, however, that the danger of over-exposure to X-rays and radium emanation can be avoided by the provision of efficient protective measures and suitable working conditions, and it is reassuring to note that the recommendations contained in the X-ray and Radium Protection Committee's preliminary report, the contents of which are referred to in some detail elsewhere in this issue, are being widely acted upon, and the decision of the National Physical Laboratory to advise on, and undertake the inspection of, X-ray installations on request is welcomed as being another step in the right direction. Similar inspection facilities are provided by the N.P.L. for radium workers, and a number of hospitals have already availed themselves of them.

Nevertheless, while it is the duty of those in charge of X-ray and radium departments to ensure efficient protection and suitable working conditions for the personnel, and although it is believed that an adequate degree of safety would result if the recommendations put forward by the Committee were acted upon, it must be emphasised that everything entirely depends upon the loyal co-operation of the workers themselves in following strictly and intelligently the precautionary measures outlined for their benefit.

The F.B.I. and Allied Debts.

Among the many questions which have engaged or which are engaging the attention of the Federation of British Industries, that of allied private claims for compensation against Germany and the problem of inter-Allied debts occupy a very prominent position. In the former case the question arose as a result of a recent application made by Germany for a reduction from £2,000,000 to £500,000 sterling in the amount of the monthly payment to the Allies Offices of Compensation (Debt Offices), which was fixed by the agreement of June 10th, 1921. The Federation addressed a letter to the Board of Trade, asking that instructions might be given to the British representative on the Reparations Commission not to accede to the German request, as a reduction in the amount of the instalment would result in further delays beyond those already occurring in the settlement of claims for compensation by British firms. When the representatives of the Allied Debt Offices investigated the application last week, they reached the conclusion and expressed the unanimous opinion that Germany should continue to pay her fixed monthly instalment owing to the bad faith shown by the German Government in the matter of Allied debts in Germany. As a consequence of this unanimity, M. Poincaré at once informed the German Ambassador in Paris, who signed the request for a reduction in the amount of the instalment, that the payments must be maintained at two millions sterling per month.

It will be seen that the wish of the Federation has been fulfilled in one respect, but its attitude on the much larger question of inter-Allied debts raises some very delicate points. When the Grand Council of the Federation met on July 19th, an impressive speech was delivered by Colonel O. C. Armstrong, president, in the course of which he stated that if Great Britain, as had been suggested in certain quarters, should entirely remit the debts owing to her by her Allies, Great Britain should look for some return in the direction of the breakdown of the tariff walls which are being raised against us by other countries. In the result the Grand Council decided to send a letter to the Prime Minister in the sense suggested by the president.

The letter points out that excluding Russia, other countries owe Great Britain approximately £1,100,000,000, representing an annual charge of £70,000,000 for interest and sinking fund; but the debtor countries are as yet not providing for either of these charges. On the other hand, Great Britain owes £998,000,000 to the United States as a consequence of having used British credit for the benefit of these debtor countries, and on this debt interest at the rate of £50,000,000 per annum is already being paid, and an additional annual charge for capital repayment must be anticipated in the near future. What this means is that the British taxpayer is shouldering a burden equal to over 1s. in the pound on the income tax, which may rise to 1s. 6d. as soon as sinking fund payments begin, in order to relieve the taxpayers of the debtor countries from a liability which they cannot meet at present.

On the other hand, the Federation states that British industry, upon which the chief burden of this taxation falls, is experiencing the most severe depression in the history of the country, accompanied by an unprecedented rate of unemployment. But the debtor countries, which are less heavily taxed than Great Britain and comparatively free from unemployment, have erected and are erecting formidable tariff barriers against the entry of British goods. At the same time, the industries of these particular countries, benefiting by a lower rate of taxation, and temporarily at least by the depreciation of their currencies, are becoming increasingly serious competitors of British industry in the remaining export markets.

It is under these circumstances that the Federation is opposed to permanent cancellation of the debts owing to Great Britain, as such cancellation would not only represent the throwing away of our principal weapon for bargaining in any future settlement, but we should also run the risk that such a settlement might never be made. In conclusion, the Federation expresses the hope that the Government will make no further surrender of British rights except in return for immediate counter-concessions of definite and substantial economic value.

South African Fields.

If only on account of the large programme of railway development which it has now been definitely decided to put in hand in South Africa, that country offers great attractions to the engineering exporter. For the electrification work which has so far been put to tender, satisfactory orders have been secured for this country in the face of American competition. Before the war, it will be recalled, there was a tendency here and there in the Union to install power plant offered at low prices by our foreign competitors. This course apparently has effected no economy in the long run, and purchasers are once more showing active recognition of the fact that in reliability and cheapness in operation, British machinery has no equal. Last year the value of manufacturing machinery imported amounted to £1,514,000, the highest total ever recorded. Of it, the United Kingdom supplied £1,119,000 worth. Some details of the various headings were given recently in our news columns.

These reflections are prompted by the perusal of Mr. C. W. Francis Harrison's admirably produced and illustrated review of the trade, industries and productions of British South Africa. It is a revised edition of his 1919 report to the Federation of British Industries. Mr. Harrison sees a widening outlet for British manufactures in connection with the growth in divers directions of the Union's industries, new and old. His view may at first sight seem distorted, but it must be borne in mind that in the fostering of the new industries, plant, equipment and semi-manufactured material will be required, and that their successful progress means a general advance in the economic state of the Union and in its purchasing power. If the country builds up a number of prosperous industries, it will acquire a more stable position than if dependent on one alone, even such an industry as gold production. It is to be hoped that Mr. Harrison will prove a true prophet in foretelling a bright outlook again for the mining industry. The prospect lends interest to the detailed tables he gives of the quantities and values of all the various stores, including electrical and other machinery purchased by the mines. A warning is added that British firms should economise in their sales organisations because the mining houses feel that they are paying too much in commissions. On the subject of representation, he says, there is universal agreement as to the desirability of technical specialists visiting oversea markets in order to study the trade in their own particular lines and glean first-hand information as to what is required. A very important function these specialists could perform would be the investigation of what new demands could be created. Mr. Harrison adds that they could also inquire into the necessity for firms to amalgamate their manufacturing interests in order more effectively to serve oversea markets. The advisability of arranging combined selling organisations has been advocated by us again and again in these columns.

D

FALSE MARKING AND DESCRIPTION OF GOODS WITH SPECIAL REFERENCE TO ORIGIN.

By THEODORE RICH.

Part I.—Do the Profits Justify the Means?

There is a saying that "all is fair in love and war," but to-day, owing perhaps largely to what might be termed international commercialism, there seems to be almost a convention in some quarters that all is fair in commerce, and that in order to sell goods any deception or humbug is legitimate. The commercial conscience is being seared with the hot iron of "business acumen," and actions which years ago would have been called deliberate fraud, are now often condoned with the remark that the public likes to be defrauded, and therefore deserves to be so. While "friends of the people" have been offering glittering prizes in the way of political social reform, it has been too often forgotten that many boasted improvements have been accompanied by a lowered commercial morality; those who become rich are considered to be *ipso-facto* respectable regardless of the way in which they have made their money; real progress or reform does not stop at the door-mat of the counting-house: it must go through and through business transactions.

There is an old saying, "He that pays the piper calls the tune"; in accordance with the same principle, the man who makes purchases has a right to know who he is dealing with, where the goods come from, and what the quality or description is. Many firms, places, and countries have from time to time earned reputations for goods they manufacture, and vendors, whether direct or indirect, have no right to deceive the customer, directly or passively, into the idea that he is buying something that he is not. It is a fraud on the purchaser, and it is from the point of view of common morality a sort of theft from the people from whom the customer thinks that the things have come.

A customer chooses a particular butcher or baker to deal with, because he thinks he will then get good value and a square deal, and even when prices are equal he may prefer to put the business through a particular tradesman because he likes him and he wants to help him on. A purchaser has the same right of preference regarding the origin of the goods he buys; if a man has prejudices, that is no reason why he should be swindled.

"Caveat Emptor."

A vast amount of dishonesty has been cloaked under the legal maxim, *Caveat emptor*: let the buyer beware. This is all very well when the buyer and seller are both experts, but in most classes of trade the buyer has, to a material extent, to rely on the honesty of the seller, the matter being rendered much more important owing to the very much greater variety of goods brought within the reach of the working classes by the increased exchange value of labour resulting from inventions and improvements in co-ordinated manufacture and transport.

After a great war, when many people have made sacrifices and suffered terrible losses, there are naturally many men and women who do not wish to deal with their late enemies, at any rate on a par with their countrymen or their war allies; and although this feeling may be sneered at by those who made hay while the blood flowed, it is a legitimate feeling. While to deceive such people may be fashionable in some circles, yet it is cruelly unfair to the best of the nation, and should, if right were right, be punished with the utmost rigour of the law.

It is very difficult to deal with a subject such as the false marking and description of goods without going somewhat into the history of the question, and while it is possible to deal with the law as it stands and certain legal decisions alone, such an examination is of very little use unless the practical difficulties connected with the application of the law are explained, and these can only be handled when economic, political, and other factors are taken into consideration. It is difficult to entirely separate trade marks from other questions, and therefore they will be touched upon from time to time.

Blue Books.

A considerable part of the matter in this series of articles has been based on the minutes of evidence of different Parliamentary Committees which have inquired into the marking of goods and produce from 1893 to the present day. The following are among the reports of interest:—

House of Commons.—Report on the Merchandise Marks Act of 1887. 1890. 360 pages. Price 3s.

House of Lords.—House of Lords' Second Report on the Marking of Foreign and Colonial Produce, 1894. 83 pages. Price 11d.

Report on the Marking of Foreign Meat, &c., 1893. 220 pages. Price 3s. 1½d.

Board of Trade.—Merchandise Marks Committee, Minutes of Evidence. Published August, 1920. 272 pages. Price 30s.

Report on same. Published July, 1920. 16 pages. Price 2d.

By examination of the blue books it is possible to note the gradual change in mentality which has taken place during the last 30 years, not merely in commercial circles, but also among Government officials, whose actions and ideas tend to follow the wishes of their Parliamentary superiors.

It is interesting to note that the cost of printing has gone up ten times from 1890 to 1920.

The prohibitive cost of recent Government publications tends to shut out from the public the very information that Government Committees are formed to bring out. If the Government decides to publish evidence or other information in the form of blue books for the information of the public, the cost of setting-up should be a charge on the State, and the only cost to those who want to obtain the information should be that of paper and machining. To charge 30s. for minutes of a committee whose findings may affect every manufacturer and trader in the country, is to cut off a vital source of national education, to publish in theory and to suppress in fact. The object of a Government Committee is to elucidate facts, promote discussion, and encourage reforms where necessary. Recently the sum of 15s. was charged for a short report on the railless trolley system.

In the 1919-1920 Committee, members of the Committee itself were allowed to give evidence, a procedure more modern than honest; a man should not be put in a position where he might be plaintiff, witness, judge and jury of his own case. This procedure was brought into notoriety during the 1919 Coal Commission; it tends towards the selection of members by professional politicians in order to obtain the findings desired.

Change in National Outlook.

The evidence of the 1890 Committee is worthy of study, because at that time our industry, commerce, and finance were to a very material extent British in character and not merely in name, and ample evidence could then be seen of that common honesty and sterling character which did so much to build up the nation.

When one comes to study the minutes of the 1919-1920

inquiry, one is forced to the conclusion that ideas of commercial morality and public duty have undergone a change for the worse.

The idea that the profit justifies the means may be all very well to some people; a public that is being fooled, which notes that all kinds of trickery are condoned, which is told that, provided there is profit in it, we should trade with Krassin and Trotsky, begins to react and condone "free fraud." Those who ridicule the efforts of the old trade guilds in the past to keep down bad workmanship, imitation, and fraud, are the same class of persons who come to give evidence, proclaiming, in effect, that the purchaser deserves to be fooled—that he has no right to know what he is buying and where it came from.

"What they call Patriotism."

At the 1919-1920 inquiry a representative of a number of concerns, controlled largely by multi-millionaires and specialists in mergers, who opposed the idea of an Empire Trade Mark, crystallised, in paragraph 4,938, the commercial mentality of the day into a few words:—

"*Question*: As a general inference, Sir John Cockburn (who was interested in the question of 'national' and 'community' marks) is taking the patriotic view that British goods are better than those of the rest of the world? *Answer*: That is the *inherent vice* of this application; that is prompted more *by what they call patriotism* than by sound business sense.

Question: We have had an immense amount of evidence that it is to the interests of a very great number of people to infringe British get-ups and trade marks? *Answer*: Yes."

Experience in the war has shown that it is of importance, from a strategic point of view, that a country should be as far as practicable self-contained. Germany could not have kept going 12 months if it had not been for the remarkable system by which the production of food and manufactures could go on simultaneously. Between 1914 and 1918 France found herself as a manufacturing nation.

After the war a number of patriotic French manufacturers banded themselves together to encourage co-operative national production and to that end got out a trade mark "Unis," "a mark of origin on the one hand; on the other hand it is a mark of quality" (paragraph 5,143).

A number of British firms, some of them concerns whose names are household words, persuaded perhaps by influences which came so often to a head before and since the war when matters of real value to the Entente Cordiale were proposed, opposed the use of this mark in the United Kingdom, and recently spent many hundreds of pounds in law costs to try and prevent our former comrades in arms from obtaining reasonable facilities in our Courts of Law, by registration under the Trade Marks Acts, in order toprevent fraud.

Friends of Free Fraud.

During the last 30 years evidence at official inquiries on matters from frozen beef to plated forks, seems to show, whether on the part of retailers, wholesalers, import merchants, shippers or transhippers, that those who oppose the honest marking or description of goods or produce are those who passively allow the intermediate or ultimate purchaser to be deceived, because by doing so they make more money. Provided extra profits are made, it is reactionary to ask inconvenient questions. The way in which friends of self-deception by customers wriggle when under cross-examination by friends of honest trading, is a most interesting feature of several inquiries, and one must say regarding many dealers that "*qui s'excuse s'accuse*." Some of the arguments used by some of those who admit that they have been large importers and dealers in German goods give an indication of where their sympathies lie.

German Competition: its Inception.

Years ago British manufacturers had a very high character for integrity, and although the British workman was, so we are told by gushing sociologists, in the depths of degradation, he nevertheless turned out about the best work in the world at the fastest rate. It came about, therefore, that British goods found their way into all parts of the world, and enjoyed and deserved a very high reputation.

In the second half of the last century, when after a series of wars the European boundaries were settled and the wave of organised communism began to die down, great efforts were made to build up manufacturing interests or operations in Central Europe, especially in Germany.

Bismarck realised that to obtain success as a world power the sword was useless unless backed by a solid structure of industry, and he therefore called in, to aid him in his programme, the manufacturer, the merchant, and the financier. Wherever the German commercial traveller went he found British goods supreme, with a high reputation, and therefore it was decided to imitate the Machiavellian methods of Frederick the Great to gain the ends desired by peaceful penetration and trickery. Numbers of financial and commercial men were sent over to worm their way into our business community, with instructions to take an enthusiastic interest in industrial politics. Men of the Karl Marx type were financed and encouraged to beat up industrial trouble; swarms of German clerks came over to act as foreign correspondents at low wages, and their services were accepted by those who could not see many inches in front of their noses, and week in week out the theory was preached that immediate profit was the main thing, leaving the future to take care of itself.

Scores of men, backed by Mid-European finance, set up in business in London and in the big manufacturing centres, obtaining the rights of citizenship at the earliest possible moment whilst buying certain quantities of British goods to send abroad and to sell at home. As soon as they got a footing, samples of local productions were sent to their brothers and cousins in the Fatherland, and imitation British goods, got up, packed and labelled to look like local productions, were sent into the markets where British goods went.

Taking advantage of British easy-going tolerance, scores of men of German origin changed their names or floated companies with a British or local flavour about them, thus heightening the illusion. According to evidence given before the 1920 Marks Committee, paragraph 3,675, the Sheffield Chamber of Commerce "submitted that legislation ought to be passed to enable a city or town celebrated for the manufacture of some particular goods, to have some jurisdiction over the assumption of the name of that city or town in the titles of limited companies or firms or other trading concerns. A small trader often selects the highest sounding name. . . ." In Sheffield several companies have been registered in recent years in which "Sheffield" is put first in such a way as to lead to the belief that the concern is one of immense local importance; *e.g.*, Sheffield Steel Makers, Limited—a concern formed by a German. It failed, and all the chief Sheffield steel manufacturers bought the goodwill from the liquidator to get the title into their own hands.

At the 1890 inquiry, paragraphs 1,377 to 1,381, a witness from the Sheffield Federated Trades Council said: "Foreigners come and take up positions among us as factors, and also manufacture goods in Sheffield, have large consignments of foreign-made goods come to their warehouse in Sheffield; they send them out without distinction; the invoice bears the word 'Sheffield'; the goods are blank. . . If you are a South American importer, that is to say, you receive so many gross of knives from Sheffield, and you believe them all to be Sheffield make."

We therefore got the following state of affairs:—A foreign or home buyer hearing of some firm with a British-sounding name in some centre, such as Nottingham, Birmingham, or Manchester, celebrated for some class of goods, forwards an order; British goods mixed

up with German, or German goods only, are supplied, which the retailer quite innocently sells as goods of the locality in question.

There is a further incentive to false marking. It was pointed out in 1890, paragraphs 3,731-6, that there were firms of foreign origin in Sheffield which even at equal prices gave preference to their foreign allies, a matter of importance when the purchaser did not know he was buying a foreign article.

In the 1890 inquiry (paragraphs 4,062 to 4,068) it was pointed out that in some trades "There is nothing new which comes out in France and England but which is copied in Germany." "They imitate everything, . . . the goods, . . . the marks" (paragraph 3,660). "The greatest offenders are the Germans." The crux of the matter was that people were willing to pay a better price for British goods than for German; therefore it paid to sell one as the other.

Although the above extracts are mostly taken from the 1890 inquiry, the practices complained of had gone on for years. Manufacturers got alarmed at the way their designs were being copied, and they were being robbed of trade they had built up legitimately, and the result was the Merchandise Marks Act of 1887.

The question of the revision of this Act is now under discussion in Parliament.

ELECTRICAL ENGINEERING AT THE LIÉGE EXHIBITION.

By W. POLYDOROFF, A.M.I.E.E.

One must be well acquainted with Belgium to be able to appreciate the efforts of the Society of Engineers of this industrious little country in the organisation of such a wonderful exhibition of technical developments and various Belgian products.

Liége, being considered as the Belgian industrial centre, was chosen as a suitable place for the exhibition. Three magnificent palaces, and a number of small kiosks in which provision is made for different firms to exhibit their productions, are situated on the right bank of the river Meuse, in the grounds of the beautiful park of Boverie.

It would take too much space to describe all the exhibits; I shall therefore only mention some interesting improvements in electrical engineering. Electrical machinery is a much developed branch in Belgium, and is well represented at this exhibition. Many new types of dynamos, motors, &c., are shown. The Société d'Electricité et Mécanique exhibits new types of large and small d.c. motors which, being strong, simple, and waterproof, are suitable for use in collieries; there is also a variable transformer with a ratio of transformation of 1 to 300, which is a very useful apparatus for laboratory testing or experimental work.

An entirely new and very remarkable type of rotary converter is built by the Constructions Electriques de Belgique. The rotor is of squirrel-cage type, and the machine is self-starting and self-synchronising. The simplicity of handling by means of a special controller makes this machine still more convenient. I was told that this rotary converter was the second machine of its kind, the first one having passed through many successful trials. The designer claims for it very high efficiency.

The Ateliers de Constructions Electriques de Charleroi shows various heavy enclosed machines. The firm has developed very reliable high-pressure switchgear and other h.p. apparatus.

Oil circuit breakers and switches of high capacity for high pressure are the speciality of Soc. Anon. Jean Labouverie, and are very well designed for great durability. The same firm exhibits the Fuss automatic voltage regulator, which is a small, inexpensive, and reliable instrument based on a new principle; it is used all over Belgium, but is almost unknown in England.

Messrs. Brown, Boveri exhibit their well-known high-power mercury rectifier (220 volts, 910 amp.). Their engineer told me that the firm had recently solved the problem of transformation from high pressure to low pressure with the high efficiency of 97-99 per cent. by means of the mercury arc. They had also succeeded in obtaining a.c. from a d.c. source with the aid of their apparatus. The firm exhibits models of its electric locomotives of 1,750 h.p. for Swiss railways; the Oerlikon Co. has made great progress in this direction, and shows 2,300 h.p.

The Heyland type 3-phase commutator motor is made by the Comptoir Franco-Belge d'Electricité; it is a small motor for common use, easily regulated by moving the brushes.

It is worthy of note that nickel-iron (alkali) accumulators are now in common use in Belgium, and replace the ordinary sulphuric-acid ones. I saw the new type of Jungner battery, which was as big as the Tudor. All the new miners' lamps are fitted with nickel-iron cells, and there is very little difference in cost.

Wireless telegraphy is well represented by the Société Indépendant Belge de la T.S.F., which has acquired various French patents in Belgium. The S.I.B. has its own reception room, with a single aerial. It was only by means of a special pass from the Society that I could get into the reception room—so large was the crowd of people awaiting their turn to listen to the wireless mysteries. The Society has taken advantage of the great public interest in wireless, and besides developing its famous French apparatus, has produced an amateur's set called "Radio-puzzle." This set is very nicely finished, and is offered at a reasonable price, so that the amateur buying set No. 1 is easily tempted to buy Nos. 2, 3, &c.

I am afraid it would increase the rush of British visitors to Belgium if I were to tell them that a really good French valve only costs 7s. there, and every amateur can afford to use several valves.

I must mention the magnificent scheme for the exploitation of the water power of Belgium (River Meuse) expounded by a group of leading engineers of the country. It has been calculated that the exploitation would give 1,830 million kWh per annum, thus effecting a saving of three million tons of coal, equivalent to 400,000,000 francs per annum. The complete scheme would cost about 5 milliards of francs, representing 2 per cent. of the annual budget of the country during 25 years. The outlay necessary to bring the river into a navigable state through the country is included in the scheme.

It is an audacious and wonderful enterprise, and I am sure it will be sooner or later carried out either by the State or by a private company. It is enough to visit once this assiduous country to understand its capacity for enterprise throughout the whole world.

The Rubber Industry.—On July 26th Lord Colwyn opened the new laboratories of the Research Association of British Rubber & Tyre Manufacturers at Croydon. The premises comprise offices, a library, experimental and test laboratories, and a rubber factory in miniature. Mr. Alexander Johnston (North British Rubber Co.), who presided, said that rubber entered into every branch of industry, making the manufacture of rubber an important process. He was confident that prosperity would soon be restored to both the production and manufacturing branches. Lord Colwyn said that Germany was a keen competitor, for whereas she had money to develop her industries, British enterprise was handicapped by excessive taxation. The rubber industry was in a bad position, and he hoped that America would not be in a position to buy up properties at the present low prices. On the same day, at the annual meeting of the Bukit Mertajam Rubber Co., Ltd., the chairman (Mr. A. G. Angier) said that restricted production and rigid economy were in force—the estate was only producing half of the possible quantity, thus conserving the bark against better times. The loss for the year was £2,900, as against £9,460 in the previous year.

THE ELECTRICAL EQUIPMENT OF THE LONDON COUNTY HALL.

Formed by Act of Parliament in 1889, the London County Council was charged with the administration of an area of 117 square miles, which contained a population of 4½ millions—as many souls as Australia or Canada at that date. Yet, in spite of the dignity and importance of the Council, it was not until 1905 that active steps were taken to house it and its growing staff in a building worthy of the purpose. In the following year a site was acquired on the south side of the river, opposite the Victoria Embankment, and as the result of an open competition, a design submitted by Mr. Ralph Knott was adopted, the author being subsequently appointed architect for the building in association with Mr. W. E. Riley, the official architect to the Council.

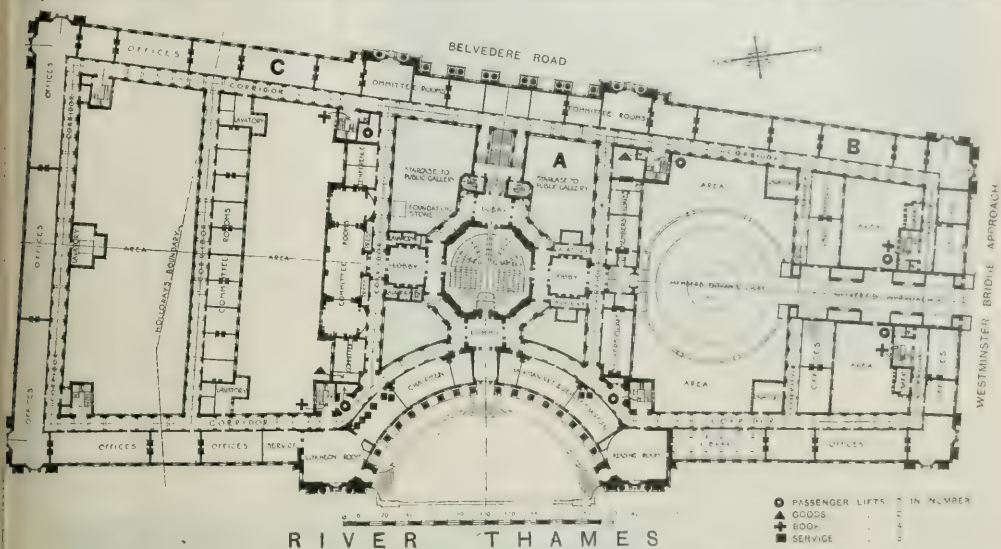


Fig. 1.—Plan of Principal Floor of New County Hall.

The area of the Westminster Bridge site, including some 2½ acres reclaimed from the river, is about 6½ acres, and the building, when completed, will be 750 ft. long, with an average width of more than 300 ft. It will be appreciated, therefore, that the County Hall is one of the largest structures in the country; it has already cost 3½ millions sterling, and the total cost, when the remaining section is completed, will be over 4 millions. The building comprises 9 storeys, the lowest two of which are below ground level, and will be used mainly for storage purposes. The whole of the site is covered with a concrete raft 5 ft. thick, surrounded by retaining walls; a plan of the principal floor is reproduced in fig. 1. The contractors for the superstructure were Messrs. Holland, Hannen & Cubitts, Ltd., whose tender was accepted in March, 1913; it was hoped that the building would be completed during 1916, but the outbreak of war seriously delayed the work, which in fact was brought to a standstill early in 1916, the habitable part of the building being occupied by the Ministry of Food and H.M. Office of Works until 1919. In that year work was resumed, and on July 17th, 1922, the County Hall was formally opened by the King, who had laid the foundation stone in 1912.

The whole of the building work has been carried out in accordance with the highest standards of material and workmanship. The Council Chamber, fig. 2, which accommodates 200 members, is octagonal in plan, is 55 ft. in height, and is lined with marble and oak panelling of great beauty, and the committee rooms, lobbies, and main staircase, fig. 3, of the principal floor are decorated in similar fashion. Great attention has been given to the heating and ventilation of the building, especially with regard to the Council Chamber, which is supplied with filtered air cooled or heated according to the season, and maintained constantly at a temperature of 65 deg. F. by automatic apparatus controlled by thermostats. The electrical equipment of the building, which comprises lighting, lifts, protection against lightning, telephones and electric clocks, bells



Fig. 2.—Council Chamber.

and annunciators, and power for various purposes, is naturally very extensive and elaborate.

The installation generally has been carried out by the builders, Messrs. Holland, Hannen & Cubitts, Ltd., through whom sub-contracts were entered into with the various firms mentioned below. It represents thoroughly up-to-date practice in the electrical equipment of an important building.



Fig. 3. Main Staircase.

Electricity is supplied by the London Electric Supply Corporation, at a pressure of 10,000 volts, single-phase, 85 cycles, to a 750-kW transformer sub-station in the basement under the spot marked A in fig. 1; the e.h.p. switchgear and transformers, which are not yet in position, will be supplied by the British Thomson-Houston Co., Ltd. The transformed energy from this source will be the main lighting supply; it is carried to three separate main switchboards in the basement under the positions marked A, B, C, in fig. 1, whence it is distributed throughout the building at pressures of 420 and 210 volts on the 3-wire system. A stand-by 75-kW d.c. lighting supply is furnished by the Westminster Electric Supply Corporation at 400 and 200 volts, and is distributed from three switchboards located adjacent to the three mentioned above. Fig. 4 illustrates the lighting switchboards in, and fig. 5 is a plan of, the principal distributing centre at A in fig. 1.

In this connection Messrs. Crompton & Co., Ltd., are supplying a booster set that will consist of three machines; the motor will be fed by the 460-volt incoming supply, and it will drive two boosters in the outers of the stand-by supply. Each machine will give a boost of 10 volts at light load and 15 volts at the full load of 70 kW. Messrs. Allen West & Co., Ltd., are making the control panel for the booster set, which will, in conjunction with a current relay, start the machine or stop it automatically as the case may be when the demand on the stand-by circuit reaches or falls below predetermined points, which are adjustable. Every contactor switch will be interlocked to ensure the proper sequence of operation, and a further interlock is to be provided so that in the event of an overload or failure of the supply, the motor will stop and the lighting circuits will be connected direct to their own supply mains; provision is also to be made for switching in the set by hand, if required.

The d.c. 3-wire power supply is furnished by the London Electric Supply Corporation, and from the two main switchboards it will be fed to all motors above 3 h.p. at 460 volts and to machines below that size at 230 volts. The use of the 3-wire system throughout instead of the 2-wire system has resulted in a saving of copper to the value of £8,000.

Switchgear.—Messrs. Dorman and Smith, Ltd., supplied practically all the switchgear at present installed throughout the building. Simplicity and accessibility are leading features of its design, the connections being mainly of bare copper strip or rod carried on insulators.

There are eight main switchboards in all, and a total of close on 60 sub-distribution boards located about the building. The main and stand-by lighting boards are similar in character, consisting of black enamelled slate panels with the insulation reinforced with micanite all supported on steel framework extending from floor to ceiling. The bus-bars are rigidly supported and clamped on to the back of the framework, porcelain insulation being employed; the bus bars as a whole are protected by fire-proof insulating screens, and deep insulating safety barriers are placed between adjacent panels, the whole design being on the lines of safety.



Fig. 4.—Lighting Switchboards.

One main lighting board provides for two 250-amp. incoming feeders, 10 100-amp. single-throw outgoing feeders, and two 100-amp. change-over balancing feeders. The second main lighting board is similar, except that the number of outgoing circuits is less. The third main lighting board controls a 500-amp. incoming, 12 100-amp. single-throw outgoing feeders, and three change-over balancing feeders. One stand-by lighting board provides for one 300-amp. incoming feeder, five 100-amp. single-throw outgoing feeders, and two 30-amp. change-over balancing feeders. The second and third stand-by lighting boards each control one 100-amp. incoming feeder, two 100-amp. single-throw outgoing feeders, and two change-over balancing panels of 30 and 50 amps. respectively. On each panel are mounted instruments, with switches, fuses, and neutral links, and in the case of the main lighting boards, provision is also made for recording the current carried by any feeder by means of graphic recording instruments of the continuous chart pattern, which are mounted on portable panels with flexible connections. All the instruments were provided by Messrs. Everett, Edgcumbe & Co. From the switchboards the incoming and outgoing cables pass upwards to sealing boxes mounted on the framework immediately above the respective panels. The

two main power switchboards are of the totally-enclosed unit patern and completely ironclad; the incoming and outgoing cables pass through self-contained sealing boxes to the units containing the switches, fuses, links, bus-bars, &c. Cast-iron boxes with hinged lids having machined facings are used throughout, and safety interlocks are provided in the case of the switches to prevent access to the apparatus while "alive." The bus-bars are fully ironclad and enclosed, and the complete gear is supported on massive framework cemented into the floor and ceiling. Barriers are placed between metal work of opposite polarity, and locking up provision is made in all cases, so as to prevent access by unauthorised persons. One main power board controls one 500-amp. incoming feeder, six 200, one 100, and three 50-amp. outgoing circuits, and the

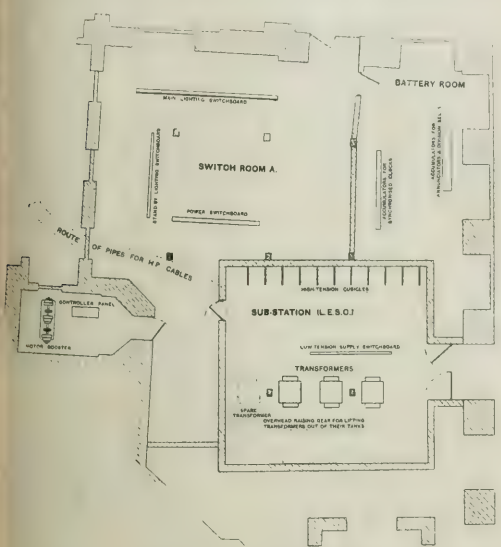


Fig. 5.—Plan of Sub-station.

other main power board controls a 300-amp. incoming circuit, one 200, one 100, three 50-amp., and one 15-amp. outgoing circuits.

The sub-distribution boards are of the ironclad totally-enclosed pattern, those for the general power circuits having separate compartments for opposite polarities, with double lids and safety interlocks, so as to prevent access to both poles at the same time; locking provision is also made to prevent unauthorised interference. As in the case of the main power boards, the joints between the lids and boxes have machined facings, and screwed conduit is used for the cables. There are a number of distribution fuse boxes of the ironclad pattern for the ventilation plant, while the lighting distribution is effected throughout the building by means of Dorman & Smith standard porcelain "Factory Thumb" and "Factory Damper" fuses, with bus-bars and terminal blocks embedded in porcelain bases and mounted at the various distribution centres. The type of fuse used for the smaller currents has been standardised throughout the building; similarly for larger currents the firm's "Handle" fuses have been standardised, and all the switches are of the Dorman & Smith standard d.p. "C" pattern. The standardisation of the equipment in this manner permits of full interchangeability, and at the same time reduces very considerably the number of spare parts that needs to be kept in stock.

(To be concluded.)

Wireless on the Stage.—A feature of a forthcoming London revue is to be a wireless number, in which genuine Marconi apparatus will form part of the stage "props."

SOME SIDELIGHTS ON ELECTRICAL PUBLICITY.

By "VOLTMAN."

It might be thought by many that in these times when the influence of the Press amongst the great mass of the public in general is universally recognised, and the wonders and advantages of electricity as applied to everyday life are so widely extolled in the newspapers, there could be very few of the middle-class public who knew little or nothing of the aforesaid advantages and conveniences of electricity readily available if they only chose to utilise them. It is nevertheless a patent fact that a large section of the middle-class public has but a very hazy idea of the many conveniences, and the amount of time and labour that can be saved by an intelligent use of electricity in the household. There is undoubtedly a great deal of electrical publicity practised, much of it clever and original, but in the writer's experience at any rate this publicity and propaganda makes very little impression on the important class of the public in question. There are so many people who have the rooted idea that the electricity laid on to their houses is limited in its usefulness to lighting. Most of the publicity they see every day deals with lighting, and, generally speaking, they use electric light, and that is the sum total of their interest in domestic electricity.

The writer contends that if this section of the public could be impressed with the wide possibilities of electrical applications in their own homes it would be all to the good and prosperity of the industry. The fact must be kept in view that there is a great want of imagination and enterprise in many people. Electricity is a "mystery" to them. Anything beyond switching on a light requires "expert knowledge" when it comes to handling electricity, so they think!

Here is an instance that came under the writer's observation a little while ago. A lady who uses a hand-driven sewing machine very largely had never heard of such a thing as a small-power electric motor that could be run from an ordinary lampholder. The writer explained that this very diminutive motor could without much difficulty or expense be attached to the sewing machine and vastly increase its usefulness and convenience. The lady was so struck with the idea that she decided then and there to have this useful electrical application. Obviously, this will be good publicity, as this—to her—novel idea will so impress her friends that they will want an electric drive for their sewing machines.

Take the case of small electric fans. There are thousands of homes wherein a small fan would be a much-appreciated accessory. Yet how many people ever think of buying one? They do not seem to know that they can easily tap off the current for the fan from any ordinary lampholder. True, they may see a fan working in a shop window or at an ideal home exhibition, but that does not necessarily impress them that it is something they can readily utilise in their own home; they think that special arrangements are necessary, and possibly expert handling!

Another instance: a City man of considerable means known to the writer, and a man who is generally "*au fait*" as to novel and useful appliances, was totally unaware that there was such a thing as an electric cigar and pipe-lighter that can be worked off any house supply. Being a "devotee of the weed" he has quite a collection of petrol lighters, but now that he has seen how much safer, cleaner, and more convenient the electric lighter is he is delighted with it, and has bought several to use throughout the house. This, again, means good publicity in proportion to the number of people who will see and use that contrivance under conditions just as in their own home.

Again, whilst many people would be unprepared to go in for the larger applications of electric heating,

they would probably adopt the smaller applications. The lady members of a household can, as the writer knows, be very favourably impressed with such conveniences as small portable radiators that can be taken anywhere and connected to a lampholder. Then there are electric irons, curling iron heaters, electric hair driers, and one must not forget vacuum cleaners! The people who would be delighted to use these appliances want "educating electrically." They do not know anything about them at present. They want to be taught how useful a servant a small electric motor can be in the kitchen for knife cleaning, polishing various kinds of ware, and other jobs that require much time and labour. The people with a motor-house want to be taught that their electricity supply is useful for warming the motor-house when a sharp frost sets in and thus saving them from getting a damaged engine. In short, a new educational publicity campaign to further the use of domestic electricity is badly needed; and now would seem to be the time for it, just when the industry is in need of all the support it can get.

[Yes; but the lampholder propaganda is a dangerous one, and is apt to result in ruined holders and flexible cords, with consequent irritation to the user. Let us have the publicity campaign, but not in terms of lampholders.—Eds. Elec. Rev.]

PARLIAMENTARY NOTES.

(From Our Special Parliamentary Reporter.)

Electricity (Supply) Bill.—This Bill was considered in report on July 25th.

Mr. Neal, Parliamentary Secretary to the Ministry of Transport, moved a new clause empowering the Electricity Commissioners to exclude from the area of supply of a power company any part of an area in which any right of the power company to supply electricity was subject to the absolute veto of some other authorised undertaker and any part of that area which at the time of the local inquiry was not being supplied by the power company, and which could be better served by the Joint Electricity Authority itself, or acting through any authorised undertakers. He said that the new Clause had been agreed on between the Government, the Power Companies Association, and the Association of Municipal Corporations.

Mr. G. Balfour said that, in his view, this would authorise the Commissioners to over-ride the authority given by Parliament to a company, and might deprive a company of an area which it was prepared to supply as soon as a request was received from an intending consumer, and in respect of which expenditure might have been incurred with a view to a supply being provided.

The clause was agreed to.

On the motion of Major Hills, a new clause was agreed to allowing a railway company which took a supply of power to use it for traction outside the area of supply of the electricity authority as well as inside it. Other new clauses agreed to related to payment in respect of stand-by supplies of electricity, and set forth the conditions on which restrictions on generating stations and obligation to take supply from them were not to apply.

The report stage of the Bill was concluded, and on the motion for the third reading, Mr. Hopkinson said that if the scheme embodied in the Bill were carried out it would put the supply of electricity on a syndicalist basis under which geographical monopolies would be created. To put the electrical undertakings on such a basis meant that the consumer was going to pay just as in the case of the railways.

The motion for the third reading was carried.

Wireless Telegraphy and Signalling Bill.—During the Committee stage of this Bill on July 25th, Mr. R. Richardson said that he understood that under the regulations British-made wireless sets were to have some preference. He asked what was the nature of such preference, and how were the public to be protected against exploitation?

Mr. Kellaway, Postmaster-General, replied that the intention was to limit licences for a period of two years to receiving sets manufactured by British firms. There was no risk of the users being in any way injured. They would be if there were not effective competition, but he was satisfied on this point. If there were a danger of the manufacture becoming a monopoly of one firm, there might be justification for allowing foreign-made sets to be imported; but there were some twenty firms in the country which were anxious to manufacture and to place on the market these receiving sets. It was clear, therefore, that the interests of users were adequately protected.

The Committee stage was concluded and the Bill was reported to the House.

Wireless Broadcasting.—On July 27th, Mr. Kellaway, the Postmaster-General, replying to questions, said that no licences had yet been issued to establish broadcasting stations, but he understood that the principal manufacturers of wireless apparatus in Great Britain would combine to form a company or companies to provide broadcasting services. Any *bona-fide* manufacturer in this country would be admitted to membership of any company so formed. It was proposed that the receiving apparatus which might be used under the licence, should be limited to types submitted by members of the broadcasting companies, and that it should conform to certain technical standards.

The functions of the Post Office would be limited to approving types of apparatus submitted by members of the company, and inspection of individual sets would not be necessary. Those who had constructed their own receiving sets or had already purchased imported receiving sets would be allowed to use them. The revenue required for providing the services would be derived partly from a contribution by the manufacturers to the company and partly by a proportion of the annual licence fees.

On July 30th, Mr. Kellaway informed Mr. Raffan that it was intended that the apparatus which might be used for the reception of broadcast matter should be limited to types submitted by members of the proposed broadcasting company or companies by which these services would be provided.

Wireless Telegraph Act.—On July 28th, Capt. W. Benn moved to omit the Wireless Telegraph Act, 1904, from the scope of the Expiring Laws (Continuance) Bill, on the ground that the Postmaster-General had now before the House the Wireless Telegraphy and Signalling Bill. But his main reason was the proposed improper use by the Postmaster-General of his powers under the scheme for broadcasting wireless messages. Broadcasting was put into the hands of a combine with regard to which the House had been given but little information, and, secondly, the apparatus to be used for the transmission or reception of messages must be of British manufacture. Why, he asked, should not a person who obtained his licence be at liberty to construct his own apparatus, or buy apparatus that was made abroad?

Mr. Kellaway, in reply, denied that any monopoly was possible under the terms he had already indicated. The electrical firms of this country had reached as high a degree of efficiency as any in the world. The scheme was open to every *bona-fide* electrical manufacturer in this country.

The amendment moved by Capt. Benn was rejected by 126 votes to 30.

Underground Fares.—On July 27th, Mr. Gilbert asked the Parliamentary Secretary to the Ministry of Transport whether he could announce the decision of his Department regarding an inquiry into the present fares of the underground railways of London.

Mr. Neal replied that it had been decided to ask the Rates Advisory Committee to advise the Minister, in pursuance of Section 6 of the London Electric Railways (Fares, &c.) Act, 1920, as to what, if any, modifications should, in the circumcumstances, be made in the fares now in operation and charged by the companies under that Act.

Private Bills.—In the House of Lords on July 25th, the Grampian Electricity Supply Bill, and the London County Council (Tramways and Improvements) Bill, were read a third time and passed. The North Metropolitan Electric Supply Bill was read a third time in the House of Commons on July 26th.

On July 30th the Black Country Tramways and Light Railways Bill was read a third time in the House of Commons.

Vulcanised Fibre.—On July 30th Dr. Murray asked the President of the Board of Trade, whether his attention had been drawn to the fact that the standard price of American vulcanised fibre in this country for several months past had been 1s. 7d. per lb.; whether he was aware that the price quoted by the British firm which was the complainant before the committee appointed under Part III of the Safeguarding of Industries Act was 1s. 3½d.; and on what grounds he considered a *primâ facie* case to exist for proving that sales of American fibre, which was the raw material for many trades, were causing, or likely to cause, unemployment in the British industry?

Mr. Briant asked why the meeting of the committee appointed to consider the complaint and application for a duty of 33⅓ per cent. on imported vulcanised fibre, which was fixed for August, had been adjourned; whether this complaint was only made by one firm employing a small number of people; if so, in view of the serious position to which many firms which found it necessary to import this substance to carry on their business were exposed, and seeing that the prices of the imported article had not varied substantially for the last six months, would he see that this case should either be heard at once or dismissed?

Sir P. Lloyd-Greame, Secretary to the Overseas Trade Department, said that a complaint in respect of American vul-

canised fibre was made on April 7th by the British Electrical and Allied Manufacturers' Association, acting on behalf of one of its members. As there appeared to be *prima facie* evidence that the American price in this country current at a very recent date was below the British cost of production, as defined in the Safeguarding of Industries Act, the complaint was referred to a committee. He understood that the Committee had been informed that about April last the American price was increased, but in all the circumstances he thought that the Committee should proceed with its inquiry, and he did not propose to interfere with its discretion as to how that inquiry should be conducted. Pending a report, he did not think it would be proper for him to make any statement on the subject, but as to the position of importers he would refer Mr. Briant to the provisions of Section 4 of the Act.

Decisions of Electricity Commissioners.—Sir P. Richardson asked the Parliamentary Secretary to the Minister of Transport, whether, in the interests of the electrical industry, he would take steps to reduce the time now elapsing between the holding of inquiries and the publication of their decisions by the Electricity Commissioners; and whether he would take steps to expedite generally the procedure before the Electricity Commissioners and bring it more in accordance with the duration of proceedings before Select Committees.

Mr. Neal said that every effort was made by the Electricity Commissioners to publish their decisions as early as possible, but in view of the numerous and difficult points, both administrative and technical, which were involved in their more important inquiries, some time must necessarily elapse before the promulgation of a decision. The Commissioners informed him that the passing of the Electricity (Supply) Bill would tend materially to expedite matters.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Sale of Wireless Apparatus.

The letters under the above heading in your July 7th and 14th issues are obviously intended to convey the perfectly legitimate exception taken by the writers to the usurpation, and the undoubted exploitation in vogue, of the rights of the genuine electrical engineer in business. It is coincident at this juncture that I should come across a cutting from the *Electrician*, five years old, under the heading "Electrical Trade Anomalies," and written by J. M. M. Munro.

I would advise your readers, at least those to whom the article applies, to read this authentic and "straight to the point" exposition of the state of feeling in the year 1917. Now, after five years of alternate slumps and booms in trade, the broadest outlook reflects a more hopeless plight than that outlined by Mr. Munro.

It is conspicuous in many of the discussions appearing in the Review upon the subject matter that a remedy is suggested through the medium of the Electrical Contractors' Association, and that one has merely to become a member to render his business exclusive. Admittedly, such an association may be a very desirable medium for an interchange of opinion of exclusive information upon current topics of special interest to its members, but, and here let's get down to "clay," it cannot assure its members preferential treatment from wholesale houses on the material side of the job, or discriminate between the "electrical sanitary engineer" and the genuine electrical engineer on the installation side where skilled supervision plays an important part, and is mainly responsible for the compliance of an installation with the various rules in force.

I, for one, hold the view, therefore, that the remedy is as yet beyond the reach of the E.C.A., and, further, so far as I have been able to ascertain, its doors are open to all and sundry. Briefly put, the position at present appears to be, that so soon as a plumber attains a position in his business to be able to employ a wireman, and provided the latter gentleman is a member of the E.T.U. or, preferably, holds some sort of office in his district branch, the said plumber starts and continues with each and every facility enjoyed by his only competitor.

In all but a few isolated cases there is no demand for the really good jobs, since they can be carried out quite as well in the public eye by the sanitary engineer as a side line.

Would it not be in the interests of the trade generally if the E.C.A. persuaded municipal and supply company engineers to jointly formulate conditions under which electrical work may be carried out, and by whom, upon their respective systems? They, as engineers of a supply undertaking, have the monopoly of supply in an open market to meet the demand created by the activities of the trade in machinery and appliances. We also, as electrical engineers, think (merely think) that the commodities or consuming devices, from the sale and installation of which we live and have our being, ought, either by preference from the manufacturers, or recognition by the supply authorities, to come under a fittings and accessories clause.

On this point one need not travel far afield to find motors, starters, fans, radiators, ring (and other) lamps, vacuum cleaners, irons, &c., on display in the windows of plumbers and ironmongers; in fact, the "whole boiling" of the electrical engineer. The trade as a whole, both in supplies and its *personnel*, is sadly in need of a weeding-out process, and both factors are at the present time polluted.

In conclusion, I am with Mr. Munro in so far that it is a curious anomaly.

Engineer Contractor.

July 22nd, 1922.

[The above letter has been abbreviated.—Eds. Elec. Rev.]

D.C. Meter Testing.

Although it is now some years since "I shook the dust" of a meter testing and standardising department of a large corporation "off my shoes," I am still keenly interested in meters.

One cannot refrain from expressing astonishment on reading—in these days—a description of "an arrangement" for the above work in your July 28th issue.

Mr. "J. W.B.," however, appears fully alive to the difficulties that will have to be contended with, and I feel sure other meter engineers will not envy the user.

There was no battery room in my last job, but the chief "saw to it" that we had a battery and made space for it with control boards, &c. I have good reason to believe it is still rendering good service to my successor in the performance of his functions.

Without this plant it would have been impossible to bring the "units sold" figure so close to the "units generated." How can one standardise meters, vital instruments in a supply undertaking, down to 1/40th, 1/20th, and starting currents, any load for that matter, with standard instruments and unsteady, uncertain amperes? Towards the end of the description one reads that an extra observer is engaged in keeping the current steady!

I will not digress further beyond saying that, as a reader, I regret I am unable—as the writer suggests—to see any modifications to such an arrangement, but would strongly advise others contemplating d.c. meter testing to use a battery—having used both methods myself.

J. C. Elvey.

London, W.C.2.
July 29th, 1922.

The I.E.E. Wiring Rules.

Many of us who are interested in electrical installation work will, I feel sure, welcome, and generally endorse, Mr. J. R. Willingham's letter, published in your issue of July 21st. There is amongst many a feeling that the above rules are unsatisfactory, but at present they are the only approach to standard available, and are generally accepted as such. That the standard of wiring installation work requires raising few will deny; however, ask any man you know and he will almost invariably abuse the I.E.E. rules, but will seldom put his finger on any one clause and say: "this is rot; it should read," &c. Mr Willingham confines his remarks to what I term the home installation, but they apply with 100 per cent. greater force to the industrial power installation. All must be more or less familiar with some of the fearful and wonderful local rules relating to motors and their starting currents, &c., particularly on a.c. systems. Again, of late, very rightly, in my humble opinion, the call is for H.O. type of gear. Query: What is H.O. equipment? How does one stand with regard to standards? In student days we learnt that 746 watts equalled one electric horse-power. I have yet to meet the motor rated at 1 h.p. which will only draw 746 watts from the line, yet quite a number of important undertakings do their calculations on this 746 figure for all and every motor calculation or connection to the main.

At last supply men are waking up to the fact that there is such a thing as "power factor" blighting their a.c. system. Cos ϕ looks quite pretty in print, but means little or nothing to quite a number of supply station men. When the "powers that be" give up talking about cos ϕ, and our mains men really appreciate that an angle of lag of 45 degrees corresponds to a cos ϕ of 70.7, and that at this power factor, for every 70.7 per cent. of revenue earning current an equal current in magnitude is also flowing, which not only fails to earn revenue, but actually produces, amongst other things, C^2R losses whilst inductively impairing the voltage regulation, in addition to all-round capital inflation, then we shall begin to make real progress. Had the reprehensible power factor properties of the induction motor been generally appreciated in the early a.c. days, possibly development would have taken place on more satisfactory power-factor lines. During the late war the electric furnace made huge strides owing to its success from the users' point of view. Likewise the arc welder is progressing without anyone in the early stages calling attention to the fact that all arcs operate at a

very low power-factor. In conclusion, I sincerely trust that those who suffer from a " power-factor " will take up this promising load of arcs as applied to industry before we are further compromised or afflicted with even lower power-factors than we have to-day.

Walter E. Rogers, A.M.I.E.E.

London, *July 23rd*, 1922.

[This letter has been abbreviated.—Eds. Elec. Rev.]

A Maximum Demand Problem.

How far, if at all, will a consumer on a 3-phase circuit, taking his current through a maximum demand indicator (of the ordinary temperature rise) be affected by conditions outside his own premises, i.e., assuming: (1) a very bad power-factor in the supply mains; (2) a unity power-factor. It would seem reasonable, as the mains are warmed up by the extra current when power-factor is low, that the maximum demand indicator should be affected adversely too.

A Consumer.

July 25th, 1922.

The I.E.E.'s Outlook.

I was interested in the remarks contained in Mr. J. W. Meares's letter in your issue of the 21st instant, and think that, instead of the *bare* names of candidates for election to the Council of the I.E.E. being submitted to the members, such should be supplemented by a few notes stating their present positions in the electrical world, and a few particulars of their careers.

I venture to think that were the name of such a distinguished overseas member as Mr. J. W. Meares included in the list, many members would welcome the innovation.

I hope that I am not disclosing any secrets of the ballot when I state that I know where one of my votes would be cast, and think it would be by no means lonely, or in poor company.

Is there any reason why the members of the Institution should not be given details of the candidates' qualifications for office?

As at present, it is probable that a good many of those who do vote know little or nothing of the value and personalities of the candidates, and follow, accordingly, the Council's recommendations. If one, for example, may think that three of the names submitted are in his opinion suitable for his representation on the Council, he votes accordingly, but the probability is that, finding he has further votes, and thinking it is a pity to waste them, he uses them all, and so negatives his initial selection.

It would be interesting to hear what proportion of the members take sufficient interest and trouble to fill up and return their ballot forms.

In Parliamentary, municipal, and other elections, candidates' qualifications are well advertised. If candidates for the I.E.E. Council are worth nomination, it follows that their qualifications ought to be worth advertising.

In the event of the Institution being unable to state particulars of the career of each candidate, and I don't see why it cannot be done, we have the obliging Press to elaborate what has previously been done, and so give greater publicity to the matter, and secure an adequate representation.

Should the Institution provide such details, the Press will, no doubt, review and, where deserved, supplement them.

I await with interest next year's ballot paper, and hope that, if Mr. Meares's name is among those submitted, he will find his election will prove his " fact " to be fiction, at least as far as he himself is concerned.

Gus. C. Lundberg.

London, N.7, *July 26th*, 1922.

Where are the Wiremen?

I had no intention of entering into a long correspondence on the above subject, I am much too busy for that; however, I must reply to your correspondents who, with few exceptions, seem to make veiled attacks on myself. What I wanted was recommendations from engineers; not applications for the post.

In reply to " One Applicant," my letter was sent with the advertisement, but owing to lack of space in your " Correspondence " columns was not inserted till the week following. The letter, of course, refers to a former advertisement. In the present instance the applications would be nearer a thousand than two hundred. I never asked for any embellishments, and am not lax, or fastidious, and fully agree that it is a simple job that is vacant. In reply to the " Ex-I.E.E.," I never suggested that the applicants were incompetent, and if he is not applying for any jobs under a box number, it may be a surprise to him to hear that the present position I hold was secured by applying for the position under a box number.

Personally, I am always proud to show my references, and I expect whoever is appointed will be a stranger to me; we do not require personal details, only references as to experience. My primary reason for putting the advertisement under a box number was to save unnecessary expense to applicants, several of whom would have at once run down to see me, and as there is only one vacancy it is obvious considerable expense would have fallen on men who could ill-afford it. This is born out by several applicants who desire an interview.

In reply to " Indentured Electrician," no, it's not a case of " too old at 40." We do not want a man with a large family to take a junior's job, and cannot afford it. In reply to " Fed Up," no, we do not require a specialist, only a man with average intelligence. Finally, in answer to " Not 1 in 200," who said anything about one and a half per cent. of the applications being not satisfactory? By the tone of his letter I should not like to accept anyone he recommended; and to prove he is right in his concluding paragraph that the trouble is at the top, I give a few examples below which will prove whether I did or did not understand my business. I might have been easily suited that is perhaps what he means; if not, he has a lot to learn, including not to jump to conclusions too quickly.

The first man I had had some 15 years' experience and had excellent references and said there was not a job I could put him on which he could not tackle. I gave him a job of eight lights to do and he wired some lights in parallel, some in series, and some would not light at all. On another job of four lights, at £2 per point for the job, his time came to over that, and when he had finished I found he had wired a hall light so that one had to go into the dining room to switch on the hall light and into the hall to switch on the dining room light; these are only two of his achievements. No. 2 I sent to connect a small sausage machine motor and found he had put the armature in series with the no-load release coil of the starting switch; this man left me to take a three-weeks' job at a few pence more per hour. No. 3 proceeded to upset a Bastian meter on a consumer's premises, but did not observe the reading and filled it up to what he thought it ought to be, which was ten units above the actual reading on the top of the scale. He wired a few two- and one-light jobs and none of the lamps would light. No. 4 had a job with me at four times the rate he was previously getting, and after three days' work came to me and said " hired by the hour, hour's notice." I said " correct," and off he went. Of my present staff, two have been with the firm for nearly twenty years, one for three years, one about seven years, and one four years. I agree, Mr. Editor, that some of the applications are heartrending, and I will as soon as possible thank the unsuccessful ones and announce in your columns when the vacancy is filled, which will be in about a week's time. I have not up to the present had time to deal with the large number of applications.

Engineer.

July 31st, 1922.

[This correspondence is now closed.—Eds. Elec. Rev.]

The I.E.E. Summer Convention.

In your issue of June 16th, Mr. A. B. Muirhead, commenting on your leading article of June 9th, gave us some information on low grade fuel. He says it will be agreed by those in a position to judge, that power developed from such fuel can be obtained at a price with which water power in this country has no chance of competing. Now, this statement is just a little misleading. While the economical position at the majority of mines remains as at present, there is little, if any, of this low grade fuel, most of it being required in preparing the better grades for the market. I am in touch with a large colliery worked on modern lines. Its electrical system is 3-phase, a.c.; it is composed of three 1,300-kW sets combined. The average load is two-thirds the capacity; the power factor is a lagging one varying from 0.3 to 0.7. The water used for steam generation is unfiltered, and is mostly pumped from the mine, a good percentage of it being mud. It takes all the low grade fuel at the mine with a quantity from smaller collieries mixed with a better grade to generate the steam used at this mine. One of the sets is a mixed-pressure turbine and it is the usual thing to see exhaust steam blowing off, and no questions asked. As one who has worked among water-driven machinery for a time, I should say the antique water-driven wheel could compete favourably with this fuel as it is used at some mines to-day.

J. Shiels.

Glasgow, *July 29th*, 1922.

Where are the Young Men of the I.E.E.?

My attention has been drawn to a letter which appeared in your issue of July 21st, signed by Kenneth Pittaway, in which the following statement is made:—

" Such Associations as the A.M.E.E., the S.T.E., and the E.P.E.A. are doing their utmost to set a ' first-class profession ' upon a first-class basis, as far as ' salaries and status are concerned.' "

I feel sure that the writer does not wish to make a statement which cannot be borne out by facts, and I have to say

that the Association of Mining Electrical Engineers, to which presumably he refers, does not interfere in any way whatever with the question of salaries of its members.

A. B. Muirhead,
Glasgow, *July 29th*, 1922. *President, A.M.E.E.*

[The letters A.M.E.E. were obviously intended to stand for the Associated Municipal Electrical Engineers (Great Britain and Ireland).—Eds. Elec. Rev.]

Removal of a Static Charge.

During the process of rinsing silk and other garments in warm dry benzine, static electricity is generated in such quantities as to ignite the vapour by a spark discharged under certain conditions.

All the metal tanks and machinery are electrically earthed, but owing to the benzine being a non-conductor it appears to retain sufficient electricity to produce a spark on discharge, and I should be much obliged if any reader could give information as to how to conduct the electricity from the surface of the benzine as fast as it is generated.

F. W. F.
July 19th, 1922.

Whitegate Brick Co. v. R. O'Brien & Co.

With reference to the article in your July 21st issue on page 106, we wish to call your attention to the fact that we were not backed in any way whatever by the English Electric Co. in this case. We carried out the defence entirely ourselves.

We trust you will announce this in your paper, as the article mentioned above has caused a wrong impression in the trade.

R. O'Brien & Co.
Manchester, *July 31st*, 1922. F. Hyman

[The "article" was a report of legal proceedings, and the statement alluded to was that of counsel for the plaintiffs.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—Leslie Rowland Henson, 23, Green Lanes, Islington, London, N.—The public examination of this debtor was held on July 28th at the London Bankruptcy Court before Mr. Registrar Francke. The accounts, showed debts £165, and assets £72, subject to realisation. In the course of his evidence the debtor stated that for fourteen years he was in the employ of various firms of electrical engineers, and in June, 1919, commenced business on his own account. Owing to lack of capital and the slump in trade he could not make it a success, and being pressed by creditors last May, he petitioned the Court. The examination was concluded.

Charles Archibald Henderson, 63, Queen Victoria Street, E.C., and The Grove, Sutton.—A sitting of the London Bankruptcy Court was held on July 28th before Mr. Registrar Francke, for the public examination of this debtor, who failed in April last, with total liabilities £24,371 (unsecured, £23,405) and net assets valued at £18,359, after deducting £205 for payment of the preferential claims. In reply to Mr. Vyvyan (Official Receiver), the debtor stated that in November, 1919, upon being demobilised from the Army, with the rank of lieutenant, he purchased for £450, which he obtained on loan from relatives, the business of a merchant in insulating materials carried on at 63, Queen Victoria Street, under the style of "Allen & McMaster," and he had since continued it under the same style and at the same address. In October, 1921, he, under a scheme entered into with other persons for obtaining the finance necessary for the proposed formation of a limited company and the equipment of a factory in connection therewith for manufacturing ebonite, became the nominal borrower of £20,000 from an insurance company on the security of policies effected with it on the lives of three persons, and on the guarantees of four others. One-half of that sum was to have been applied for the purposes of the said company and factory, but the whole loan, less certain deductions, was applied by his associates to another company which they were financing. Witness attributed his insolvency (*a*) to a falling-off in his business since June, 1921, owing to a curtailment of his credit consequent upon its becoming known in the trade that he contemplated manufacturing ebonite, which he had hitherto purchased; (*b*) to bad debts, trade and personal; and (*c*) to heavy discount charges and interest on loans. The examination was concluded.

J. E. Rollinson, electrical engineer and contractor, 5, Tavistock Chambers, Beastmarket Hill, Nottingham.—Receiving order made July 26th, on debtor's own petition.

C. P. M. Downie (P. Downie), electrical engineer and factor, 355a, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released July 21st.

T. Hyde, electrician, 180, London Road, Croydon.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released July 21st.

R. H. Liddell (Liddell & McInnes) electrical engineer, 4, The Crescent, Carlisle.—First and final dividend of 5s. 6¾d. in the £, payable August 8th, at the Official Receiver's office, Carlisle.

H. S. Rogers, electrical engineer's sales manager, 21, Derby Street, Walsall.—Receiving order made July 26th on debtor's own petition.

R. A. Depledge, electrical engineer, 53, Frodingham Road, Scunthorpe.—Last day for proofs for dividend, August 16th. Trustee, Mr. S. M. Forrester, 1, Town Hall Street, Grimsby.

W. W. Threapleton, electrical and mechanical engineer, Thornbury Road, Bradford.—First and final dividend of 6s. 9d. in the £ payable at the Official Receiver's office, 12, Duke Street, Bradford.

W. Caldwell (Caldwell & Son), electrical engineer, 26, Victoria Road, Hale, Cheshire.—Receiving order made July 29th on debtor's own petition.

Company Liquidations.—Alberti Lee & Co., Ltd., lighting accessories merchants, 8-9, New Zealand Avenue, London, E.C., and at Glasgow and Newcastle.—In pursuance of the provisions of the Companies (Consolidation) Act, a largely-attended meeting of the creditors of the above was held on July 24th at the offices of the London Chamber of Commerce, Oxford Court, Cannon Street, E.C.4. The chair was occupied by Mr. Thomas Keens, of Messrs. Keens, Shay, Keens & Co., I.A., 25, College Hill, E.C., who had been appointed to act as the liquidator in the voluntary liquidation.

The chairman, at the outset, stated that at the request of the principal creditors he was appointed as the liquidator, and he was not the nominee of the shareholders. A large number of proxies, totalling nearly £70,000, had been received in favour of the voluntary liquidation being continued with him (Mr. Keens) as liquidator. The directors desired him to express their regret at the position which had arisen, and he was asked to state that it was hoped that the outcome of the liquidation would be the introduction of a scheme for the reconstruction of the company.

The statement of affairs presented showed ranking liabilities of £87,185. Of that amount £36,943 was due to the unsecured creditors, while there were fully-secured creditors for £12,622. The securities held were valued at £17,160. There were also partly-secured creditors for £80,129, of which £50,242 was expected to rank. The assets were estimated to realise £63,594, from which had to be deducted £1,244 for preferential claims, and £41,651 due on debentures. The net assets therefore amounted to £20,700, or a deficiency, as regarded the unsecured creditors, of £66,485. The assets were as follows:—Cash at bank, £180; cash in hand, £44; stock-in-trade at cost, £70,000, expected to produce £39,425; fixtures, fittings, &c., £1,228; investments, £1,223; loans on mortgage, &c., £2,300; lease and goodwill, £1,200; good book debts, £10,456; doubtful and bad debts, £4,728, estimated to realise £1,000; debtors on agency accounts, £2,000; and surplus from fully-secured creditors, £4,588.

Mr. Keens said that the partly-secured creditors were five in number. The Deventer Glas Maatschappij, of Holland, were partly-secured creditors for £28,329. As security they held debentures in the company to the extent of £9,300, and were unsecured for the balance of their claim. Messrs. George Wills & Sons, Ltd., were creditors for £24,618, and they held debentures to the value of £3,500 and stock valued at £5,082, and were included as unsecured creditors for £16,036. Messrs. M. Samuel & Co., Ltd., were partly-secured creditors for £22,152, their security consisting of third debentures for £3,200 and stock valued at £5,707. The amount of their unsecured claim was therefore £13,245. Mr. F. A. Fairchild was a partly-secured creditor for £4,381, and he held third debentures for £2,700, which were issued on April 10th last. He was unsecured for £1,661, but some question might arise as to the validity of the issue of the debentures to him. The remaining partly-secured creditor was scheduled for £648, of which £250 was unsecured. There had been three issues of debentures. The first debentures were for £10,000, the second for £6,000, and the third for £25,000. In his opinion certain of the second and third debentures were open to some question. A receiver for the debenture holders was appointed on June 24th last. It was contemplated that the Newcastle branch should be closed at once. On December 31st, 1920, the company's accounts showed a debit balance on trading of £1,241. The share capital then amounted to rather more than £11,000, and, as regarded the shareholders, there was a surplus at the date mentioned of £10,564. Since December, 1920, there had been a loss of £31,925 incurred in carrying on the business. The present position was due to that loss, together with the writing down of the assets and claims for losses on contracts amounting to £[illegible]. The company then entered into large transactions and [illegible] commenced for the introduction of £50,000 [illegible] these foreign firms. The chief reasons which actuated those firms

were the connection which Albert Lee & Co. Ltd., possessed, and the contracts which had been entered into for goods, and which were considered to be extremely advantageous. The premises at Cambridge Heath were extended and showrooms opened in London. The scheme which the company had intended to follow did not, however, materialise owing to the slump in trade. Contracts thought to be advantageous resulted in serious losses. Further, there were many serious cancellations of contracts.

Proceeding, the chairman stated that the company was registered on May 27th, 1916, with a nominal capital of £5,000, and it took over an existing business for which it paid £2 in cash and the balance in shares. Subsequently the capital was increased to £12,500. During the year to January 31st, 1917, there was a loss of £324, whilst in the following 12 months there was a loss of £324 on a turnover of £38,305. During the year to January 31st, 1919, the turnover fell to £19,131, with a loss of £3,473. In that year the whole of the staff was in the Army, and temporary employés had to be engaged. During the period to June 30th, 1920, the London sales were £73,491, with a net profit of £4,518, and £7,000 was carried to reserve. In the same period the Newcastle branch had a turnover of £2,856, with a loss of £153. During the six months to December 31st, 1920, the sales were £44,945, with a loss of £2,824, after a heavy writing down of stock. There was a loss at Newcastle of £20, on a turnover of £7,593. During the 18 months to July 5th last the London turnover was £69,897, with a loss of £19,817, while at Newcastle the sales amounted to £7,919, and there was a loss of £8,300. He agreed that the loss in the latter period seemed extraordinary, and he could not explain it at all. During the same period the sales at Glasgow were £14,782, with a loss of £3,759. The overwhelming feature in connection with the losses was the depreciation of the stocks. As previously intimated, there was a desire for a reorganisation of the company. Certain foreign manufacturers had expressed a wish to acquire the goodwill and connection of the business. Negotiations had been opened for the sale of the goodwill and lease, and it was proposed, as part of the scheme, that the manufacturers referred to should act as selling agents for the receiver and the liquidator with a view to disposing of the assets in the ordinary way of trade. If that was done it was possible that the assets would realise more than the figures at which they appeared in the statement of affairs. If the assets were sold at a break-up he was unable to say what they would fetch. If the scheme went through, the intention would be for the assets to be sold and part of the consideration would be paid in cash. That would enable a small composition to be paid to certain of the creditors, and deferred shares in a new company would also be issued. In addition, there would also be available for the creditors any moneys which might be in hand at the close of the receivership. Any scheme would have to be submitted to the creditors.

In answer to questions, the chairman stated that certain debentures were issued last April to a number of creditors, and in his opinion such debentures were of doubtful validity.

A resolution was unanimously passed confirming the voluntary liquidation of the company, with Mr. Keens as the liquidator, and it was decided that an application should be made to the Court for the appointment of a committee of inspection consisting of the representatives of five of the principal creditors. The following are creditors:—

	£
Atkinson Bros.	200
Adams & Co., Ltd.	15
Arova & Co.	14
Asnew Electric Lamp Co. ...	54
Burners (1921), Ltd.	41
Bedford & Co.	241
Bate & Sons	34
British Thomson-Houston Co.	21
British Thomson-Houston Co.	22
Bamaglicht Gas, M.O.L. ...	12
De Boer, H. G.	40
De Boer, H. F.	40
Bathurst, A.	16
Bathurst, J.	174
Cooper, G. R.	19
Caldwell & Troller	40
Crick & Heath	97
Chisholms, Ltd.	25
Crossling, G., & Co., Ltd.	33
Carter, Paterson & Co. ...	20
Clyde Shipping Co., Ltd. ...	30
Catchpole & Maurice, Ltd. ...	15
Celtic Stamping Co., Ltd.	30
Curtis, H., & Son	28
Cooper & Smith	11
Cunningham, E. S.	21
City of London E.L. Co. ...	23
Canning, W., & Co.	13
Cooke & Segal	504
Cable Accessories Co.	12
Deventer Gas Maatschappij	12
Deventer Gas Syndicaat	26,142
Dernier, L., & Hamlyn, Ltd.	15
Davies, Kent & Stewart ...	45
Davis Nesbells	15
De Carra & Allen, Ltd. ...	38
De Blecourt	71
De Blecourt, W. F. H. (decd.)	279
Eagle, Star & British Dom. Insurance ...	92
East London Mica Co., Ltd.	11
Electrical Review	57
Elect. Distributing Co. ...	42
Feaver, John	11
Crepal	25
Great Eastern Railway	15
Gas Light & Coke Co.	33
General Electric Co.	48
Great Eastern Railway	18
Hillbar Press	95
Harper & Co., Ltd.	23
Hardware Trade Journal ...	76
Harris, T.	832
Harper & Broom	179
Harris, A.	916
Heath & Sons, Ltd.	61
Hawkins Bros. & Co.	12
Hartland & Eastwood	28
The Ironmonger	75
Ironmongers' Chronicle ...	73
James, H., & Co.	61
Jowett, F. W.	27
Joseph, C. F.	72
Kerr, W. P.	34
London Telephone Service ...	22
Marks, H.	18
Middlesbrough Steel Tube Co.	27
Metaaldraadlampenfabriek Volt.	19
Mayer, W. G.	38
Mile Borough of Hackney ...	38
Malleable Fittings, Ltd. ...	12
Marks, A	37
Morris, J. R.	367
National Carbon Co.	151
Neuchatelaise Glasworks ...	70
Newcastle Corporation	16
Oakes, W.	72
Pirelli, Ltd.	23
Pilot Mantel Co.	263
Pugh, E., & Co.	27
Pomells, Collingh, J.	40
Phillips, D. J., & Co.	344
Pattrick, A. C., & Co., Ltd. ...	14
Parrott, C. K., & Co., Ltd. ...	56
Panel Ateliers, Albert	62
Reid & Gregory	15
Reliance Fleet Wire Co. ...	14
Reid & Gregory	12
Ronco, Ltd.	16
Robbins R. W., & Co.	12
Rylands Glass & Eng. Co. ...	13
Redman & Co., Ltd.	92
Scupham & Wood	20
Surveyor of Taxes	27
Truscott, James, & Co., Ltd. ...	13
Thompson & Norris	22
United Kingdom Lighting Trust	24
Underwood (Manchester), Ltd.	76
United Flexible Metallic Tubing Co.	87
Van Tennsya, J.	1,042
West End Incandescent	11
West African Publishing Co. ...	31
Wyatt, J	254
Worrow, H. & F.	180
Wakefield & Son, Ltd.	260

Technical Intelligence Service, Ltd.—A meeting of members is called for September 2nd at Arundel House, Arundel Street, Strand, W.C., to hear an account of the winding-up from the liquidator.

Technical Review, Ltd.—A meeting of members is called for September 2nd at Arundel House, Arundel Street, Strand, W.C., to hear an account of the winding-up from the liquidator.

Brotherton Ediswan Tubes & Conduits, Ltd.—Winding up voluntarily. Liquidator, Mr. R. H. Johnston, 49, Queen Street, Wolverhampton.

Dissolution of Partnership.—Melling, Son & Pilkington, mechanical, electrical and automobile engineers, 22a, Virginia Street, Southport.—Messrs. W. Melling (Senior), W. Melling (Junior), and F. W. Pilkington, have dissolved partnership. Debts will be attended to by Messrs. W. Melling (Senior), and W. Melling (Junior).

Private Arrangement.—T. A. Keating, 186, Westcombe Hill, Blackheath, electrical engineer.—The following circular has been issued in this matter by Messrs. Corfield & Cripwell, accountants and auditors, of Balfour House, Finsbury Pavement, E.C.:—"With reference to the recent adjourned meeting of creditors in this matter, we beg to inform you that upon our further representations the debtor has undertaken to carry through a composition scheme of 17s. 6d. in the £, in place of 15s. in the £, arranged at the last meeting. The necessary deed of composition and assignment has been executed by the debtor and the trustees, and the matter is being immediately placed upon a proper footing."

Trade Announcements.—Mr. Bernard Goldenberg, for many years representative of the Harland Engineering Co., Ltd., of Manchester, has now taken charge of the wholesale electrical department of Walter E. Deeley, 18, Victoria Buildings, Manchester. He desires to receive price-lists for kinema carbons, accessories, switchgear, and everything electrical.

Mr. William Sharp, M.I.Mech.E., constructional engineer, Messrs. Alex. Jack & Co., Ltd. (Motherwell), and Messrs. Wright, Anderson & Co., Ltd. (Gateshead-on-Tyne), have removed their offices in London to 11, Carteret Street, Queen Anne's Gate, London, S.W., where their telephone number is "Victoria 6529."

The Concordia Electric Wire Co., Ltd., has appointed Messrs. A. McArthur & Co., of 2933, Clarence Street, Sydney, as its sole selling agents in Australia. The company's agents in New Zealand are Messrs. Arthur D. Riley & Co., of Wellington.

Messrs. W. & T. Marshall, of The Burnside Works, Stirling, have opened new showroom premises for electrical appliances, lamps, fittings, &c., at 12, Upper Craigs.

Mr. J. Sheppard has removed to 119, Holland Park Avenue, Shepherd's Bush, W.11. He desires to receive publicity literature from manufacturers of ignition, power, lighting, heating, and other electrical goods.

The Telegraph Condenser Co., Ltd., of Vauxhall Street, Kennington Oval, S.E.11, has appointed Mr. E. W. Dorey as its sales engineer, to handle the sales at home and abroad of static condensers for power factor improvement. The sales business will be conducted from Norwich House, Southampton Street, High Holborn, W.C.1. Mr. Dorey has also been appointed by the Anglo-Belgian Co., of Ghent, as its sales agent in the United Kingdom, for vertical semi-Diesel crude oil engines.

Messrs. Leonard G. Tate & Co., Ltd., electrical contractors, of 20, Bucklersbury, E.C.4, who will shortly be opening a branch establishment and showrooms at 31, Bond Street, Ealing, W.5, desire to receive catalogues of fittings, domestic appliances, accessories, &c.

The "Watt" Electrical Co., Ltd., have changed their address to 161, Westminster Bridge Road, London, S.W., where they desire to receive catalogues of electrical goods.

Catalogues and Lists.—Messrs. Ruston & Hornsby, Ltd., Lincoln.—A well-produced list of "Ruston" cold-starting oil engines, with numerous letters of satisfaction from customers' and details of test results.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C.2.—List W.A.1, giving illustrated details of unit-type distribution pillars of several patterns.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—A card giving prices of various grades and sizes of cables.

Messrs. Herbert Morris, Ltd., Loughborough.—A booklet (No. 98) giving illustrations and prices of Morris steam cranes, overhead electric cranes, hand-power cranes, battery trucks, pulley blocks, &c.

Electrical Utilities, Ltd., 1-3, Shelgate Road, S.W.11.—Leaflet TF/1, illustrating and describing the "Utility" electric toaster-fire. Priced.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Leaflets 336 and 327, dealing respectively with the "Magnavox" loud speaker and the "Marconiphone" wireless receiving sets. Illustrated and priced.

Messrs. Pratt & Co., 23, Queen Anne's Gate, S.W.1.—An illustrated and descriptive price list of small wireless receiving sets.

Messrs. F. & C. Osler, Ltd., 100, Oxford Street, W.1.—An album containing about 130 photographs of electric lighting fittings of all types, including bowls, shades, candelabra, lanterns, crystal, alabaster, &c., in many styles of decoration. A useful feature of many of the photographs is the insertion of the principal dimensions. A price list is contained in a pocket in the front cover.

The London Factors & Agents, Ltd., 38 and 39, Parliament Street, S.W.1.—An illustrated list of d.c. motors and dynamos. Priced.

Plant & Supplies, Ltd., 12-13, Henrietta Street, W.C.2.—A price list (No. 2) of "Sceando" metal filament lamps; and List No. 3, giving prices of various sizes and types of v.i.r. cables.

Holidays.—The Midland Electric Manufacturing Co., Ltd., of Birmingham, is closing its offices from August 5th until the morning of the 8th inst., and its works from to-night until the morning of Monday, August 14th. Urgent stock orders will be dealt with during that period.

The works of the Artic Fuse and Electrical Manufacturing Co., Ltd., at Birkenhead, will be closed from August 7th to 12th.

Annual Outing.—The annual outing of the Enfield Ediswan Cable Works took place last Saturday, when considerably over 300 employés, including the works manager, Mr. Heffernon, Mr. Kaye, and several of the works and London office staff, travelled by special train to Southend.

Annual Sports.—The first annual sports meeting of Messrs. A. Reyrolle & Co., Ltd., Hebburn, Newcastle-on-Tyne, was held at their own sports ground, Hebburn, on Saturday, July 22nd. The events, which numbered 36, were admirably organised by a committee composed of the works and management, and were successfully carried out. Three challenge cups were presented by officials of the firm for annual competition. The Hebburn Colliery Prize Silver Band kindly gave their services for the day. It is estimated that there were between 2,000 and 3,000 people present, and as the proceeds at the gate are to be given to the Ellison Hall Accident Infirmary, it is expected that a substantial donation to the funds will be made.

Book Notices.—"The Development of Stainless Steel: Its Properties and Uses." 82 pp., 7 figs., 7 plates. Sheffield: Thos. Firth & Sons, Ltd. Price 10s. 6d.—This volume is a very complete treatise upon the nature and properties of stainless steel, formed by a collection of reports and data from the firm's research laboratories. The first chapter describes four distinct types of steel, classed according to the purposes for which they are suitable. Then the manufacture is dealt with, and various processes such as hardening, tempering, welding, and brazing are briefly touched upon. Mechanical tests provide the matter for the next two chapters, and the information given here is very exhaustive, showing that the anti-corrosive properties of the steel do not detract from its mechanical strength. Chapter VI is devoted to a general description of the physical characteristics of the metal. These include a specific gravity varying but slightly from that of mild carbon steel, and an electrical resistance some 42 times the resistance of copper. The remainder of the volume deals with the effects of a large number of re-agents upon the steel, and the action of a diversity of chemical substances is considered. As this is, so far as we are aware, the only work dealing exclusively with stainless steel, it has a unique value to those interested in the subject.

"Magnetism and Electricity." By J. Paley Yorke, M.Sc. 248 pp. London: Edward Arnold & Co. Price 5s. net.—This is a re-written edition, couched in simple terms, which makes it suitable for even very young students. Magnetism takes up the first half of the volume, and is treated very adequately. The purely electrical part opens with the usual definitions of electricity; the electronic nature of the energy is dealt with very briefly on a different page to that mentioned in the index. Electrostatics, contrary to the usual practice, is dealt with near the end of the book.

"The Trade Industries and Productions of British South Africa." By C. W. Francis Harrison. Pp. 196. Woodchester: Arthur's Press, Ltd., for the Federation of British Industries.

"The Brown, Boveri Review," June, 1922. 17 pp. London: Brown, Boveri & Co., Ltd.—This issue deals with the use of Brown, Boveri turbines for ship propulsion, and describes a number of typical installations.

"Industrial Unrest: A Way Out," by B. Seebohm Rowntree. Pp. 48. London: Longmans, Green & Co. Price 1s. net.

"Transformer Abstracts," Nos. 11 and 12. Charlton, S.E.7: Johnson & Phillips, Ltd.—The first of these useful booklets deals with transformer losses, efficiency, and regulation, in considerable detail. No. 12, which is the last of the series, treats of the parallel operation of transformers, and full consideration is given to the principal necessary characteristics.

The *Financial News* has published (price 7d.) a new edition of its pamphlet "Income Tax up to date" (by H. J. Gully, F.C.A.), in which is given an explanation of the arrangements for winding up the E.P.D. and a table showing what income tax is payable on a given income.

"The English Electric Journal," Vol. II., No. 2, April/July, 1922. London: The English Electric Co., Ltd. Price 1s.—Among the articles contained in this issue are: "A Modern Rotary Converter," "A New English Electric Induction Motor for Medium and Large Outputs," and "An Analysis of Regenerative Braking on Electric Locomotives."

"The Builders', Plumbers', and Decorators' Pocket Book" (230 pp.). London: Thomas Tofts. Price 5s. net.—This is a work likely to be of use to others than those for whom it has been compiled, as it contains a great deal of information upon materials and quantities, and specifications for the mixing of many useful compounds for all purposes. The glossary of terms at the end of the book contains many words not found in an ordinary dictionary.

For Sale.—Borough of Stepney, one 1,000-kW and two 1,500-kW turbo-generators. By direction of the Disposal Board, Messrs. Bowler & Blake will sell by auction on August 22nd and following days, at H.M. Dockyard, Portsmouth, H.M. Gunboat Yard, Haslar, R.A.O.C. Depôt, Hilsea, and the Seaplane Training School, R.A.F., Lee-on-the-Solent, plant, machinery, and electrical equipment. One 300-kW Willans-Siemens d.c. turbo-generator is offered by the Carlisle Electricity Department. (See our advertisement pages today.)

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—September 2nd to 8th, Radio Exhibition and Wireless Convention; October 13th to 23rd, Commercial Motor Exhibition; November 2nd to 11th, International Motor Show; November 14th to 24th, Marine and Small Craft Exhibition; November 27th to December 2nd, Motorcycle and Cycle Show.

Birmingham.—February 19th to March 2nd, 1923, British Industries Fair.

Manchester.—September 13th to 23rd, Business Efficiency Exhibition; October 6th to 20th, Textile Machinery Exhibition.

Austria (*Vienna*).—September 10th to 16th, International Sample Fair.

Belgium (*Mons*).—November, Commercial Fair.

France (*Lyons*).—October 1st to 15th, Sample Fair.

Italy (*Naples*).—September 16th to 30th, Sample Fair.

Poland (*Lemberg*).—September 5th to 15th, Eastern Fair.

Trieste.—September 3rd to 18th, Sample Fair.

United States (*Chicago*).—October 14th to 22nd, Radio Show.

New Zealand Electrical Imports.—H.M. Trade Commissioner at Wellington (N.Z.) gives, in the *Board of Trade Journal*, tabulated and other particulars of the value of imports into New Zealand during the March quarter of this year. We extract the following details of values of imports of electrical machinery for that quarter compared with the figures of the corresponding quarter of 1921:—

Electrical Machinery.

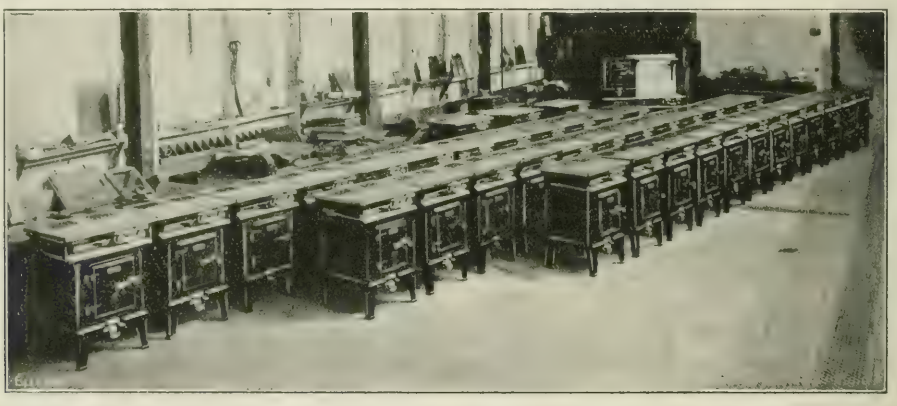
Country of Origin.	March Quarter, 1922.	March Quarter, 1921.
	£	£
United Kingdom ...	176,942	248,542
Canada	4,442	7,964
Australia ...	2,845	7,368
Japan ...	880	11,729
United States	68,041	105,926
Other countries	14,416	16,357
Totals	£267,216	£397,886

Imports from the five countries named mark heavy falls in value, probably due in a large measure to the lower prices established in the interval between the two periods.

Australian Tariff Decisions.—Amongst the tariff decisions approved by the Customs Department are the following:—Electrical appliances, &c.—Primary batteries, comprising glass jars, porcelain covers, elements, caustic soda (in tin), sufficient only to charge each battery; oil (in bottle), sufficient only for each battery. Item 180 (e), 27½ per cent. under the British preferential tariff, 35 per cent. under the intermediate tariff, 40 per cent. under the general tariff. Hydro-electric machinery, *viz.*, water turbine, 1,180 h.p., 500 r.p.m., 110 ft. head; alternator, 3-phase, 1,000 kVA, 5,500-6,600 V, and necessary switchgear therefor. Item 174: Free, 5 per cent., 10 per cent.—*Reuter's Trade Service* (Melbourne).

Electrical Trade in China.—In the course of an article on the report of the Maritime Customs, the *Board of Trade Journal* gives some information respecting trade in electrical materials. It is stated that the satisfactory development of this branch of the import trade has continued unimpeded by the course of events. The Customs figures for the importation of electrical materials and fittings are 13.2 million taels for 1921, which is a noteworthy advance over the 6.3 million and 5 million taels recorded for 1920 and 1919 respectively. "As might be expected, the adverse trade conditions have caused a marked decline in the sale of small lighting plants, which, however, may also be partly due to the installation of new, or the improvement of existing plants for public light services. Several contracts for large power and light plants for places in the interior were settled during the year, and an increasing tendency to install larger units of 1,000, 2,000, and 5,000 kilowatts is noticeable, while only a couple of years ago 200 and 400 kilowatts were considered sufficient to meet requirements. It is interesting to mention here, as an indication of the progress that is being made in the use of electricity, that current is now supplied during the day in several important centres instead of the plant being run during the night only, as has hitherto been the practice: Nanking, Soochow, and Hangchow are cases in point. As regards electrical accessories, fittings, and lamps, Japanese manufacturers have held the market for wires and cables, porcelain insulators, &c., Dutch manufacturers for lamps, and American manufacturers for the better-class fittings and glassware. Towards the end of the year German glassware fittings appeared on the market at prices which undersold the American product. Altogether this line of trade is in a flourishing condition, with good prospects ahead."

Jackson Electric Cookers.—Many municipal authorities are taking advantage of their powers to hire out electric cooking appliances, and the Jackson Electric Co., Ltd., has secured a number of orders for cookers in this connection. These have been supplied to Glasgow, Hackney, Southampton, and many other places. The accompanying illustration shows a consignment of cookers for the Woolwich Borough Council.



Jackson Electric Cookers for Woolwich.

Municipal Electricity Undertakings.—A circular published by the Conference of Local Authorities Owning Electricity Undertakings says that it is not generally realised how far the growth of electricity supply has been dependent upon the energy and foresight of municipal authorities. It is claimed that the average selling price of electricity from municipal undertakings is approximately one-third less than the average price charged by other suppliers, and statistics are given of the generating stations in London and Greater London. The aim is to urge every consumer to see that nothing is done to prejudice the position of municipal undertakings in schemes for the reorganisation of electricity supply.

Trade Conditions in South Africa.—The general managers of the Standard Bank of South Africa supply the following information regarding trade conditions throughout the Union. The slight improvement in business conditions reported in June has been maintained, and some increase in ordering reflects a more optimistic outlook on the part of importers. The agricultural implements, mining machinery, and iron and steel markets are dull, but prices are firm. The electrical goods market shows activity, with prospects of expansion in the near future. Stocks are ample in all lines.—*Reuter's Trade Service* (Capetown).

New Russian Electric Lamp.—A Russian journal, the *Pravda*, states that the "Svetlyana" electric factory of Petrograd has brought out a new 100-V electric lamp—its own production—"which from a technical point of view is greatly superior to electrical lamps of foreign manufacture."

The Deficits of the Russian Electrical Industry.—In the U.S. Commerce Reports just to hand there appears an abstract of an article published in the Soviet official daily *Economic Life* of May 11th, "for the accuracy of which the Bureau assumes no responsibility." It reports the holding of a special session of joint committees of the Economic Council, Bureau of Industries, and of various industrial groups and trusts at Moscow on May 10th, with the view of determining the extent to which basic nationalised industries must be subsidised. "According to calculations compiled from data presented by the participants of the meeting, the minimum total requirements of the principal industries for the fiscal year were estimated at 450,000,000 pre-war rubles, of which amount 360,000,000 rubles is for operating expenses and 90,000,000 rubles is for necessary equipment and repairs. Since no such funds are available for the purpose, it was decided to take the course of estimating the sums necessary to cover the deficit which is expected to be incurred within the next three or four months under existing conditions. This cash deficit was figured out for all of the principal industries at 150,000,000 pre-war rubles. The highest share of the deficit was claimed for the metal industry—37,500,000 gold rubles. Next came the textile industry. The mining industry will require 24,250,000 rubles, of which 22,000,000 rubles is for coal mining alone. This amount is equivalent to the estimated cost of three months' output, less about 20 per cent. for proceeds of sales of coal in the open market. The deficit of the electrical industry is estimated at 12,000,000 rubles, distributed as follows: Electrotechnical works, 5,000,000 rubles; central power plants, 7,000,000 rubles.

"The report of the Chief Electrical Bureau, given in detail in *Economic Life*, May 7th, 1922, places the indebtedness of the nationalised electrical industry for wages alone on May 1st at 431,000,000,000 soviet rubles. The chief consumers of the industry are State institutions, which are extremely lax in paying for service. The total arrears in payment of past-due accounts of the various commissariats were estimated on May 1st at 3,000,000 gold rubles. Up to April, 55 per cent. of consumers of electric current were on the free list. The total subsidy required by the electrical industry to balance the budget of the current fiscal year (up to October 1st) is estimated in the report at 27,248,000 gold rubles, of which amount 12,787,000 rubles is needed for working funds and the remainder for industrial investments."

Lantern Slides.—Messrs. Tangyes, Ltd., Cornwall Works, Birmingham, have available for loan (free of charge) to engineering lecturers and technical instructors a large selection of lantern slides of their manufactures, also an assortment of slides of historical interest. A list of these will be sent on application.

A Dutch Manufacturing Company.—The report of the Netherlands High and Low Tension Apparatus (Hapam) Works Co., of Amsterdam, states that many difficulties arose in 1921 owing to the continued depression and the competition of countries having a depreciated currency. As a consequence it was impossible for the works, which is organised for production in bulk, to obtain sufficient orders to run at full capacity. Although the stocks were carefully valued in 1920, prices further declined last year, and thus exercised a great influence on the results, having regard to the large stocks on hand. In addition, the company had to meet its own contracts and accept the delivery of many goods which had to be placed in stock. As a consequence the results were not favourable, and after deducting the balance brought forward there was an uncovered amount of 24,000 florins on working account for 1921. The report adds that the turnover in the first half of 1922 was not very satisfactory, although the orders received in June showed progress.

Visit of Swedish Engineering Students.—Under the auspices of the Department of Overseas Trade a party of engineering students from the Technical High School, at Stockholm, have recently made a tour of this country. Among the works visited were those of Ferranti, Ltd., W. T. Glover, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., at Manchester, and the turbine works of C. A. Parsons, Ltd., at Newcastle-on-Tyne.

South African Railway Construction Act.—His Majesty's Senior Trade Commissioner in South Africa (Mr. W. G. Wickham) has forwarded to the Department of Overseas Trade a copy of the Railway Construction Act, 1922. This has been introduced by the Minister of Railways and Harbours, and provides for the construction and equipment of certain lines of railway, the electrification of railways, the validation of certain rights, and the construction of certain deviations, &c. In conjunction with the above, H.M. Trade Commissioner has also forwarded a copy of a report of the Railways and Harbours Board on proposed new lines of railway, 1922. Engineers' reports and estimates of cost of construction, with a route map showing the projected railway, are attached in each case to the Board's report, to which, subjoined, will be found information showing the approximate length, the ruling grade, the weight of rails proposed to be used, the total estimated capital cost of construction, as well as the cost inclusive of rolling stock, and a statement in balance-sheet form of the probable revenue and expenditure for the first 12 months of working after the line has been opened for traffic. Copies of the above may be seen by United Kingdom firms on application to the Department of Overseas Trade (Enquiry Room), 35, Old Queen Street, Westminster, London, S.W.1. (Ref. 9088/ED/EP.)

An Argentine Directory.—The proprietors of the Argentine Standard Directory have notified the Commercial Secretary to H.M. Legation at Buenos Aires of their willingness to include in the 1923 edition of the Directory the names and addresses of British manufacturers who are not represented in Argentina but are desirous of receiving inquiries from that country. No charge will be made for the inclusion of names of firms who will be classified in the Directory under the headings of the goods they manufacture. British firms interested should communicate direct with the Standard Directory Co., Tucuman 692, Buenos Aires, Argentina.

Indian Railway Co.'s Extensions.—According to *The Englishman*, the Bengal-Nagpur has an extensive programme of improvements in hand. Four and a half lakhs of rupees has been set aside for the extension of the electricity generating plant at Khargpur, and one lakh of rupees for a similar purpose at Adra. Extensive developments are to take place at the Khargpur workshops within the next three years, as 22 lakhs of rupees is to be spent in improving the machinery and plant.—*Reuter's Trade Service* (Calcutta).

E.D.A. Activities.—The advantages of electric shop-window lighting as a "Silent Salesman" are set forth in a pamphlet recently published by the Association (E.D.A. 265). This advocates the illumination of windows after closing hours, utilising time switches. Another publication (E.D.A. 295) gives instructions regarding electric cooking by "Dorothy," an ordinary housewife—not a technical expert. This should prove useful to suppliers of electricity and electric cookers in extending the use of energy for this purpose.

Copper and Lead Prices.—Messrs. F. Smith & Co. report August 1st:—Copper (electrolytic bars), £72; 10s. increase. Do., do. (sheets), no change. Do., do. (wire rods), £82; 10s. increase. Do., do., h.c. wire, no change.

Messrs. James & Shakespeare report August 2nd:—Copper bars (best selected), sheet and rod, no change. English pig lead, £26 15s.; 5s. decrease.

The Engineers' Wages Reduction.—As briefly stated in our last issue, the members of the various engineering unions voted against acceptance of the employers' terms involving a reduction in wages of 16s. 6d. in three stages. Later it was announced that the vote of the Engineering and Shipbuilding Trades Federation was to the same effect, but as the majority against acceptance was less than two-thirds the men are to continue working. The result of the ballot was conveyed to the employers by the men's representatives on July 27th, and following this conference a statement was issued by Mr. J. T. Brownlie (A.E.U.) and the officials of the other unions concerned urging the men to remain at work, having regard to the state of trade and the widespread unemployment. The employers stated that if the proffered terms were not accepted they would have to consider making the reduction in one "cut."

It is also announced that the employés' opposition to systems of payment by results has recently undergone modification, so much so, that a meeting of the unions and the employers was to have taken place yesterday to discuss the general institution of the system.

Yorkshire Power Co.'s Coming-of-age.—To celebrate the 21st anniversary of the formation of the Yorkshire Electric Power Co. about 300 employés and their wives and friends were entertained to tea and a party at the Rectory Grounds, Thornhill, on July 27th. There were sports for the children and other entertainments. The officials and staff presented a solid silver tray to Mr. W. B. Woodhouse, engineer and manager to the company, and a solid silver rose bowl and flower and fruit stand to Mr. J. J. H. Stansfield, secretary, both of whom have been with the company for 19 years.

Manufacturing in Russia.—In connection with the movement which is on foot in Russia under the auspices of the Soviet Central Electrical Department for the reorganisation of the electrical manufacturing works (to which reference appears on page 160) one works suggested that it was necessary to make the country independent of imports of electrical machinery and plant, and that reorganisation could only be carried out by the scrapping of most of the producing plant in the works. At any rate, these statements were made in a recent issue of the Soviet newspaper *Ekon. Zjizn.*, copies of which, a correspondent states, were placed at his disposal by Russian interests in London.

LIGHTING AND POWER NOTES.

Australia.—Bathurst (N.S.W.).—The Municipal Council has received a report from its consulting engineer formulating a scheme for the supply of electricity. The estimated cost is £37,000.

Newcastle (N.S.W.).—The annual report for 1921 of the municipal electrical engineer (Mr. G. Allbut) shows a total revenue of £100,258 and an expenditure of £86,246. The net result was a profit of £10,128. The number of units sold rose from 9,304,442 to 14,793,597. The City Council has decided to borrow £50,000 for additional electrical plant.—*Reuter's Trade Service* (Newcastle).

Bootle.—Transfer of Undertaking Approved.—The Electricity Commissioners have sanctioned the transfer of the electricity undertaking to the Liverpool Corporation.

Brighton.—Year's Working.—The accounts of the electricity undertaking (engineer: Mr. John Christie) for the year ended March 31st, 1922, record a total revenue of £206,213, as compared with £202,117 in the previous year. Working expenses increased to about the same extent, *viz.*, from £141,817 to £144,885, leaving a gross profit of £61,328 (£60,300). Capital charges were considerably less—£37,609, as against £48,441, giving a net result, after crediting bank interest, of £23,825 profit. The capital expenditure during the year amounted to £25,637, including an item of £15,813 for machinery and plant. The number of units sold increased from 11,261,408 to 11,408,093, and the maximum demand from 7,000 to 7,600 kW. The plant capacity is 12,500 kW.

Canterbury.—Loan Sanctioned.—The Town Council has received from the Electricity Commissioners sanction to a loan of £4,642 to complete payment for new plant at the electricity works.

Cheslyn Hay (Staffs).—Electricity Supply.—The Council has under consideration a proposal to supply the district with electricity.

Chester.—Year's Working.—The accounts for the year 1921-22 of the city electricity undertaking (engineer: Mr. S. E. Britton) show a total income of £50,278, comparing with a revenue of £47,716 in the preceding year. Working expenses absorbed £39,036, as against £33,838, reducing the gross profit to £11,242 from £13,878. Capital charges absorbed £10,439, leaving a net profit of £803. The amount of energy sold decreased from 3,717,802 to 3,539,560 kWh. The capital expenditure during the year totalled £47,787, the bulk of this being spent on machinery and cables.

Continental.—Ruthenia.—The *Gazette de Prague* says that a scheme is on foot, supported by the Slovak General Credit Bank, for the electrification of Ruthenia. The country is very rich in water power, so that the scheme should meet with success.—*Reuter's Trade Service* (Prague).

Spain.—The Sociedad Hidro-eléctrica Española hopes to put into operation shortly its works at the Las Aguas Fall, which will relieve it of the necessity of employing coal at seasons of low water. This will represent a saving of about 45,000 tons of coal per annum. Several important hydro-electric companies have works of considerable extent in progress with the same object, and when all the works are completed the saving of coal may be estimated at at least 200,000 tons per annum.—*Reuter's Trade Service* (Madrid).

France.—The development of the supply system in Paris is making remarkable strides under the operation of the new d'Electricité and the municipality, which was brought into force last year. Although the consumption of energy for power purposes in 1921 experienced a decline as compared with the preceding year, owing to the industrial depression, the total sales advanced from 191,155,000 kWh in 1920 to 202,720,000 kWh last year, and in the early months of the present year the consumption showed an increase of 20 per cent over the corresponding period in 1921. The work of raising the capacity of the stations from 120,000 to 240,000 kW has now been almost completed. These works represent only one stage, and a new programme of works has been submitted to the City Council

of Paris, which represents a supplementary financial expenditure of 300,000,000 fr. Among other matters it is found necessary to provide new sub-stations, increase the number of district offices, and, above all, make preparations for the unification of the network to a frequency of 50 periods, so as to enable the company to receive, if necessary, bulk supplies from other works.

Holland.—At a meeting of the Town Council of Dordrecht, held on July 11th, the proposal of the Mayor and Corporation to grant the concession for the supply of electricity to the municipality of Hoornaar was accepted. Plans have also been discussed for the electrification of the municipalities of Hoog Blokland, Arkel, Kodechem, Heukelon, and Asperen, and if these are carried out the total cost will be about gld. 345,000.

Belgium.—The Special Commission appointed by the Provincial Council of the Province of Liége in 1920 for the study of the distribution of electrical energy throughout the province has furnished a report, and makes a proposal that an intercommunal electrical co-operative society should be immediately constituted. H.M. Consul at Liége has furnished two copies of the above report, which can be consulted by United Kingdom firms interested on application to Room 49, Department of Overseas Trade, 35, Old Queen Street, Westminster, London, S.W.1. (Ref. 18,317/F.W./E.P.)

Russia.—It is stated in the *Izvestiya* that little has been done with electricity at the mines of the Donetz coal basin; in fact, only limited electrification or so-called "circuit" work, which consists in connecting up a system to some powerful station, with the simultaneous closure of other stations, has been carried out. It is hoped thus to have a large station of 70,000 kW in place of the present number of small stations now producing 95,000 kW. The total load on all existing stations is about 40,000 kW.

Croydon.—Hire of Domestic Appliances.—The Town Council has decided to expend £2,000 on electric cookers and motors to be let out on hire.

Dublin.—Water-power Scheme.—In connection with the scheme for the harnessing of the River Liffey to supply electrical energy to the city of Dublin, an inspection was made last week by representatives of the Free State Provisional Government, the Dublin Corporation, and Messrs. Buchi and Fey, of Zurich, consulting engineers, of the entire catchment area of the river and of the sites of the proposed electricity works. A dam is to be built, which will form a lake of 3,000 million cu. ft. capacity, which will provide sufficient power to supply all the electricity required for the city and district. The dam will be built about 200 yards above the walls of the Poulaphouca Valley, Co. Wicklow. The estimated cost of the scheme is about £1,000,000. The power stations suggested in the Water Power Committee's Report are at Poulaphouca, Ballymore Eustace, Salmon Leap, and Connell Ford, with subsidiary stations at Lockstown on King's River and at Cloghleagh. Storage will be needed above Poulaphouca and above Leixlip. The latter would be necessary both for peak loads and for daily regulation owing to the fact that the water allowed to flow down from Poulaphouca would only reach Leixlip about 20 hours later. Ballymore Eustace will be capable of dealing with a peak load of about 30,000 h.p., and Leixlip with a peak load of 10,000 h.p. These two stations will, however, be more than enough for the total present requirements of the city. As the demand develops, subsidiary stations will be put into operation.

Federated Malay States.—Singapore.—A report submitted by the electrical adviser to the Government states that although for some years the various areas of supply in Malaya will be isolated from each other, it is practically certain that all public supplies from Singapore to Penang will eventually be connected together to form one supply. The total cost of reconstructed and new installations to meet the full demands of the present population is put at 37,136,000 dollars and the power at 51,120 kW. This is for the whole country, including the Unfederated States. It is recommended that in Singapore a central power station should be erected to supply light and power to an area of about 30 square miles, replacing the present supplies which are obtained from the tramways and the Singapore Harbour Board. The system of supply would be a.c. 3-phase, with a frequency of 50 cycles. The e.h.p. transmission lines would be run at 22,000 or 33,000 V. and the supply to domestic consumers would be 240 V. For large power demands, electricity could be supplied at any intermediate pressure. The capital cost of the new and reorganised supply for Singapore is estimated at 5,167,000 dollars. It is estimated that a steam station of 7,500 kW could be installed, and, later on, as demands increased, extended to a capacity of about 12,500 kW, which, with additional transmission lines, sub-stations, feeders, distributors, and house services, would necessitate a further expenditure of 1,273,000 dollars, making a total capital cost of 6,440,000 dollars. It is estimated that within a few years the demand for electricity in Singapore will be about 5,700,000 kWh per annum for domestic use, &c., eventually rising to 23,400,000 kWh per annum.—*Reuter's Trade Service* (Singapore).

Formby.—Electricity Supply.—The District Council is considering a scheme for supplying the district with electricity for both power and lighting. It is proposed to obtain the energy in bulk from the London & North-Western Railway Co.

Ipswich.—Year's Working.—The report of the chief engineer and manager of the municipal electricity undertaking for the year ended March 31st, 1922, shows a total income of £83,489, as compared with £90,854 in 1920-21. Working expenses totalled £55,481, as against £61,682 in the previous year, leaving a gross profit of £28,008 (£29,172). Capital charges absorbed £10,074 (£9,390), making the net result a profit of £17,934, as against £19,782. The capital account shows an expenditure of £46,106, the largest item being £23,145 for engines and dynamos. The sales of energy decreased from 5,464,955 to 4,906,830 units, and the maximum demand from 3,438 to 3,382 kW. During the year the second 3,000-kW Brush-Ljungström turbo-alternator was installed, and is now ready for use. A large amount of mains and feeder extensions were carried out.

Kingston-on-Thames. — Price Reductions.—The Town Council has reduced the maximum charge for electricity for general lighting from 9d. to 8d. per unit, and the 10 per cent. addition to the scale charges for electricity for power and heating has been removed.

Leek.—Loan.—The Urban District Council has decided to apply for a loan of £15,000 for new plant at the electricity works.

Liverpool.—Bulk Supply.—The Electricity Committee has recommended that an application be made to the Electricity Commissioners for an Order authorising the Corporation to furnish a supply of electricity in bulk to the Hightown Gas and Electricity Co., subject to the granting and confirmation of the Liverpool Electricity (Extension) Special Order, 1922.

Paisley.—Price Reductions.—It is proposed to reduce the charges for electricity for lighting by 1d. per unit and for heating by ½d. per unit.

Rochdale.—Street Lighting.—The Gas and Electricity Committee has adopted a scheme for the lighting of all the main streets of the borough by electricity, for which cable is to be laid at an estimated cost of £7,000.

Venezuela.—Electricity Scheme.—The City of Carupao is to install electrical plant on the Guarenas River, located at a point about 18 miles distant from Caracas, the capital. Electricity for both light and power will be generated up to a total of 2,500 h.p. The head of the fall is approximately 3,000 ft., and about 20 miles of transmission line will be required. The transmission pressure will be 35,000 V.—*Reuter's Trade Service* (Caracas).

Wrexham.—Loan.—The Town Council has applied for a loan of £1,570 in connection with the supply of electricity from Gresford Colliery.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—The Tramways Board is submitting for official sanction a scheme to construct an electric tramline traversing a portion of the centre of Melbourne. The estimated capital cost of the undertaking is £270,000. The policy of the Board with regard to the extra cars required was outlined in our last issue.

Sydney.—Work in connection with the city railway (a portion of which will travel underground) will shortly be proceeded with. Reports prepared show that nearly £1,000,000 has been spent already on the project. The Ministry of Railways has stated:—"The City Railway must be proceeded with and brought to completion at the earliest date possible. Traffic is increasing at the rate of 10 to 12 per cent. per annum, and the present tracks are at the limit of their capacity."—*Reuter's Trade Service* (Melbourne).

Cardiff.—New Electric 'Buses.—The Finance Committee has authorised the expenditure of £13,000 on the acquisition of eight new electric motor omnibuses.

Dutch East Indies. — Railway Electrification. — The Government of the Dutch East Indies has decided to convert all the railways in Java to electric traction. Two power stations are to be erected for this purpose at distances of 39 and 27 miles respectively from Batavia. The reconstruction of the line between Meester-Cornelis and Tandjong-Priok is first to be put in hand, and it is hoped to be able to start work on this line next year.

Fife.—New Track.—The Fife Tramways Co. is to construct a tramway line from Rosyth to Inverkeithing.

Ipswich.—Year's Working.—The accounts of the borough tramway undertaking for the year ended March 31st last record a total revenue of £44,528, as compared with £50,341 in the previous year. The expenditure amounted to £44,735, as against £51,942, resulting in a gross deficit of £207 (£1,601). This was increased by capital charges to £4,596 net, which, however, compares favourably with the previous year's deficit of £5,163. The number of car miles run declined from 652,420 to 550,703, and the number of passengers carried from 6,170,242 to 5,552,849.

London.—Ticket-issuing Machine.—The Metropolitan Electric Tramways, Ltd., are introducing an automatic ticket-issuing machine on the new type of tramcars in course of construction.

The exits from the cars, both from the upper and lower decks, will be separate from the entrances, and the doors will be automatically controlled. It is also proposed to provide duplicate ticket-issuing machines at certain points on the route to facilitate travelling during the busy hours.

Newcastle-on-Tyne.—Light Railway.—The City Corporation has received the sanction of the Light Railway Commissioners to construct a line through Gosforth Park, which will connect the Westmoor extension of the City system with the Gosforth Park section of the Tyneside Tramways and Tramroads Co., over which the municipality has already running powers. The track through the park will be on sleepers, and will consist of a double line. The estimated cost of the scheme is £50,000.

Salford.—Track Renewals.—The Tramways Committee has recommended the Council to apply for sanction to borrow £39,500 for relaying parts of the tramway track in Eccles New Road and Eccles Old Road.

TELEGRAPH AND TELEPHONE NOTES.

Esthonia.—Telephone Development.—The telephone system of Esthonia, inherited from the Russian *régime*, is so antiquated that extensive betterments are becoming imperative, states a report published by the U.S. Department of Commerce. Except the private lines of the Soviet Mission, which connect with Petrograd, the only connection with other countries is the submarine cable to Helsingfors; trunk lines throughout the country are so scarce that long-distance calls are seldom made, says the *Financier*. Not only is line construction contemplated, but an entirely new central plant must be installed. The number of subscribers could be tripled at once if equipment were adequate, and a switchboard of 25,000 lines is under discussion. The chief engineer is now making an investigation in Germany, Belgium and Sweden to determine whether a manual, automatic or semi-automatic board will be purchased, as well as other modern devices. The Siemens Co. has sent representatives from Germany with a small model automatic system. Development in Reval was delayed because pre-war rates were four or five times as high as in Finland. There are at present only 2,000 subscribers, all on single lines, in this city of nearly 130,000 inhabitants; but this number will shortly be increased to 3,000. The annual basic rates are 4,000 Esthonian marks for residence and 8,000 Esthonian marks for a business 'phone, plus 1 mark per call from each. The latter surcharge was recently added in an attempt to make the system more self-supporting. At present the central office equipment is old Russian, cables are German, connecting wires Swedish, and instruments and miscellaneous equipment are from the Esthonian factory in Dorpat. The few underground cables are not laid in conduits, and the cost of locating and repairing is so great that concrete conduits must be laid.

Ireland.—Wireless Station Destroyed.—The Marconi wireless station at Clifden, Co. Galway, was destroyed by "irregulars" on July 25th. The receiving station was burned down and the condenser house bombed. The station was connected with London by a land line, and its chief use was for communicating with Canada, which service is now being worked from the new Marconi station at North Weald, near Ongar, in Essex, which also maintains services to France, Switzerland, and Spain. The Clifden station was opened on October 7th, 1907, and the corresponding Canadian station was at Glace Bay, Nova Scotia. It was manned by 25 operators, 10 engineers, and about 50 general staff; and, in addition, as a side line, big peat works gave employment to a large number of people, so that the living of not less than 1,000 people depended upon it.

Italy.—Transmarine Cable Scheme.—A Royal decree has been published in Madrid ratifying the text of the concession, approved by the Council of Ministers and granted by the Spanish Government to the Italian Submarine Cable Co., which proposes to establish cables between Italy and South America. The concession authorises the company to create two landing places at Malaga and Las Palmas respectively, and to erect and work receiving and transmitting stations.

Wireless Apparatus.—A prize competition of 100,000 lire has been instituted by the Italian Ministro della Guerra for the invention, by an Italian, of a wireless telephone specially suitable for use during intense operations in the field of war. The power of the apparatus is fixed at 2 kW, at least; secrecy of messages sent, capability of being used by non-technical individuals, ease of repair, and other qualifications are stipulated. The designs must be submitted within a period of two years.

Philippines.—Broadcasting.—A broadcasting wireless service has been established in the Philippine Islands by an American manufacturing concern. The range is 600 miles, and both telephone and telegraph messages will be transmitted broadcast daily.—*T. & T. Age.*

Uruguay.—Telegraph Developments.—The Executive Council will shortly consider a project for considerably extending the State telegraph system; an internal loan of 1,000,000 pesos will be issued for the purpose.—*Financial Times.*

Wireless Telegraphy.—Broadcasting.—The six companies which are to have control of the British wireless broadcasting stations are the Metropolitan-Vickers Electrical, the General Electric, the Western Electric, the Radio Communication, the B.T.H., and the Marconi companies. The Postmaster-General's meetings with the representatives of the wireless distributing companies have been satisfactory, and the companies will now get to work in earnest.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—October 17th. Postmaster-General's Department. Automatic c.b. telephone equipment, with all associated equipment including material for use at subscribers' premises. (Sched. 39 and 40.) (July 7th.)

September 27th. Telephone apparatus and parts. (Sched. 561.) (July 14th.)

Victorian Electricity Commission.—Ten surface feed-water heaters; 6 surface vapour condensers; 12 feed-water evaporators. Specifications £2 2s. Particulars from Agent-General for Victoria, Melbourne Place, Strand, W.C.2.

September 13th. Tramways Board. Twenty-seven straight air-brake equipments for single-truck tramcars.

December 18th. Victorian Electricity Commissioners. Supply of a complete brown coal-handling plant.—*Reuter's Trade Service* (Melbourne).

Brisbane.—September 20th. Postmaster-General's Department. Supply and delivery of switchboard apparatus and parts. (Sched. No. 559.)*

Belgium.—August 16th. Administration des Télégraphes et Téléphones, La Salle Madeleine, Brussels, 120 tons of copper wire, 1-4 mm. dia., having a conductivity of 30 per cent.; 40 tons of ditto, with 80 per cent. conductivity; and 40 tons 2 mm. dia. and 80 per cent. conductivity.

August 2nd. Municipal authorities of Schaerbeek, Brussels. 10,500 metres of armoured l.p. cable and 3,000 metres ditto for h.p. mains. Service de l'Electricité, Hotel Communal, Schaerbeek.

Commandant des Bâtiments Militaires de Liége-Rive Droite, 22, Rue des Bonnes Villes, Liége. Generator for the electric lighting station at the military sanatorium at Marchin.

Edinburgh.—September 5th. Corporation. Conversion of two overhead cranes from mechanical to electrical operation. (See this issue.)

Manchester.—August 8th. Electric lighting of portion of Monsall Hospital. City architect, Town Hall, Manchester.

August 24th. Electricity Committee. Two steel ash wagons and a lifting sling. (See this issue.)

August 8th. Tramways Department. Single-deck petrol omnibus; steel tramway poles. General manager, 55, Piccadilly, Manchester.

New Zealand.—October 24th. Mangahao Power Scheme. Copper wire. November 21st. Battery booster-transformer. Specifications may be obtained from the office of the High Commissioner.

October 3rd. Mangahao Power Scheme. Power-house and sub-station transformers; travelling electric cranes; ventilating fans; goods lift; and 110,000-V insulators.*

September 30th. Teviot Electric Power Board. One horizontal turbine, Francis type, coupled to a 125-kW, 3-phase, 50-cycle, 3,300-V generator; one 7.5-h.p. Pelton wheel; one 5-kW motor generator set; and complete switchboard and power station equipment.*

Nelson.—September 21st. The Waimea Electric Supply and Manufacturing Co., Richmond, Nelson. Supply of a 150-kVA, 2,500-volt generator and control panels.

Wellington.—City Council. Erection of a large reinforced concrete power station at Shag Point.—*Reuter's Trade Service* (Melbourne).

Oxford.—August 15th. Oxford Electric Co., Ltd. One 1,000-kW turbo-alternator and condensing plant; and one 500-kW conversion plant (3,000 V, 3-phase, to 1,100 V, d.c.), complete with switchgear. (July 21st.)

Rhondda. Urban District Council. Two 3-in. and two 6-in. vertical-spindle centrifugal pumps, together with electric motors. Also two cast-iron tanks in connection with the pumps. Specifications (£1 1s.) from Mr. E. Taylor, engineer and surveyor, Rhondda Urban District Council Offices, Pentre, Rhondda.

Rochdale.—August 16th. Union. Installation of automatic telephone system at Dearnley Institution. (See this issue.)

South Africa.—Grahamstown.—September 1st. Electric lighting plant and equipment, comprising steel poles, overhead wiring, house services, fuses, transformer switches, meters, street lamps, &c. Consulting engineer: Prof. W. Buchanan, 75, Louis Botha Avenue, Houghton Estate, Johannesburg.*

Pretoria.—August 17th. Municipality. Supply and delivery of 950 steel poles for the Tramway Department.*

Tasmania.—Hobart.—October 2nd. City Council. 750-kW rotary converter and transformer and 550-volt, d.c. switchboard panel. Further particulars are due to arrive at the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2, about the middle of August.

Warrington.—August 14th. Electricity and Tramways Committee. High and low-pressure paper and lead-covered cable, and earthenware conduits. (July 28th.)

Wimbledon.—August 31st. Electricity Committee. One 3,000-kW turbo-alternator, condensing plant, and accessories. (July 28th.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Glasgow.—Tramways Committee. Recommended:—
D.c.c. wire.—British Insulated & Helsby Cables, Ltd.
Steel for tie bars.—P. & W. MacLellan, Ltd., and Smith & McLean, Ltd.
Air compressor for Dalhousie sub-station.—Fleming & Co.
Cast-iron exhaust piping for Pinkston.—Macfarlane, Strang & Co., Ltd.
Brass tubing for cars.—C. Henderson & Co., Ltd.

Government Contracts.—The following Government contracts were placed during June, 1922:—

Admiralty (Contract and Purchase Department).
Submarine batteries.—Hart Accumulator Co., Ltd.; Tudor Accumulator Co., Ltd.; D.P. Battery Co., Ltd.; Chloride Electrical Storage Co., Ltd.

Air Ministry.
Accumulators.—Peto & Radford.
Electrical material.—General Electric Co., Ltd.
Electrical equipment of Lancia cars.—S. Smith & Sons (M.A.), Ltd.

Crown Agents for the Colonies.
Cells.—J. Stone & Co., Ltd.
Electrical equipment.—Siemens Bros. & Co., Ltd
Electrical instruments.—Railway Signal Co., Ltd.
Motors and control gear.—Lancashire Dynamo & Motor Co., Ltd., associated with the Crypto Electrical Co., Ltd.
Train lighting spares.—J. Stone & Co., Ltd.; Vickers, Ltd.

Post Office.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co., Ltd.
Testing, protective apparatus, &c.—Morgan Crucible Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—Connolly's (Blackley), Ltd.; Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Compound.—W. H. Keys, Ltd.
Loading coils.—Western Electric Co., Ltd.
Cords for telephones.—British Insulated & Helsby Cables, Ltd.
Ducts.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.; G. Jennings; J. Oakes & Co. (Clayworks Department); Sutton & Co. (Overseal), Ltd.; Stanley Bros., Ltd.; J. H. Turner & Lisney, Ltd.
Insulators.—J. Bourne & Son.
Lead (sheet and strip).—G. Farmiloe & Sons.
Lead lugs.—I. N. Lyons, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Thermionic valves.—General Electric Co., Ltd.; Marconi Wireless Telegraph Co., Ltd.
V.I.r. wire and cable.—Hackbridge Cable Co., Ltd.
Laying conduits.—Numerous contracts have been placed during the month.
Telephone exchange equipment.—Darlington: Western Electric Co., Ltd. Epsom: Automatic Telephone Manufacturing Co., Ltd.

H.M. Office of Works.
Converter set.—General Electric Co., Ltd.

Ilford.—The Urban Council has decided to accept a tender from a British firm supplying Belgian material for tram rails and fishplates, this being the lowest quotation. The difference in the tenders was £9 a ton for Belgian material, and £12 for British, and the total saving on the contract by accepting the lowest tender is £150.

Liverpool.—Electricity Committee. Recommended:—
The erection of an electric sub-station in Bull Lane, Aintree (£1,206).—Joshua Henshaw & Sons, Liverpool.

London.—St. Pancras.—Electricity Committee.
Conversion of Grafton Road Chapel into an electricity sub-station (£4,221).—National Building Guild, Ltd. (recommended).

Cable for the supply of electric power to Messrs. Hulton's premises in Gray's Inn Road:—

Macintosh Cable Co., Ltd.	£16,499
Electrical Supplies Co.	15,458
Callender's Cable & Construction Co., Ltd.	14,679
Enfield Ediswan Cable Works, Ltd.	14,351
Watsham's	14,291
Pirelli-General Cable Works, Ltd.	14,225
Hackbridge Cable Co., Ltd.	14,205
W. T. Glover & Co., Ltd.	14,045
W. T. Henley's Telegraph Works Co., Ltd.	13,906
Siemens Bros. & Co., Ltd.	13,743
British Insulated & Helsby Cables, Ltd.	13,657
Western Electric Co., Ltd. (recommended)	**13,634**
Johnson & Phillips, Ltd.	13,639
Union Cable Co., Ltd.	13,362

Closed-circuit boiler-feed and water-testing apparatus at King's Road Station (£1,415).—Weir & Co. (recommended).

Coal for the electricity station. Accepted:—
500 tons Cadby Hall nutty slack, 22s. 5d. per ton; 500 tons Ramcroft 1½ in. nutty slack, 22s. 11d. per ton; 500 tons Pinxton low main nutty slack, 22s. 11d. per ton; 500 tons Pinxton low main ½ in. nutty slack, 19s. 5d. per ton; 500 tons Bentinck nutty slack, 24s. 3d. per ton; 500 tons Fenton 2 in. nutty slack, 21s. 5d. per ton.—J. H. Beattie & Co., Ltd.
200 tons Russell black vein washed nuts, 35s. per ton, plus 2s. 9d. ton cartage.—Harper & Christopher.
100 tons Ramcroft large, 33s. per ton.—J. H. Beattie & Co., Ltd.

L.C.C.—Highways Committee.
Steel rolling shutters for the Central Tramway Repair Depôt (£1,790).—Wilson Rolling Shutter Co. (accepted).

Three-phase motors, &c., for the central repair depôt extension:—

Crompton & Co., Ltd. (accepted)	**£1,016**
General Electric Co., Ltd.	1,019
Metropolitan-Vickers Electrical Co., Ltd.	1,117
Lancashire Dynamo and Motor Co., Ltd.	1,149
Electric Construction Co., Ltd.	1,166
Bruce Peebles & Co., Ltd.	1,186

Erection of a trailer car shed at Brixton Hill.—L. H. & R. Roberts, £14,986, plus £1,064 for boarded and slate covered roof coverings instead of galvanised iron (accepted).

Metropolitan Asylums Board.—Installation of internal automatic telephones at River Hospitals:—

T. Clarke & Co., Ltd. (recommended)	**£4,600**
Reliance Telephone Co., Ltd.	4,996
Automatic Telephone Manufacturing Co., Ltd.	6,134
E. Shipton & Co.	6,600
Electrical Contracts & Maintenance Co., Ltd.	6,800
Commercial Telephone & Electrical Co., Ltd.	6,897
F. G. Howard, Ltd.	7,944

Installation of electric lighting in ward blocks, &c., Grove Hospital:—

E. Beckwith & Co., Ltd. (recommended)	**£1,431**
Scottish Power & Electric Contracting Co.	1,532
S. Reed & Sons	1,590
Malcolm & Allan, Ltd.	1,826
J. Briggs & Co.	1,872
A. F. Goodwin & Co.	1,885
D. Henderson	1,975
G. Hopkins & Sons (Clerkenwell), Ltd.	2,050
Myall Bros.	2,078
T. H. Smerdon	2,333
Rawlings Bros., Ltd.	2,335
Keeble (1914), Ltd.	2,375
Tov & Winslow	2,500
S. G. Cozens & Co.	2,750
F. G. Howard, Ltd.	3,878
Hill, Upton & Co.	4,239

Loggerhead (Cheshire).
Electric lighting installation at the Burntwood Sanatorium.—Carrington and Button, Crewe.

Luton.—Town Council. Accepted:—
2,000-kW transformers (£2,303).—Brush Electrical Engineering Co., Ltd.

Manchester.—Education Committee. Accepted.
Electric lighting of schools:—Mulberry Street school, Maitland & Co.; Southall Street do., Seddon & Sons; Duke Street do., Alliance Electric Co.; Johnson Street do., Building Guild, Ltd.; Waterloo Road do., Power and Lighting Supplies Co., Ltd.; Sunnyside do., Ward & Booth.

Electricity Committee. Accepted. (Barton Works):—
Three electrical distance indicating thermometers.—Siemens Bros. & Co., Ltd.
Two electrical distance recording thermometers.—Cambridge & Paul Instrument Co., Ltd.
Ventilating plant for transformer and testing chambers.—Matthews and Yates, Ltd.; sub-contractors for switchgear, Midland Electrical Manufacturing Co.; for auto-transformers, Ferranti, Ltd.
Cables.—Callender's Cable & Construction Co., Ltd.
Capstans and bollards.—Sir W. G. Armstrong, Whitworth & Co., Ltd.; sub-contractors for motors, Lancashire Dynamo and Motor Co., Ltd.; for control gear, E. Holme & Co., Ltd.
Main and switch house batteries.—Chloride Electrical Storage Co., Ltd.

Housing Special Committee. Accepted:—
Installation of electric light at houses on the Catterick Hall, Newton Heath, and Gorton Mount Estates.—E. M. Evans & Sons.

Reigate.—Town Council. Accepted:—
Overhead travelling crane (£1,234).—Carrick & Ritchie.
Oil tanks (£1,050).—Oxley Bros.
Dismantling, reassembling, and refixing existing cast-iron water tank (£251 5s. 7d.).—Tamplin & Makovski, Ltd.
Diesel engines and alternators.—Mirrlees, Bickerton & Day.

Salford.—Electricity Committee.
Switchgear, &c., required in connection with the new generating station at Agecroft (£56,506).—Metropolitan-Vickers Electrical Co., Ltd. (Recommended.)
L.p. lead-covered cable (£1,889).—W. T. Glover & Co., Ltd. (Accepted.)
One 500-kVA transformer (£505). Metropolitan-Vickers Electrical Co., Ltd. (Accepted.)

Tramways Committee.
One low-built tramcar (£2,150).—Brush Electrical Engineering Co., Ltd. (Accepted.)

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week, we need the names of suppliers or manufacturers of:—
The Lester dynamo.

Wireless on Aircraft.—The International Commission on Air Navigation has decided that in the interests of public safety all aeroplanes must be fitted with a wireless installation.—*The Times.*

NOTES.

Reduction of Electricians' Wages.—We learn from the president of the Electrical Contractors' Association (Mr. H. Marryat) that at a meeting held in York on July 27th between the executives of the N.F.E.A. and the E.T.U., an agreement was arrived at by which a reduction of electricians' wages will take place in two stages, 5 per cent. on the second pay day in October, and a further 5 per cent. on the second pay day in December. The agreement has been confirmed by the National Joint Industrial Council. It was suggested by the employers that wages should only be reduced in districts where the wages of electricians in other branches of the industry were lower than those in the contracting branch, but the proposal did not meet with the approval of the E.T.U. representatives. Other matters decided at the conference were the down-grading of Southampton and Belfast to Grade "C," and the retention of Bournemouth and Cambridge County in their present grades.

Appointments Vacant.—Meter tester for Wolverhampton Electrical Engineer's Department; demonstrator in the Electrical Engineering Laboratory, for the East Ham Technical College; engineer for the testing and calibration of switchgear instruments, &c. (75s. and bonus), for the L.C.C. Tramways Department. (See our advertisement pages to-day.)

British Engineering Standards Association.—The B.S.S. No. 96-1922 for "Parallel sided carbon brushes for d.c. commutator machines" has just been issued. After a great deal of consideration by the committee responsible for its preparation, it was decided to standardise only sizes of brushes for d.c. machines in the first instance. The specification is divided into two sections referring to carbon and metal-carbon brushes and compressed unburnt graphite brushes respectively, for which nominal dimensions and permissible tolerances are specified.

Wireless Developments.—An invention likely to cause a revolutionary change in wireless long-distance work has been made by Dr. Irving Langmuir, the world-famous physicist. Senatore Marconi recently paid a visit to Dr. Langmuir's laboratory to see it at work. It is a simple tube for the generation of powerful wireless currents, and its possibilities are such that it may "scrap every big plant in existence when fully developed." Mr. Marconi has himself recently predicted that to-day's equipment will be obsolete ten years hence.

A method of wireless telephony that has been used between Moscow and Berlin (over 1,000 miles) with success and is stated to give remarkably true rendering of the human voice is known as the Pungs-Gerth system. Its chief feature is the novel way in which the microphone currents are made to influence the currents radiated from the antenna by a new magnetic device giving great purity of tone and distinct speech reproduction.

Further progress has been made in the automatic recording of wireless messages, in the shape of a new apparatus which allows of two messages of nearly equal wave-length being simultaneously registered in the operator's absence. Despite the sensitiveness of the device—which is the work of Mr. F. W. Dunmore, of the American Bureau of Standards—it can be used to record messages on an aeroplane, being proof against vibration.

A remarkable new receiving apparatus, invented by Major E. H. Armstrong, is stated to amplify wireless impulses more than a hundred thousand times, and to be many hundreds of times more sensitive than the best heterodyne receiver. It has been recently described at the American Institute of Radio Engineers, and has caused intense interest. Much depends upon the evolution of the receiving apparatus in long-distance wireless; the more sensitive that it can be made, the less power will be required for transmission.

One of the most remarkable developments in wireless broadcasting is the extensive transmission of time signals. Started in 1909 by the Eiffel Tower, the sending of time signals is now a feature of over forty of the world's chief wireless stations. They are sent out on widely varying wave-lengths and systems. The familiar time signals of the Eiffel Tower make it easy with a little practice to register the correct time to within a half to a quarter of a second.—*Daily Mail.*

Fatality.—On July 24th Tudor Williams, assistant electrician at Blaencaegurwen Colliery, South Wales, and an international footballer, was killed by an electric shock. It appears that while examining a cable at the colliery he accidentally came into contact with a current-carrying wire.

A Wireless Telephony Experiment.—One of the receiving stations arranged for the much-advertised *Daily Mail* wireless concert from The Hague was at the offices of a well-known London electrical firm. On the appointed evening a large audience had assembled before the scheduled time. Seven o'clock arrived, but the loud-speaking apparatus which had been set up remained dumb, and it was apparent that something was wrong. Whether it was the inadequacy of the transmitting power (800 watts) or whether atmospherics and Croydon were to blame, the fact remains that a large crowd was disappointed. An attempt to mitigate their chagrin was made by the running over of a few gramophone records, and, later, by a wireless concert from a nearer source. The first was rather nerve-racking, and the second was reminiscent of the earliest of phonographs. No doubt better success will attend later efforts, but in the meantime it will be better, both for "wireless" and the public, if audiences are not summoned together to be experimented upon.

It is only fair to say that in several places The Hague concert was received—these places being chiefly upon the East Coast.

American Electric Railway Association's Convention.—The American Electric Railway Association, comprising nearly 600 railway and manufacturing companies, will hold its forty-first annual convention at Chicago from October 2nd to 6th, simultaneously with the conventions of its subsidiary organisations, the Engineering, Transportation, Manufacturers', Accountants', and Claims Associations. Large city and interurban passenger cars, motor 'buses, and machinery of various sorts will be exhibited. The electric railways of the United States and Canada represent an investment of about $5,000,000,000.—*Reuter's Trade Service* (Chicago).

The Salaries of Municipal Electrical Engineers in Scotland.—The action which has been taken by municipal authorities in several places regarding the salaries of chief electrical engineers has been reported in our "Personal" columns during the last few weeks. One of the most prominent cases has been that of Dundee, and it arose when the appointment of a successor to Mr. H. Richardson was receiving attention. A similar subject was last week under discussion at a meeting of the Edinburgh Town Council, when, according to the *Dundee Courier*, Mr. Stevenson moved that the Council accept the recommendation of the Electricity Committee to withdraw from the National Joint Board. Mr. Stevenson quoted the salaries paid to the employés in the electrical undertaking before the war, and compared them with the largely increased salaries paid under the Government scheme which set up the National Joint Board. Mr. Mancor, in seconding, said that if they were going to carry on such a large and costly undertaking as the electric power station at Portobello they could not afford to be burdened with such high salaries as they would be saddled with under the scale of this Joint Board. Mr. Guest, vice-convener of the Electricity Committee, said all he wanted was that this matter should be delayed till they saw the revised schedule of salaries which was to be put forward by the Joint Board. Judge Robertson said what they had to decide was whether the Town Council should settle the remuneration to its own servants or leave it to outsiders. Under the schedule of this Joint Board they found men receiving 100 per cent. more than their previous maximum, which was far more than the Town Council gave to any of its other officials. On a vote, Mr. Stevenson's motion was carried by 33 votes to 17.

The decision of Edinburgh has been followed with great interest at Dundee, as may be gathered from the following editorial comment appearing in the *Dundee Courier*: "Dundee Corporation should note for their encouragement the action taken by Edinburgh Town Council. That body decided to withdraw from the National Joint Board, which was set up under a Government scheme, and which requires them to pay the officials in their electricity department salaries which the Council consider excessive. The Dundee authorities have been somewhat taken aback by the refusal as inadequate of the salary they offered to a prospective new electrical engineer for the city. And there have been comparisons with other towns, and some misgivings as to whether they would get a competent official at their own figure. Let Edinburgh's example strengthen them in the determination to stick to their own estimate of what is fair remuneration for their officials."

The New Magnetic Atom. In order to improve his original theory of magnetic induction in ferromagnetic materials, Sir J. A. Ewing published in February his theory that the magnetic element is not the atom itself but something smaller, which can rotate within the atom. It may be likened to a wheel with a number of like poles on its rim and the poles of opposite kind at its centre. Around it is a fixed ring provided with magnetic poles, under the action of which the wheel may take up a number of positions of equilibrium. Two months later Prof. E. T. Whittaker showed that a model of this type, when approched by an electron with kinetic energy exceeding a certain amount U, would take from it an amount U depending on the electronic charge and on the constants of the model, and that if ν is the frequency of the oscillations of the model and of the radiation it emits, then $U = h\nu$ where h is the constant of the quantum theory. More recently Dr. H. S. Allen has pointed out that such a vibrator would not lead to the equi-partition law, and Dr. R. A. Houston has shown that for the model to vibrate with the frequency of sodium light its diameter must be 2.7×10^{-8} cm. and with its X-ray frequency 3.5×10^{-9} cm. which agree well with the known diameter, 2×10^{-8} cm. of the hydrogen atom. The four papers mentioned will be found in the *Proceedings* of the Royal Society of Edinburgh. —*Nature.*

South-East Lancashire (Interim) Electricity Advisory Board.—The Electricity Commissioners have published a draft order establishing the above Board, which, it is anticipated, will shortly be made by the Ministry of Transport, upon which the Board will become a statutory body vested with the powers conferred upon it by the Order. In the meantime matters have reached an advanced stage in the South-East Lancashire area. The whole of the constituent authorities have voluntarily agreed to set up an Interim Board and to act in relation thereto in all respects as though the Order was actually in force. Moreover, the Commissioners have also agreed to refer to the Interim Board all matters which would have to be referred to the Board if the Order was in actual operation. The Interim Board held its first meeting on July 11th, and appointed Alderman W. T. Dagnall (chairman of the Manchester Corporation Electricity Committee) who has been chairman of the Conference during the past two years, to the chairmanship of the Board. Dr. H. F. Parshall was appointed vice-chairman. In pursuance of the Order the Board at its first meeting appointed an Engineering Advisory Committee, consisting of the following members:—

Undertakings Generating more than 5 per cent.: Mr. S. L. Pearce (Manchester), Mr. C. D. Taite (Lancashire Electric Power Co.), Mr. J. J. H. Wood (Bolton), Mr. J. A. Robertson (Salford).

Undertakings Generating more than 3 per cent., but not more than 5 per cent.: Mr. F. L. Ogden (Oldham), Mr. B. Lomax (Stockport).

Undertakings Generating more than 1.5 per cent., but not more than 3 per cent.: Mr. R. Owen (Wigan).

Undertakings Generating not more than 1.5 per cent.: Mr. G. H. Fawcus.

Stalybridge, &c., Board (Qualified Membership): Mr. R. Blackmore.

Railways, North-Western, Midland, and West Scottish Group: Mr. C. W. Neele. (Co-opted.)

Railways, North-Eastern, Eastern, and East Scottish Group: Lieut.-Col. H. E. O'Brien. (Co-opted.)

This election was made from nominations made by the constituent authorities. The Engineering Advisory Committee has appointed as chairman Mr. S. L. Pearce, C.B.E., M.Sc., chief engineer and manager of the Manchester Corporation Electricity Department, and Mr. C. D. Taite, of the Lancashire Electric Power Co., vice-chairman. Both the Interim Board and the Engineering Advisory Committee are now meeting and transacting business as though the Order had been approved by Parliament, and the constituent authorities have great confidence in the future success of the Board.

Iron and Steel Institute.—The annual autumn meeting of the Institute (president: Dr. J. E. Stead, F.R.S.) will be held by kind permission of the Yorkshire Philosophical Society in the Museum Theatre, York, in September. Members will assemble at York on Monday, September 5th; on the Tuesday the Lord Mayor of York, Ald. W. H. Birch, will welcome the visitors, and the day will be devoted to the reading and discussion of papers. During the afternoon Mr. W. McConway, of Pittsburg, will give a film demonstration of the new process of producing steel disks by centrifugal-hydraulic methods direct from molten steel. On the Wednesday morning more papers will be read and discussed; in the afternoon there will be a garden party and visits to mediæval and other buildings in and around the beautiful grounds of the Yorkshire Philosophical Society; and in the evening a conversazione will be held. On the Thursday a visit will be paid to the Devonshire works of the Staveley Coal & Iron Co., Ltd., near Chesterfield. In the afternoon there will be a charabanc excursion, and members will dine together informally in the evening. On Sepember 8th, the last day of the meeting, the works of the Parkgate Iron and Steel Co., Ltd., will be visited. Amongst the papers to be read is one by Messrs. E. D. Campbell and — Johnson, being "A Preliminary Magnetic Study of Some Heat-treated Carbon Steels," and another by Mr. G. A. V. Russell on "Reversing Cogging Mills: Their Drives and Auxiliary Equipment."

Ealing and the Electricity Commissioners.—The Chairman of the Ealing Electricity Supply Committee has presented a report to the Council upon the facts of the recent litigation regarding the taking of a bulk supply of electricity, in which the Council has been involved. The discharge of a rule *nisi* obtained against the Electricity Commissioners was reported in our last issue, and the earlier proceedings in the Electrical Review of June 2nd last.

The report states that in accordance with the directions of the Commissioners the Ealing Town Council sought terms for a bulk supply from the Metropolitan Electric Supply Co., Ltd., which quoted a price of £4 10s. per kVA of maximum demand per annum, plus .5d. per unit, subject to variation by a "coal clause." As the offer was considered unsatisfactory the Hammersmith Borough Council was approached, and, according to the report, quoted terms which, as compared with the Supply Co.'s offer, represented a saving to the Ealing Council of £7,000 a year for the first three years, and £3,000 a year thereafter. The Electricity Commissioners did not agree with these figures, but on their own showing the Hammersmith supply would have been given at a lower price per unit (.167d. lower) than the company's supply, and this represented an annual saving of £2,087, which was so serious a difference that it merited every consideration. Nevertheless the Commissioners declined to depart from their predetermined plan, supplying, says the report, "a very significant commentary upon the object of the Act of 1919, 'to provide or secure the provision of a cheap and abundant supply of electricity.'"

Since the legal proceedings the cost of the production of electricity at Hammersmith has been considerably reduced, and under the proposed scheme, which was one of co-partnership, Ealing would have benefited to a large extent. The report concludes as follows: "The policy of the Commissioners appears to be to give commercial undertakings carried on by undertakers, such as the Metropolitan Electric Supply Co., every possible benefit at the expense of undertakings carried on by local authorities for the benefit of those who reside in their areas and are supplied with electricity at what amounts to the actual cost of generating and distributing, plus the cost of capital charges, as compared with the object of the company to pay the best possible dividends to its shareholders. It is a very serious matter to all local authorities that their freedom should be fettered in such an unjust manner as indicated by the foregoing facts."

Institute of Transport.—Among the papers arranged for the ensuing session is one by Sir Philip Dawson, M.P., on "The Investigation of the Return on Capital Expenditure resulting from Electrification." The meetings, which commence on November 6th, are to be held at the Institution of Electrical Engineers.

Adhesives Research Committee.—The first report of the above-named Committee has been published by H.M. Stationery Office (Cornwall House, Stamford Street, S.E.1; price 4s. net). It embodies the results of certain of the investigations initiated by the Adhesives Committee of the Conjoint Board of Scientific Societies and also the researches of a more fundamental character which have been undertaken by the Adhesives Research Committee of the Department of Scientific and Industrial Research. The report is thus a comprehensive summary of the wor kfrom its inception in 1918, up to the end of 1921. It is illustrated with diagrams and photographic plates.

Electrically-driven Yachts.—Slowly yet surely electric transmission beteween marine motors and the propellers they have to drive is making headway. Possibly for tugs the advantages of big, slow-running propellers, perfect control from the pilot-house, and an almost unlimited range of speed may be found sufficient to counterbalance the cost. These benefits would be particularly pronounced for tugs of moderate power which are propelled by semi-Diesel engines, as the latter are notorious for their want of flexibility. With big tugs having Diesel engines of 1,000 h.p. and over, the speed range, although not so great as with electric transmission, is good enough for the purpose, while the normal revolutions can be sufficiently slow to allow of using big propellers. In yachts electric transmission is adopted for the sake of the easy control from the bridge, the silent reduction gear, the perfect flexibility, and the ability to move for short distances under electric power; also with it larger vessels can be controlled single-handed better than with the ordinary installation. For small cruisers the system is not worth while, since the steersman, being on the same level as the motors, is able to control them direct. It is in the vessel with the engine below and the wheel on deck where the benefits are more apparent. If large auxiliary yachts are to be driven by high-speed engines reduction gear is essential, and electric transmission is ideal for the purpose, while offering the other advantages to which reference has been made already. Admittedly the system is expensive, and, if anything, less efficient than the chain drive; but first cost is often of little consequence for yachts, the owners wishing to have the most perfect type of installation regardless of initial outlay. A not improbable reason for the growing popularity of electric transmission is the desire of some owners to astonish their friends by the possession of unusual machinery, the accruing advantages being a secondary consideration; moreover, when the system is fitted electric cooking and heating, as well as lighting, become practicable, while small motors can be used to lighten the domestic work. Whatever the cause, it is evident, from the number of recent examples on both sides of the Atlantic, that electric transmission is gaining in favour among yachtsmen.—*Light Motor.*

German Industry.—The *Financial News* of yesterday contains an interview with Dr. Felix Deutsch, Director-General of the A.E.G., under the title "German Industry Hemmed In." French animosity is described as the keynote of the present impossible situation. He asks: "How can one wonder at despair and insanity spreading in a nation which has been tortured and terrorised for the last three years without the least respite being granted to it?" Dr. Deutsch fails to excite our bowels of compassion, for how can we forget?

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. Reginald Alexander Dalzell, C.B.E.—Mr. R. A. Dalzell, concerning whose appointment as Director of Telegraphs and Telephones a reference appeared in the Electrical Review for July 14th, was born in Poona in 1865. He was educated in Edinburgh and at Dulwich College, and joined the School of Electrical Engineering and Telegraphy in Hanover Square. When he entered the service of the Globe Telephone Co. in 1881, we were not a great deal advanced from the time when only musical sounds could be transmitted by means of the telephone. Indeed, it was only a few years earlier, in 1876, that Sir William Thomson (Lord Kelvin) had introduced Bell's speaking telephone to the British Association meeting in Glasgow. Mr. Dalzell took part in the erection of a telephone exchange for the Globe Co. at the Wool Exchange, where all the lines were single circuits. The Post Office started the first metallic circuit system at Newcastle, and when eventually Mr. Dalzell went to Sunderland to assist the Northern Telephone Co., a similar system was adopted by that company in Newcastle.

When the Globe Co. came to an end as the result of litigation with the United Telephone Co. over questions



Elliott & Fry.] *London.*

Mr. R. A. Dalzell, C.B.E., Director of Telegraphs and Telephones.

affecting patents, Mr. Dalzell transferred to the latter company for the purpose of supervising the Globe apparatus which was then in operation. Neither of those early companies was overburdened with subscribers; the United had about 3,000 and the Globe a few hundred. On moving to Sunderland, where he was employed by the Northern District Co., Mr. Dalzell found that they had no subscribers at all in Newcastle; but the company soon established an exchange larger than that of the Post Office, which had just previously set up its first large exchange in the country there, and a fairly large *clientéle* was quickly obtained.

Mr. Dalzell recalls that in the old days two operators were required to handle a subscriber's local call. Under the original system the subscriber pressed a button on his telephone, thus causing a shutter to fall in front of the operator at the switchboard. She manipulated a flat plug, which she inserted in the switchboard to connect the caller with another operator who sat immediately behind her. The second operator inquired the number, and then passed it to the first operator, who proceeded to establish the connection. The whole process was comprised in one operator speaking with the subscriber and the other operator moving the plugs as required.

After successive periods of service as manager of the Blackburn and Leeds districts of the National Telephone Co. and district manager of the Western District of the National Co., with his headquarters at the old Pelican Club in Gerrard Street, Mr. Dalzell, in 1903, became Assistant Superintendent for London, an appointment which carried with it supervision of both the engineering and administrative sides of the business. He then moved on to Bristol as Superintendent of the West of England province, and he was stationed there in 1912, when the telephones were transferred to the Post Office. He was selected by the staff to give evidence before the Select Committee on the Post Office Telephone Agreement, the outcome of which was the acceptance of a modification of the agreement respecting the staff by the then Postmaster-General. Shortly after the transfer to the State, Mr. Dalzell returned to London, and, in 1916, became Chief Inspector of Telegraph and Telephone Traffic.

Prior to the opening of the Bristol Exchange, telephones were worked on the magneto system. Bristol was the first central battery exchange in the country, and Kensington Exchange was the next. Subscribers on those exchanges were relieved of the necessity of turning a handle to cause a bell to ring, or a shutter to fall, in order to secure the attention of the operator. Instead, most of the electrical apparatus was concentrated in the exchange, and the mere act of lifting the receiver at the subscriber's end caused a lamp to glow at the operator's desk in the exchange. This principle is followed at the present day at practically every large exchange throughout the country.

Mr. Dalzell has therefore seen the development of the so-called scientific toy from the original single-circuit wire, with Blake or Hunnings' transmitters, and without multiple switchboards, through the period of metallic circuits, multiple switchboards and magneto operation, to the central battery system which, in its turn, is giving place to the automatic system. Automatic telephony is being rapidly developed, and Mr. Dalzell's view is that the future of telephony lies largely in that direction, but that there will always remain exceptional cases where manual operation will be necessary, either as regards more economical working, or more efficient service, or both. He hopes to see the automatic telephoning of London commenced in his time, but declares that it will be many years before such a scheme can be completed. Apart from technical considerations, the problem involves deep economical study.

Mr. Dalzell has visited the United States, and has made an exhaustive investigation of the telephone and telegraph systems. He has also made a close study of the systems of other telephone administrations. One of the main reasons for the efficiency secured in America lies, he thinks, in the fact that the use of the telephone is spread over a much longer period of the day than in Great Britain, where more than one-sixth of the trunk traffic is passed through in one hour of the twenty-four, while in America, where the working day is not so circumscribed, there is a more even distribution of traffic. The revenue-earning capacity per line is therefore very much lower in this country.

As regards future development, Mr. Dalzell's aim is to give effect to the Postmaster-General's stated policy, and he will take the public, whom he regards as the most important part of the organisation, into the full confidence of the Post Office, so that they may understand thoroughly what is being done in the way of research and development in respect of both telegraphs and telephones.

As an old telephone expert, Mr. Dalzell is painfully familiar with the congested state of the service when the Post Office took control ten years ago. It required many years of hard work to bring the system up-to-date; but that work was interrupted almost at the outset by the great war. After the Armistice the Post Office was faced with extraordinary difficulties in connection with the cost of labour and materials, and in obtaining urgently-needed equipment. The result was that the Post Office only got the machine going a year or eighteen months ago; but Mr. Dalzell looks to see all arrears of work overtaken within a measurable distance of time from now. Having noted a diminution of ill-informed criticism of the service, he is encouraged to think that, in addition to the improvements which have been effected by the staff, the public on their side have come to appreciate the difficulties under which the Post Office has been labouring through causes entirely beyond its control. "If there is co-operation between the Post Office and the public," says Mr. Dalzell, "so far as co-operation is practicable in a service possessing the complexities of the telephone serivce, it will go far towards securing that higher standard of efficiency in the working for which the Post Office is constantly striving."

On July 26th, Sir Joseph J. Thomson, O.M., F.R.S., was presented with the Franklin Gold Medal at the Department of Scientific and Industrial Research by Lord Balfour on behalf of the Franklin Institute, Philadelphia. Lord Balfour said that he had known many of the giants who rendered physics illustrious in this country, among whom was Lord Kelvin. One of the greatest pioneers in this scientific movement was Sir Joseph Thomson. In thanking Lord Balfour, Sir Joseph said that beside the personal element in the bestowal of the honour there was a contribution to the brotherhood of science between America and Britain.

The salary of Mr. F. A. Fitzpayne, deputy tramways manager of Edinburgh, has been increased from £570 to £625 per annum. A proposal to increase the salary of Mr. R. McLeod, traffic superintendent, is to receive further consideration.

The Times states that the Royal Dutch Institute of Engineers has appointed as honorary members Sir Charles Parsons, inventor of the Parsons Steam Turbine, Mr. J. H. Tudsbery, secretary of the Institution of Civil Engineers, and Mr. Charles le Maistre, secretary of the International Electro-Technical Commission in London.

In the *Sunday Times*, of Johannesburg, for July 9th, there appears an illustrated article concerning the Union Mint, which is now nearing completion at Pretoria, and will be turning out the new coinage towards the end of the year. Mr. Ralph Pearson, who has had lengthy experience at the Melbourne Mint, and at Ottawa and in London, is the deputy master, and Mr. J. T. Becklake, A.M.I.E.E., the second in command, went to Pretoria a month or two ago from the London Mint, where he had been for many years, save for a brief absence at the branch of the Royal Mint in Bombay, which was erected during the war, and is now closed.

Mr. J. J. Woods, consulting engineer, of Clones, Co. Monaghan, received a compound fracture of the right leg in a motor accident, and is confined as a patient in the Louth County Infirmary, Dundalk.

Senatore Marconi, G.C.V.O., LL.D., D.Sc., has been elected a vice-president of the Royal Society of Arts.

Mr. Charles Stewart, B.Sc., M.I.E.E., sales and contract manager of Messrs. Johnson & Phillips, Ltd., has been appointed a director of the company.

On Wednesday evening at the Cannon Street Hotel, a presentation was made to Sir George Sutton, Bart., by the staff and employés of W. T. Henley's Telegraph Works, Co., Ltd., and Henley's Tyre & Rubber Co., Ltd. A Bohemian concert followed. We hope to refer to the matter more fully in our next issue.

Mr. H. Fraser has resigned his position with the Electrical Engineering & Equipment Co., of London, and has joined the Priory Electrical Engineering Co., of Bath Street, Birmingham, as general manager.

Obituary.—Mr. W. Dow.—The death took place suddenly on July 23rd, of Mr. William Dow, founder and head of the firm of Dow & Sons, Ltd., electricians, Kilmarnock. He was 72 years of age, and had been in business in the town since 1875.

Mr. D. Gill.—The death took place on July 22nd, at the Hatch, Old Dover Road, Canterbury, of Mr. David Gill, A.M.I.E.E., late captain in the R.A.F. He was in his 31st year.

Sir Richard Vassar-Smith.—We regret to record that Sir Richard Vassar-Smith, chairman of Lloyd's Bank, passed away on Wednesday. Sir Richard was president of the Federation of British Industries in 1917-18.

Dr. Alexander Graham Bell.—We regret to learn, through *Reuter*, as we go to press, that Dr. Alexander Graham Bell, of telephone fame, passed away at his home at Baddeck, U.S.A., on August 1st.

Will.—The late Mr. W. E. Barrett, a director of the British Engine, Boiler & Electrical Insurance Co., Ltd., left £79,072 gross, and £67,811 net personalty.

NEW COMPANIES REGISTERED.

Electrads, Ltd. (183,311).—Private company. Registered July 22nd. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, importers and exporters of and wholesale and retail dealers in all kinds of electrical apparatus, machines, instruments, accessories, &c. The subscribers (each with one share) are:—A. B. de Solla, 7, Bath Road, Bedford Park, W.4, electrical engineer; J. H. Douse, 33, Mulgrave Road, S.W.6, mechanical and electrical engineer. A. B. de Solla signs as managing director. Qualification, one share. Remuneration, £50 per annum. Registered office: Evelyn House, 62, Oxford Street, W.1.

Wireless Corporation, Ltd. (183,437).—Private company. Registered July 27th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in electric, magnetic, and wireless telegraphy and telephony apparatus, wires, cables, machinery, and appliances, engineers, &c. The subscribers (each with one share) are:—J. G. Evans, 110, Murchison Road, Leyton, E.10, clerk; J. W. Ironside, 88, Livingstone Road, Thornton Heath, engineer's representative. The subscribers are to appoint the first directors. Qualification, 10 shares. Remuneration, one guinea each per meeting attended. Secretary: R. Gray. Registered office: 7 and 8, Great Winchester Street, E.C.

British Wireless Supply Co., Ltd. (183,395).—Private company. Registered July 26th. Capital, £2,000 in £1 shares. To carry on the business of wireless, electrical, mechanical and general engineers, and contractors, manufacturers, and sellers of wireless instruments, transformers, radiators, dynamos, motors, and radio instruments of all kinds, &c., and to adopt an agreement with P. F. Perry. The first directors are:—P. F. Perry (permanent director and chairman), "Ainderby," The Green, Seaton Carew (manager of nautical and wireless schools); H. F. Yardley, 6, Blenheim Terrace, Leeds, wireless engineer. Qualification, £100. Secretary: J. Lyall. Registered office: 6, Blenheim Terrace, Leeds.

F. J. Jones & Sons, Ltd. (183,402).—Private company. Registered July 26th. Capital, £5,000 in £1 shares. To acquire the business of an electrical engineer and electrician carried on by Lily A. E. Jones and W. H. Haswell (trustees of the will of the late F. J. Jones) in Chester and elsewhere as "F. J. Jones & Sons." The first directors are:—G. D. Jones, 6, Seller Street, Chester; Lily A. E. Jones, 92, Foregate Street, Chester; C. L. Jones, 92, Foregate Street, Chester; Violet B. M. Jones, 92, Foregate Street, Chester; W. H. Haswell, 94, Foregate Street, Chester. All permanent, subject to holding 250 shares each. Remuneration as fixed by the company. Solicitor: C. P. Smith, Chester. Registered office: Old Bank Buildings, Chester.

Radioelectrico, Ltd. (183,388).—Private company. Registered July 25th. Capital, £1,050 in 800 preference and 200 ordinary shares of £1 each, and 1,000 deferred shares of 1s. each. To carry on the business of electricians, manufacturers of generators and accumulators, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, and other purposes, &c. The first directors are:—P. J. H. Driscoll, 4, St. Paul's Road, Tottenham, N.; J. Kennelby, 73a, Lewin Road, Streatham, S.W.16; S. Hall, 18, Kimbull Gardens, Fulham, S.W.; R. H. Winter, 1, Cosfield Street, W.1, electrical engineer. The first three named are all directors of P. J. Driscoll & Co., Ltd. Remuneration, 5 per cent. of the net profits divided between them. Secretary: A. W. Deering. Registered office: 33, D'Arblay Street, Soho, W.

Waste Recovery Syndicate, Ltd. (183,454).—Private company. Registered July 28th. Capital, £10,000 in £1 shares. Objects:—To promote companies for the carrying on of businesses of all kinds; to carry on research work and the development of patents and inventions in the United Kingdom and elsewhere relating to the treatment of waste fuel residues, and the business of smelters, founders, rollers, platers in metals, metallurgists, chemical, mechanical, electrical, automobile, constructional, civil and consulting engineers, &c. The first directors are:—Sir James Heath, Bart., J.P., 5, Hans Place, S.W.; Major S. Weil, 3, Lancaster Gate Terrace, Hyde Park, W.2; Capt. H. G. Gilliland, "Myways," Church Crookham, Hants.; F. Winter, 2, Duke Street, St. James's, S.W.1; Lieut.-Col. A. St. J. Cooke, D.S.O., 14, Elvaston Place, S.W.7. Secretaries: St. John Cooke & Co. Registered office: 729-730, Salisbury House, E.C.

Wickford and District Electricity Supply Co., Ltd. (183,455).—Registered July 28th. Capital, £5,000 in £1 shares. To carry on at Wickford and elsewhere in Essex the business of an electric light company in all its branches. Minimum cash subscription, 7 shares. The provisional directors are:—H. F. Perry, 8, Park Grove Road, Leytonstone, E.11, cashier; F. W. Sitch, 1, Oak Crescent, Barking Road, E.16, clerk; D. C. Walsh, The Vicarage, Austinway, Gerrard's Cross, articled clerk; W. H. Butterfield, 17, New Road, Crouch End, N.8, manager; G. C. Baldock, 54, Strone Road, Forest Gate, E., clerk; C. A. Breading, 70, Park Road, Southend-on-Sea, clerk; Lily L. Brinkworth, 32, Kynaston Road, Stoke Newington, clerk. Qualification of subsequent directors, 50 shares. Solicitors: Swepstone, Stone, Barber & Ellis, Broad Street House, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dawlish Electric Light and Power Co., Ltd.—Satisfaction to the extent of £150 on June 26th, 1922, of mortgage debenture dated July 25th, 1911, securing £2,000.

Olso Light Co., Ltd.—Issue on July 4th, 1922, of £12,500, part of a series already registered.

CITY NOTES.

Anglo-Portuguese Telephone Co., Ltd.

The annual meeting of this company was held on Monday at Worcester House, Walbrook, London, Mr. Herbert Allen presiding. In proposing the adoption of the report, the Chairman said that on the surface the accounts looked bright enough, but unfortunately all was not gold that glittered. The trading profit at the old rate of exchange amounted to £260,000; but the escudo, instead of being worth 53¼d., was last year worth on an average only 6¼d., and in that way the £260,000 boiled itself down to less than £30,000. Deducting administrative expenses, &c., a profit of £20,000 odd remained, and after payment of the fixed charges, they were left with a balance equal to about 2¼ per cent. on the share capital, which they were not justified in distributing. He believed that was the first year in the history of the company that the dividend had been entirely passed. The position naturally caused the directors very great concern, and early in the present year they felt compelled once more to approach the Portuguese Government for an increase in their subscription rates, that being the fifth occasion of their making a similar application in as many years. After seemingly interminable negotiations, the authorities eventually met them to some extent, but what they gave them with one hand they largely took back with the other, inasmuch as they debarred them from surcharging unexpired subscriptions, as they were allowed to do on the occasion of the previous increase. Over the two classes of subscribers—commercial and domestic—the increase averaged about 60 per cent., and on their present volume of business that would equal over 2¼ million escudos per annum; but it would be another year before the company would feel the benefit of the new rates. Notwithstanding the repeated increases in their subscription rates in the last few years, they were anything but high even now when compared with those of many other countries. In the event of the escudo recovering to 6½d., the new charges might be subjected to revision. Although they knew pretty well to what extent the higher charges would affect their income and gross profits, much uncertainty attached to the question of exchange. The escudo at present was worth less than 4d., and one failed to see how any material recovery could be looked for in the present atmosphere of political instability in Portugal and while the printing press was still busy in turning out money. The Portuguese Budget for the current year showed a deficit of more than 300 million escudos, and the national expenditure was habitually double that of the national income. Under those circumstances it was difficult to see exactly how any improvement in the escudo was to come in. Having explained the adjustments which had been made in the balance sheet with the object of bringing its outer appearance more into line with the inner facts, the chairman referred to the resignation

of Capt. Jackson, who, he said, had felt obliged for personal reasons to resign his position as a director. Capt. Jackson had been on the board since 1899, and had given the company much valuable service. In his place the directors had appointed Mr. Percy Brailsford Lawson, and on the instructions of his colleagues that gentleman immediately on his appointment visited Portugal in order personally to acquaint himself with every phase of the company's business. Mr. Lawson had made a most interesting and valuable report on the position. He recognised that by comparison with other European cities the telephone systems of Lisbon and Oporto were greatly undeveloped, and that the company was suffering in consequence. In the main, Mr. Lawson approved the scheme which had been submitted by the company's engineers for the entire reconstruction of the Oporto system and of important additions to their facilities at Lisbon. Mr. Lawson recognised that the present position in those cities could not continue indefinitely, and he was of opinion that the longer the delay in carrying out some scheme of reconstruction and development, the more serious would the position become. The board had just decided that the work in both cities should be put in hand without further delay. On the question of establishing message rates instead of a flat rate, Mr. Lawson was of opinion that the matter was one which required further consideration before a decision was arrived at. Regarding the prospects for the current year, so far as he could see the new tariffs would give them an additional income of half a million escudos. He was afraid there would not be any reduction in expenditure because they had had to concede another increase in wages as from the first of this month in return for the increase in their tariffs. The great element of uncertainty in the business was that regarding the question of the exchange, but assuming an average of 4d. per escudo and other conditions being normal, the indications so far as he could read them seemed to point to their about holding their own this year, and that the result would be about the same as last year. Mr. F. W. Kerr seconded the motion, which was carried unanimously.

Ward & Goldstone, Ltd.

The net profit for the year ended March 31st is £15,351, of which it is estimated £6,622 will be absorbed by income tax and Corporation Profits Tax, leaving £8,729, plus the carry-forward, which brings the amount available to £15,057. The 7 per cent. preference dividend and one of 3½ per cent. on the ordinary shares have already been paid, leaving £9,807, and it is proposed to further reduce the preliminary expenses account by £2,000 and to carry forward £7,807. According to the *Financier*, during the year the works were generally running at barely half capacity. Stocks have had again to be written down to the reduced prices ruling at stock-taking, and unfortunately substantial losses have been incurred due to bad debts, for which provision has been made. In view of the adverse conditions which have prevailed, the directors consider that the results obtained are not entirely unsatisfactory.

Marconi International Marine Communication Co., Ltd.

The annual meeting was held at the Connaught Rooms on July 25th, Mr. Godfrey C. Isaacs presiding, in the absence of Senatore Marconi. The deputy-chairman said that the directors had not considered it necessary to make any addition to the reserve this year, having regard to the fact that the amount on the other side of the account, representing licences, rights, and shares in other companies figured only at £231,880. The reserve for obsolescence of plant had been reduced from £100,000 to £57,254, owing to the writing-off of the value of apparatus of an old type which had been replaced. There was a net increase of £70,000 in the amount representing plant, apparatus, furniture, and stores. The item "Expenses of ship telegraph stations, including loss of plant and apparatus and cost of training operators" showed an increase of about £200,000. This was principally due to the fact that the laying up of many ships had led to decreased receipts from shipowners on account of additional operators. The increase in the item "Depreciation of plant, apparatus, and furniture" was accounted for by a larger number of ships' stations. On the credit side, the amount received in respect of "Ships' telegrams, contracts, rentals, &c.," amounted to £1,084,460, an increase of £150,000; a substantial part of this, however, was in respect of operators' salaries, which came under contracts, but did not add anything to the net revenue of the company. The net profit of £118,043 could be considered satisfactory when the depressed state of the shipping industry was taken into consideration. If the directors had cared to enforce the terms of the contracts the resultant profit would have been doubled, but the policy was adopted of varying the conditions, and the company bore a share of the loss which the industry had suffered. The speaker was glad to say that about half the ships which had had to be laid up were again in commission and a substantial number of operators had been re-engaged. Mr. Isaacs referred to the recent telegraphists' dispute, and said that the provisional agreement put into force on April 1st, and further discussions, led him to believe that a satisfactory final agreement would be reached. The development of "broadcasting" of wireless telephony would create a great demand for telephone receiving sets at sea, and the company anticipated that a new source of revenue would be opened. There had been a substantial growth in the use of the wireless direction finder, and many lives had been saved by this means; he anticipated a still further increase as trade improved.

In announcing the dividend of 10 per cent., he urged shareholders not to be despondent, although it was 5 per cent. lower than the previous year's dividend; it was not a reflection upon the company's business, but upon the bad state of trade. A recurrence of similar conditions would not have such an adverse result, as the company's organisation had been adjusted to meet any circumstances; a recurrence, however, was not anticipated.

The report and accounts and dividend were approved, and the retiring directors re-elected.

Greenwood & Batley, Ltd.—Col. O. C. Armstrong, presiding at the annual meeting on July 25th, said that thanks to a full order-book at the beginning of the year they had been able to keep most departments fairly well employed, but the effect of the slump was now being felt. It was possible, however, to pay the proposed dividend out of earnings. The action of foreign countries to protect themselves from the effects of depreciated currency took the form of high tariffs, and it was not possible in many instances for this country to reply in a similar manner. There was need for action in this direction if British traders were not to be handicapped.

Companies Struck Off the Register.—The following companies nave been struck off the Register, and are accordingly dissolved:—

British Sherardizers, Ltd.
Colonial Engineering Agency, Ltd.
Denton Electrical Construction Co., Ltd.
Derby Lamp Works, Ltd.
E. M. F. (1914), Ltd.
Electric Timekeepers, Ltd.
Electro Galvanizers, Ltd.
Holmquist Electric Co., 1911, Ltd.
Londonderry-Moville Electric Railway Syndicate, Ltd.
Roger Dawson, Ltd.
Sandbanks Railless Electric Car Co., Ltd.
Standard Turbine Co., Ltd.
United States Railless Electric Traction Co., Ltd.
Westminster Technical Experts Corporation, Ltd.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed under Rule 148a:—

Auckland Electric Power Board.—£350,000 5½ per cent. debentures, August 1st, 1943, issued at par, fully and partly paid.
County of London Electric Supply.—500,000 new ordinary shares of £1 each, issued at 22s. 6d., fully and partly paid. Nos. 755,781 to 1,255,780; and 500,000 new 6 per cent. cumulative preference shares of £1 each, fully and partly paid, Nos. 2,150,001 to 2,650,000.
Bengal Telephone Corporation, Ltd.—£350,000 7 per cent. first mortgage bonds, issued at 97 per cent., partly and fully paid.

The undermentioned have been ordered to be officially quoted:—

Brompton and Kensington Electricity Supply.—196 ordinary shares of £5 each, fully paid, Nos. 34,500 to 34,695.
Cordoba Light, Power and Traction.—665,811 7 per cent. preference shares of £1 each, fully paid, Nos. 1 to 665,811; and £393,877 6 per cent. debenture stock.
Stone (J.) and Co.—600,000 6½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 600,000.
Yorkshire Electric Power.—803,060 ordinary shares of £1 each, fully paid, Nos. 1 to 6,990, 15,991 to 270,380, 270,991 to 278,230, 279,031 to 378,100, 378,601 to 429,250, 429,351 to 494,570, 495,321 to 520,990, 533,601 to 611,710, 612,211 to 639,280, 640,481 to 674,160, 674,831 to 791,230, and 791,451 to 830,000.

Cordoba Light, Power, and Traction Co., Ltd.—The annual meeting was held on July 28th. Sir George A. Touche, who presided, said that although the effects of the capital re-organisation were not reflected in the accounts, they showed the "decks cleared for action." With reasonably good fortune and consideration from the Government authorities the ordinary shareholders might look forward to receiving at least a part of the return which they deserved upon their capital. They could be sure that the President-elect of Argentina (Dr. Marcelo de Alvear) would give just and sympathetic consideration to the proper claims and rights of British companies which had played so great a part in the development of the country. During the current year, business had been expanded and expenses had decreased; the outlook might therefore be regarded as satisfactory.

Bournemouth and Poole Electricity Supply Co., Ltd.—Interim dividends upon the 4½ per cent. preference shares and the 6 per cent. second preference shares, less tax, for the half-year ended June 30th, 1922; also an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the same period.

Metropolitan Railway Co.—Interim dividend at the rate of 2½ per cent. per annum on the ordinary stock, which compares with 1¼ per cent. per annum paid in respect of the corresponding period in 1921.

Tottenham District Light, Heat, and Power Co.—Dividends are announced for the half-year ended June 30th at the rate of 7½ per cent. per annum on the "A" stock and 6 per cent. per annum on the "B" stock, less tax. A year ago the dividends were at the rate of 6 per cent. and 4½ per cent. per annum respectively.

Kalgoorlie Electric Tramways, Ltd.—The accounts for 1921 show gross receipts of £28,632, against £37,630, and the net profits, before charging depreciation, were £5,817, against £8,742, making the debit balance of profit and loss, after charging debenture service, £54,520.

Westminster Electric Supply Corporation, Ltd.—The directors announce an interim dividend at the rate of 9 per cent. per annum, less tax, for the half-year ended June.

Brazilian Traction, Light and Power Co.—Dividend of 1 per cent. on ordinary capital stock.

National Gas Engine Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less tax, on the preference shares, and 7½ per cent. per annum, less tax, on the ordinary shares for the half-year ended June.

Bristol Tramways and Carriage Co., Ltd.—Interim dividend for the half-year ended June 30th, 1922, at the rate of 3 per cent. (free of income tax) on the ordinary shares.

North London Railway Co.—Interim Dividend of 2½ per cent. for the half-year, as against 2½ per cent. last year.

National Boiler and General Insurance Co., Ltd.—Interim dividend of 12s. per share, less tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

Market activity in the Stock Exchange is of a very spasmodic order. It is anomalous that there should be so many features of interest round the markets, while at the same time, animation in the shape of business is lacking, except in a very few directions. From the point of view of those interested in electricity stocks and shares, the main interest this week lies in the allotment of the County of London Electric shares. There was considerable over-subscription. Shareholders alone applied for more than the amount of preference and ordinary that were offered. It is superfluous to say that the ordinary shares received most attention. They offer more speculative scope, and the announcement of an increased interim dividend flatters the expectation that the usual 8 per cent. for the full year will be augmented when the twelve months' accounts are published.

It is the same expectation of increased dividends for the year which assists the remarkably strong tone shown by the electricity supply market as a whole. If prices do not go up as quickly as proprietors would like to see, this is because prospective buyers see no particular object in pressing to have quotations raised in the Stock Exchange lists. They want to buy as cheaply as possible and a mere putting up of prices, at a time when there are few sellers, sometimes has the opposite effect anticipated by those who think that the process may tempt holders to realise their stock.

Charing Cross ordinary are 5s. higher. Kensingtons promptly regained the full amount of the dividend deducted from the price last week. St. James' and Pall Mall received similar treatment. City "Lights" have risen to just over 40s. County ordinary recovered the 2s. 6d. lost on the announcement of the new issue of shares.

Last week was one of festivities and celebrations in connection with the jubilee of the Eastern Telegraph and its associated companies. Those who were invited to the functions appear to have been much more pleased than the inhabitants of one of the northern suburbs whose rest was disturbed by firework displays, of which no previous notice had been given. The market for the stocks in the House is quiescent, and no particular alteration has occurred in any of the quotations this week. Certain of the American cable stocks and shares have risen by several points, in response to the movement in the rate of exchange.

A feature is the renewed weakness in the price of Marconi shares. After touching 16s., a relapse occurred to 42s., evidently on sales by those who wax apprehensive of what the final dividend may turn out to be. Estimates range from nothing at all to 5 per cent. An interim dividend of the latter rate was paid in December, and for the six months prior to that, the dividend was 2s. per share. Since then, the price of Marconis has been up to 56s. 6d., and dozens of limits were left with Stock Exchange brokers to sell at £3 a share. Most of the holders, it is safe to say, will be content to regard their Marconis as an investment which, in course of time, will benefit from the developments which obviously lie ahead, but there is no doubt that the relapse in the price of the shares, together with the modified dividend estimates, are giving rise to a good deal of disappointment as well as uneasiness.

Home Railway stocks are suffering from neglect. Most of the dividends are out, and with nothing much "to go for," as the Stock Exchange phrases it, for some little time the speculative element is inclined to sell stock and to stand by, awaiting further chances later on. The demand for lower fares, based partly on the modification of assessments secured by the railway companies in the parishes through which the lines run, is offset by the obviously uncomfortable conditions of crowded travelling with which most people are unpleasantly familiar. After the holidays, there will probably be a substantial issue by one of the tube railways as a further addition to the six million pounds' capital authorised by the Government, of which about 2¼ millions has lately been raised by the London Electric and City & South London railways.

East London debentures are moving steadily upwards day by day. The ordinary stock, however, remains about 4½. Underground Electric ordinary shares have recovered the half-a-crown which they shed a week ago and the Income bonds at 82¼ are a point to the good.

The Brazilian Traction Co. has declared another 1 per cent. quarterly dividend, from which it is apparent that the company means to maintain a 4 per cent. annual dividend on the common stock. The price is ex dividend at 50, so that the yield on the money is 8 per cent. British Columbia deferred has given way a point. Mexico Tramway sixes are 2 lower, but the fives rose to 72½. Mexican matters being still in suspense, the tendency is for the market to droop.

Amongst the new issues, Bengal Telephone 7 per cent. Bonds have risen to 3¼ premium, most of the stags having now cleared out of their stock. A lively market in the new County ordinary opened on Tuesday morning. At the outset, the price went to 2s. 9d. premium, from which it subsided to 2s. 3d. premium as sellers came in to take the handsome profit which they were able to secure with so little trouble. The preference stand at 9d. premium. In view of the scarcity of shares in the electricity supply market, there can be little doubt that, by degrees, the price of the ordinary will harden up, but it is natural enough that applicants should be willing to take the very useful turn which the present premium offers.

British Electric Traction ordinary stock at 52½ and the company's 6 per cent preference at 90 are both better. Calcutta Tramways rose to 4½, and, in the London group, London United Tramways preference at 4s. 6d., and the debenture stock at 57, are both higher. There has been a little demand for British Electric Transformers; the price hardened to a guinea, the preference being about 3d. per share less. General Electrics at 18s. 9d. are ex-dividend and, therefore, show little change. Siemens improved to 27s., and the other stocks and shares in the manufacturing list kept very steady. The rubber market is entirely stagnant. Amongst iron and steel shares, the only changes worth noticing are slight improvements which have occurred in connection with the greater activity brought about in British trade circles owing to the railway and engineering strike in the United States.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Aug 1. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7⅞	—	£8 0 0
Charing Cross Ordinary...	8	9	7½	+½	6 0 0
do. do. do. 4½ Pref. ...	4½	4½	8¼	—	5 16 2
Chelsea	6	6	6	—	5 0 0
City of London	14	14	2⅛	+⅛	6 18 0
do. do. 6 per cent. Pref....	6	6	22/6	—	5 6 8
County of London	8	8	1⅛	+⅛	5 16 5
do. do. 6 per cent. Pref....	6	6	1⅛	—	5 13 0
Kensington Ordinary	9	10	7⅛xd	+⅛	7 0 7
London Electric	2½	4	2⅛	—	5 14 0
do. do. 6 per cent. Pref....	6	6	5	—	6 0 0
Metropolitan	7	7	6⅞	—	6 13 4
do. 4½ per cent. Pref....	4½	4½	3⅛	—	5 16 2
St. James' and Pall Mall	12	12	8⅝xd	+½	6 17 2
South London	7	7	9⅛	—	8 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 18 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	105	+1	5 14 5
do. Def.	1½	84/6	23⅝	—	7 7 6
Chile Telephone	6	6	6⅛xd		4 18 0
Cuba Sub. Ord.	7	7	8⅛	—	8 4 8
Eastern Extension	10	10	18⅜	—	5 8 1
Eastern Tel. Ord.	10	10	18⅝	—	5 7 3
Globe Tel. and T. Ord....	10	10	19½	—	5 4 7
do. do. Pref.	6	6	11½	—	5 6 8
Great Northern Tel.	24	22	29		7 11 8
Indo-European	10	10	36½	—	6 17 0
Marconi	25	15	2⅝	—⅛	7 3 2
Oriental Telephone Ord.	12	12	2⅜	—	*6 1 1
United R. Plate Tel.	8	8	7	—⅛	*5 14 4
West India and Panama	Nil	Nil	8/-	—	Nil
Western Telegraph	10	10	19	+	*5 5 3
Home Rails.					
Central London Ord. Assented ...	4	4	68	—	5 17 8
Metropolitan	1¾	2¼	48	—	4 13 9
do District	Nil	1	38⅝xd	+½	2 12 8
Underground Electric Ordinary ...	Nil	Nil	2⅜	+⅛	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income ...	2	4	82½	+1	*4 17 7
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref. ...	5½	12½	8⅞	—⅛	8 0 0
do. do. 2nd Pref.... ...	Nil	5½	3⅝xd	+⅛	7 2 0
do. do. 5 per cent. Deb....	5	5	82	+½	6 2 0
Brazil Tractions...	Nil	Nil	50xd	—1	8 0 0
British Columbia Elec. Rly. Pce. ...	5	5	76	—	6 10 9
do. do. Preferred ...	5	93/-	6⅝	—	*6 15 0
do. do. Deferred ...	8	124/-	7½	—1	*8 5 10
do. do. Deb.... ...	4½	4½	78	—	5 9 0
Mexico Trams. 5 per cent. Bonds ...	Nil	Nil	72½	+1	— —
do. do. 6 per cent. Bonds ...	Nil	Nil	48½	- 2	Nil
Mexican Light Common	Nil	Nil	21½	—1	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	5	68½	—	7 6 0
Manufacturing Companies.					
Babcock & Wilcox	15	16	3	—	5 6 8
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2⅜	—	7 1 2
Callenders	15	15	2⅛		6 16 4
,, 6½ Pref.	6½	6½	1⅞	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/8	—	Nil
do. do. 5 per cent. Deb. ...	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	8	5	17/6	—	5 14 3
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/9xd	—	5 6 8
Henley	15	15	2⅜	—	6 13 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1⅛	—	—
Met.-Vickers Pref.	8	8	2⅞	—	6 11 2
Siemens Ord.	10	10	27/-	+9d.	*7 8 2
Telegraph Con.	20	20	26	—	*4 12 2

* Dividends paid free of Income Tax.

ELECTRICAL PROPULSION OF MERCHANT SHIPS.

By A. REGNAULD, B.Sc. (Eng.), A.R.C.Sc., A.M.I.E.E.

Particular interest attaches to the announcement that Messrs. Cammell, Laird & Co., Ltd., recently received an order to build three vessels for the United Fruit Co., of Boston, U.S.A., not only because it represents the first substantial shipbuilding order that has been booked for many months past, but also because the vessels are to be electrically propelled, Camellaird-Fullagar oil engines being employed to drive the electrical generators. It has been stated that as a result of the Washington Conference, at which the decision was made to suspend for a period the building of large warships, the development of electric propulsion would be seriously affected, and certainly the decision there arrived at has led to the cancelling of the orders for many vessels which were to have been electrically propelled. Among these, mention may be made of the American super-battle-cruisers of 43,500 tons displacement, which were to have a speed of 33.6 knots, requiring no less than 180,000 horse-power to propel them. It was also stated that one of the four "super-Hoods" which had been projected for the British Navy was to have been electrically propelled, although no official confirmation of this statement was ever given.

The principles underlying the application of electric propulsion to merchant vessels are, however, so vastly different from those which have led to its successful application to the propulsion of warships that the development of the system is not likely to be affected to any appreciable extent by the "naval holiday." In war vessels, the chief advantage of electric propulsion lies not so much in its greater economy from the point of view of fuel consumption, as in the greater flexibility which can be obtained by employing electric motors to drive the propeller shafts. When electric propulsion is employed, the main turbo-generators are kept running at full speed, starting, stopping, and reversing being carried out entirely by operating the motor switchgear —a comparatively simple matter—whereas in a turbine-driven vessel, all manœuvring must be carried out at the main turbines. Further, on war vessels which are frequently navigated for long periods at a cruising speed, with electric propulsion this can be obtained by shutting down one or more of the turbo-generators, the others operating at full load and therefore at maximum efficiency instead of, as in the geared-turbine drive, operating all the turbines at reduced speed, or, in other words, at low efficiency. In a merchant vessel, save for the brief periods when she is navigating in and out of harbour, she is being driven at her maximum speed with all the turbines developing full power. Hence the question of flexibility hardly arises.

The question is then: What are the advantages of electrical propulsion for merchant vessels? In the first place, it is necessary to distinguish between the turbo-electric drive in which steam turbines are employed to generate the necessary electrical energy to operate the motors which drive the propellers, and the Diesel-electric drive in which, as the name implies, one or more Diesel engines are employed to drive the generators. With the former, it must be admitted that economy in fuel consumption is not likely to be achieved by the substitution of "electric gearing" for mechanical speed reduction gearing. On turbine-driven vessels, the steam turbines are run at high speed, *i.e.*, at their maximum efficiency, while in order to obtain a high propulsive efficiency it is essential that the propeller shall rotate at a comparatively low speed. Helical gearing has been developed to such a high degree of perfection that in a well-cut single reduction gear the efficiency of transmission will be as high as 98 per cent. But with the introduction of higher turbine speeds, it has been found necessary to employ a double instead of a single reduction, the reduction in speed between the turbine and the propeller taking place in two steps instead of one, with two pinions and two gear wheels, and as a result the efficiency is somewhat reduced, although 96 per cent. can be obtained with a well manufactured double reduction gear. But far more serious than this is the fact that the double reduction gear does not appear to be capable of withstanding the loads to which it is subjected with the same degree of reliability as can the single reduction gear, slight errors in cutting the teeth or in the alignment of the shafts apparently having very serious results. A number of cases of failure have occurred with these gears, and as a result many are being run at considerably less than their designed load. The confidence of shipowners in the reliability of mechanical reduction gearing has been shaken, and they are prepared to consider alternative systems of speed reduction. Hence the appeal of the electric drive.

Electric propulsion is merely a method whereby the economical speed of the turbine can be reduced to the economical speed of the propeller shaft. The steam turbine is direct-coupled to an alternator, and the current from this drives a low-speed motor which is generally directly coupled to the propeller shaft. It is not to be expected that the combined efficiency of a high-speed generator and a low-speed motor will be equal to that of the double-reduction gearing, viz., 96 per cent.; in fact, it is usual to assume that the efficiency of the electric speed reduction gear will be from 88 to 90 per cent., so that assuming that the efficiency of the turbine remains the same, it is apparent that the fuel consumption will be somewhat greater. In the usual type of marine turbine, however, special units have to be fitted for driving the vessel astern; these are eliminated when electric propulsion is adopted. Moreover, a higher turbine speed can be employed than is possible with mechanical reduction gearing, and thus a greater turbine efficiency is obtained. It can, therefore, be asserted that as far as fuel consumption is concerned, there is very little to choose between the two systems. Many builders of electrically-propelled ships, both in this country and abroad, have installed Ljungström turbo-generators, and owing to the high efficiency of this type of prime mover, the claim can be substantiated that electric propulsion means a lower fuel consumption. The Ljungström turbine cannot be conveniently applied to driving through mechanical gearing.

The chief advantage of electric propulsion lies in its greater reliability. The turbines are simpler by the elimination of the astern units, and as a result on entering and leaving harbour there is no danger of distortion of the various parts of the turbine due to alternate heating and cooling as the vessel is manœuvred either ahead or astern. Further, the substitution for the mechanical gearing of well designed generators and motors of sturdy construction removes another source of weakness, while the simplicity of control, which has been so enthusiastically commented upon by engineers who have had charge of electrically-propelled ships, all makes for reliability with a consequent increase in the money-earning capacity of the ship due to the elimination of idle periods when she is undergoing repairs. One other advantage must be mentioned, although it does not apply to all electrically-propelled vessels. In some designs it is the practice to place the motors in a compartment right aft instead of in the engine room. In this way the long length of shafting between the engine room and the stern of the vessel is dispensed with, and no shaft tunnel is required. This means that the capacity of the after holds is substantially increased, which for vessels carrying bulky cargoes, such as fruit, is of considerable value. There is, however, the difficulty of ensuring adequate attention to the

motors if they are not directly under the eye of the engineer on watch, and the task of passing along the deck from the engine room to the motor room—particularly if there is a heavy sea running—may lead to the motors being neglected. It is not considered economical to increase the engine room *personnel*, and hence many designers do not favour the idea of placing the motors in a separate compartment.

Diesel-electric propulsion is being widely advocated at the present time, particularly in the United States, where the use of electricity on board ship is regarded with greater favour than in this country. The chief advantage of electric propulsion in conjunction with Diesel engines lies in the fact that it enables an improved design of Diesel engine to be employed. With one or two minor exceptions, mechanical reduction gearing has not been tried on Diesel-propelled ships, the reason being that the engine can be designed to run at a sufficiently low speed to give a fairly economical propeller speed. But one of the most unsatisfactory features of the marine Diesel engine is the reversing and manœuvring gear, and the electric drive would enable designers to dispense with this since, once started up, the engine is run continuously at constant speed while the vessel is being navigated in and out of harbour. Further, it is possible, when the Diesel engine is directly coupled to an electric generator, to design the former to run at a higher speed, say, of from 300 to 350 r.p.m. instead of a maximum of about 120 revs. per minute with the direct drive. This means that the engine is considerably lighter for a given power and consequently cheaper to construct. Greater reliability is obtained, not only on account of the absence of reversing gear, but also on account of the reduction of vibration which follows the lightening of the reciprocating parts.

The advantages are not, however, all on the side of electric propulsion. It is undoubtedly a fact that the cost of the machinery for an electrically-propelled vessel is greater than that of the corresponding double-reduction geared turbine equipment or the direct Diesel drive. Certain large savings to which reference has been made above may, when spread over a number of years, more than offset this greater capital cost, and the advocates of the electric drive are confident that in the long run it will prove more economical for merchant ships than any of the existing forms of drive. So far, of course, no definite figures are available whereby this claim can be substantiated, since, although there are a number of electrically-propelled merchant ships in service, they have not been running sufficiently long to enable a definite comparison to be made. But the results obtained have thoroughly justified the confidence which has been placed in the merits of the electric drive, and it is to be hoped that those shipowners who have been bold enough to risk considerable sums of money in the trial of a new type of propelling machinery, will receive a full reward for their far-sighted policy, not only from a monetary point of view, but in the knowledge that by their action they are helping to keep the British Mercantile Marine in its proud position in the forefront of the merchant services of the world.

THE CONTRACTOR AND WIRELESS.

By J. M. C. FIELD.

Now that the first rush of the sudden demand for amateur wireless gear is over, the local contractor is probably debating whether to establish a permanent wireless department or not. The tremendous impulse given to the trade by the recent newspaper publicity has had far-reaching effects, and there is no reason why the local electrical contractor should not benefit thereby to a considerable extent.

Why should the public be forced to buy "through the post" when the local man has showrooms, &c., all ready for the sale of wireless gear, and is always there, ready to help, advise, and supply from stock the batteries, valves, and general sundries necessary for the amateur's installation?

Many hesitate to stock wireless apparatus because they themselves have not a sufficient knowledge of radio work to be able to "talk shop" with the more scientific type of amateur.

To a certain extent this is true, and in that case the contractor has two alternatives. One is simply to sell the stuff that is asked for, and not to claim to be well up in wireless work; and the second is to employ a wireless expert who can deal with any question that is put to him by the old hand, and who can also give sound advice to the novice.

If the business is in a favourable position for the establishment of a wireless department, the contractor will be well advised to take the latter course, as it is the only one that is really satisfactory.

There are hundreds of ex-sea-going wireless operators to-day who would be suited to the job. If they possess a first-class P.M.G. certificate, it may be taken for granted that they understand their work, as this certificate is much harder to get than is popularly supposed. It is, of course, necessary to choose a man who also possesses business capacity, and is sufficiently smart and keen on the job.

The ex-operator will be found to have an excellent knowledge of elementary electrical engineering, and should be a great asset in the showroom and office of the general business, apart from the wireless department. Furthermore, he being an expert telegraphist, it could be arranged for him to give instruction in Morse code. This is a very important point, as many young men are learning wireless by post and find that, although they can undoubtedly learn the technical part by correspondence courses, it is necessary to take personal instruction in telegraphy. The combination of the two then enables them to sit for the P.M.G. examination without even seeing an expensive "wireless college."

Again, the really enthusiastic amateur will not be content to listen only to wireless concerts for long. He, too, will need to learn Morse in order to understand the most interesting working between ships and shore, and also the foreign Press messages and weather reports.

But the wireless expert's work need not end here. He can earn further money by fitting up aerials, erecting, testing, improving, and extending customers' installations. Also his electrical and business knowledge will enable him to be profitably employed in assisting in the general work of the business, should the wireless work not occupy his whole time.

Altogether it could hardly be said that his salary would not be thoroughly well earned.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1921, has been compiled from the recently-issued official trade statistics. The figures for 1920 are added for purposes of comparison, and notes of any increases or decreases are made:—

	1920	1921	Inc. or Dec.
	£	£	£
Electrical cable and wire.—			
Total	417,000	394,000	– 23,000
From Great Britain	394,000	377,000	– 17,000
,, Japan	2,000	—	– 2,000
,, United States	20,000	14,000	– 6,000
,, Germany	—	1,000	+ 1,000
Batteries, primary.—			
Total	30,000	30,000	—
From Great Britain	6,000	13,000	+ 7,000
,, United States	18,000	11,000	- 7,000
Batteries, secondary.—			
Total	74,000	37,000	– 37,000
From Great Britain	26,000	17,000	– 9,000
,, United States	47,000	20,000	– 27,000
Heating and cooking apparatus.—			
Total	41,000	42,000	+ 1,000
From Great Britain	31,000	25,000	- 6,000
,, United States	9,000	17,000	+ 8,000

	1920 £	1921 £	Inc. or Dec. £
Insulators, porcelain.—			
Total	7,000	7,000	—
From Great Britain	6,000	5,000	− 1,000
,, United States	—	1,000	+ 1,000
Insulators, all other.—			
Total	1,500	2,500	+ 1,000
From Great Britain	1,300	2,000	+ 700
Lamps, incandescent.—			
Total	78,000	133,000	+ 55,000
From Great Britain	25,000	59,000	+ 34,000
,, Holland	21,000	31,000	+ 10,000
,, United States	32,000	33,000	+ 1,000
Motors.—			
Total, kW	12,000	15,500	+ 3,500
£	151,000	240,000	+ 89,000
From Great Britain, kW	5,600	7,600	+ 2,000
£	80,000	106,000	+ 26,000
,, United States, kW	6,000	7,300	+ 1,300
£	68,000	128,000	+ 60,000
Transformers.—			
Total	30,000	71,000	+ 41,000
From Great Britain	10,000	38,000	+ 28,000
,, United States	20,000	33,000	+ 13,000
Electrical Machinery, other.—			
Total	321,000	396,000	+ 75,000
From Great Britain	199,000	198,000	− 1,000
,, United States	113,000	188,000	+ 75,000
,, Germany	—	5,000	+ 5,000
Electrical material, other.—			
Total	482,000	524,000	+ 42,000
From Great Britain	362,000	328,000	− 34,000
,, United States	90,000	158,000	+ 68,000
,, Japan	9,000	4,000	− 5,000
,, Holland	5,000	4,000	− 1,000
,, Germany	—	14,000	+ 14,000
Cranes.—			
Total	60,000	90,000	+ 30,000
From Great Britain	47,000	55,000	+ 8,000
,, United States	13,000	15,000	+ 2,000
,, Canada	—	20,000	+ 20,000
Elevators and lifts.—			
Total	27,000	66,000	+ 39,000
From Great Britain	24,000	62,000	+ 38,000
,, United States	3,000	4,000	+ 1,000
Mining Machinery.—			
Total	618,000	941,000	+ 323,000
From Great Britain	419,000	555,000	+ 136,000
,, Sweden	—	9,000	+ 9,000
,, United States	195,000	347,000	+ 152,000
,, Germany	—	21,000	+ 21,000
Telegraph and telephone material.—			
Total	32,000	60,000	+ 28,000
From Great Britain	24,000	38,000	+ 14,000
,, Sweden	2,000	5,000	+ 3,000
,, United States	6,000	13,000	+ 7,000
Tramway rails.—			
Total	21,000	37,000	+ 16,000
From Great Britain	20,500	32,000	+ 11,500
,, United States	500	5,000	+ 4,500
Tramway rolling-stock.—			
Total	87,000	55,000	− 32,000
From Great Britain	34,000	14,000	− 20,000
,, United States	53,000	41,000	− 12,000
Other tramway materials.—			
Total	17,000	38,000	+ 21,000
From Great Britain	3,000	25,000	+ 22,000
,, United States	13,000	13,000	+ —
Pumps.—			
Total	199,000	150,000	− 49,000
From Great Britain	101,000	87,000	− 14,000
,, United States	36,000	82,000	+ 46,000
Engines, oil, petrol and spirit.—			
Total	92,000	43,000	− 49,000
From Great Britain	52,000	31,000	− 21,000
,, United States	36,000	10,000	− 26,000
Engines, other.—			
Total	67,000	143,000	+ 76,000
From Great Britain	59,000	139,000	+ 80,000
,, United States	8,000	3,000	− 5,000

In addition to the above the following goods were imported as "Government stores":—

Batteries, primary.—			
From Great Britain	3,500	3,200	− 300
,, United States	—	1,500	+ 1,500
,, Denmark	—	5,000	+ 5,000

	1920 £	1921 £	Inc. or Dec. £
Batteries, secondary.—			
From Great Britain	24,000	4,000	− 17,000
,, United States	16,000	—	− 16,000
Heating and cooking apparatus.—			
From Great Britain	—	4,000	+ 4,000
Insulators, porcelain.—			
From Great Britain	10,000	4,000	− 6,000
Motors and parts.—			
From Great Britain, kW	100	344	+ 244
£	1,800	11,000	+ 9,200
Electrical cable and wire.—			
Total	86,000	256,000	+ 170,000
From Great Britain	74,000	203,000	+ 129,000
,, United States	5,000	12,000	+ 7,000
,, Canada	7,000	40,000	+ 33,000
Telegraph and telephone material.—			
Total	125,000	196,000	+ 71,000
From Great Britain	107,000	104,000	− 3,000
,, United States	6,000	7,000	+ 1,000
,, Sweden	10,000	80,000	+ 70,000
Electrical machinery, other.—			
From Great Britain	24,000	33,000	+ 9,000
,, United States	—	1,000	+ 1,000
Electrical material, other.—			
From Great Britain	11,000	12,000	+ 1,000

THE FARADAY SOCIETY.

Several papers of electrical interest were presented at the meeting of the Faraday Society held on June 26th, three of which are abstracted below.

The Electrolytic Effect of Alternating Superimposed upon Direct Currents.

Perhaps the most interesting was Mr. W. R. Cooper's account of a recent experimental investigation of the above subject. Hitherto this has attracted the attention of but three of four investigators, who have observed in a general way that some electrolytic reactions can be carried out at a lower voltage or more intensively by the superimposition of alternating on the effective direct current. Mr. Cooper has gone about the matter in a more systematic fashion, and he classifies his experiments not only as whether low frequency or high frequency currents were utilised but also depending upon the relative magnitudes of the two forms of current. Obviously, these can be such that the resultant is a unidirectional current of ripple form, or the current may during a smaller or greater part of the period be reversed in direction. The simple arrangement used in the case of low frequency currents is shown in fig. 1.

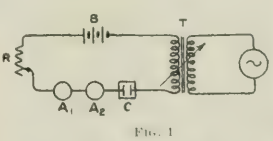


Fig. 1

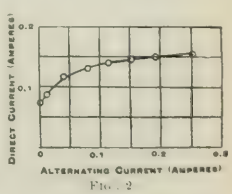


Fig. 2

A_1 hot wire ammeter. A_2 moving coil ammeter. B battery. C electrolytic cell. R—variable resistance. T transformer with variable coupling.

Fig. 1.—Arrangement For Low Frequency Currents. (Frequency 50).

Fig. 2. Showing Variation of Direct Current With Superimposed Alternating Current. Low Frequency. Electrodes 0.41 mm. Platinum Wire in Dilute Sulphuric Acid.

It is clear that the ammeter A_1 measures the total current and A_2 the direct current only. The battery employed had a capacity of about 30 ampere-hours. The direct current was varied by adjusting R, and the alternating current by altering the distance between the coils of the transformer T.

In most of the experiments the electrolytic cell consisted of platinum electrodes in dilute sulphuric acid and in all the cases mentioned above (defined by the relative magnitude of the direct and alternating currents) it was found that the

superimposed a.c. increased the magnitude of the d.c. Since this occurs even when the resultant current wave is in the form of a uni-directional ripple, the earlier explanation of the phenomenon, as due to the wiping out of polarisation effects, is clearly untenable.

The magnitude of this curious effect, of course, varies with the relative values of the two currents, but the accompanying diagram, fig. 2, illustrates the kind of effect produced. It will be noted that the increase in the d.c. reaches a maximum as the a.c. increases.

The effect only passes off some minutes after the a.c. is switched off, and the greatest sensitiveness is obtained when the voltage applied to the cell is below that of decomposition. The effect was obtained, with some differences in its magnitude, when one electrode was a wire and the other had a much larger surface.

In order to throw light on the cause of this curious phenomenon, Mr. Cooper made microscopical observations of the electrodes during electrolysis, and it was noticed that the whole of the hydrogen was at times absorbed by the cathode, while oxygen was freely given off at the anode. For example, in one case a current of over 1½ milliamperes passed before hydrogen was noticeable, although the application of high frequency a.c. at once caused evolution of hydrogen. This observation, however, does not seem to bring us nearer to an explanation of the effect.

The experiments were repeated with high-frequency currents with much the same results, excepting that when the applied d.c. voltage was below the decomposition voltage the effect of the high frequency current was much less than that of low frequency.

The phenomenon here discussed is utilised in the electrolytic detector for wireless telegraphy, but in this case one fine wire is used just dipping into the electrolyte. Mr. Cooper reproduced these conditions, using a large piece of platinum foil as the second electrode. If, under these conditions, the applied voltage is sufficient to cause a ready evolution of bubbles, the application of a small high frequency current scatters the bubbles, repelling them from one another as if they were electrified, and the direct current at the same time rises. Possibly the same effect takes place with the larger electrodes.

Another curious phenomenon was observed which does not appear to have been noticed before. If the applied d.c. voltage be reduced until only one or two minute bubbles form on the wire electrode and then a small high frequency current is passed momentarily, a large hemispherical bubble forms over the electrode, and this whether it be anode or cathode. This bubble starts its formation from the body of the electrolyte, appearing to start some 3 mm. below the electrode, and travelling very fast and taking up its position with unerring accuracy. The bubble is very large compared with those formed by electrolysis and its appearance suggests something in the nature of an electric discharge.

The Electrical Conductivity of Hydrochloric Acid and Potassium Chloride in Presence of Sucrose.

Mr. A. J. Kieran contributed an account of a research on the above subject, which arose from an attempt to determine whether sucrose in aqueous solutions was capable of forming a permanent union with the hydrogen ion. It was found that while the behaviour of KCl in the presence of sucrose is normal, in that the equivalent conductivity increases regularly with increasing dilution of the salt to an asymptotic limit, the behaviour of HCl is abnormal, the equivalent conductivity passing through a maximum and then steadily falling with increasing dilution. This was found not to indicate replacement of the fast-moving H ion by a slow-moving complex, but to be due to traces of impurity present in even the purest sucrose obtainable.

The nature of this fortuitous abnormality is considered to be not without interest in view of the close association of minute amounts of electrolytes with other organic substances of high molecular weight.

The Distribution of Colloidal Particles in Suspension.

Prof. Perrin, some years ago, examined experimentally the distribution of colloidal particles in suspension, and put forward a law of distribution, which he also deduced theoretically, analogous to that which characterises the distribution of the molecules in the atmosphere. Perrin's observations, however, were made in very dilute solutions, and Prof. E. F. Burton has shown that his law gives impossible values for concentrated solutions. Prof. A. W. Porter and Mr. J. J. Hedges in their paper described experiments made with suspensions of gamboge over a wide range of depths, and, therefore, concentrations, and they prove both experimentally and by calculation that the concentration tends to uniformity as the depth increases. In fact, the law of change with increasing concentrations does not follow the perfect gas equations as it does in the dilute suspensions examined by Perrin.

The paper describes in some detail the apparatus and method used for counting the particles at different depths. In the mathematical calculation the authors incidentally controvert Burton's view that the known distribution of colloidal particles requires the assumption of repulsive forces arising from the electrical charges on the particles. This view neglects the double layer of equal and opposite charges close to the surface of each particle.

THE X-RAY AND RADIUM PROTECTION COMMITTEE.

General Recommendations.

The question of the degree of protection offered by different "protective" appliances used in connection with X-ray installations has recently excited much public attention and anxiety. The X-ray and Radium Protection Committee, which issued a preliminary report on the subject, dated July 30th, 1921, has made certain specific recommendations that are being widely acted upon—and not prematurely, for there can be little doubt that the majority of the X-ray installations in this country are deficient from the point of view of protection. Stray radiations can generally be found in abundance throughout X-ray rooms, and such conditions are calculated to ultimately lead to detrimental effects on the operators.

It is therefore of interest to note that in his annual report for 1921 the director of the National Physical Laboratory records that that institution has agreed to examine, on request, X-ray installations in accordance with the suggestions that have been made by the above-named Committee. The inspection arrangements include measurements of the stray radiation, and tests of the individual protective appliances which are in use. Attention is also paid to general considerations, such as ventilation, electrical arrangements, and the lay-out of the installations, with special reference to the safety of the operator, and in every case advice is given on such points as may arise out of the laboratory inspection. Similar inspection facilities are provided for radium workers. On account of the importance of the subject, the recommendations of the "Protection Committee" are summarised hereunder:—

The danger of over-exposure to X-rays and radium can be avoided by the provision of efficient protection and suitable working conditions. The known effects on the operator to be guarded against are:—

1. Visible injuries to the superficial tissues, which may result in permanent damage.
2. Derangements of internal organs and changes in the blood.

These are especially important, as their earlier manifestation is often unrecognised, and the following precautions are recommended:—

1. Not more than seven working hours a day.
2. Sundays and two half-days off duty each week, to be spent as much as possible out of doors.
3. Annual holiday of one month or two separate fortnights.

Sisters and nurses, employed as whole-time workers in X-ray and radium departments, should not be called upon for any other hospital service.

The protective measures recommended are dealt with under seven sections, but it must be clearly understood that the protective measures recommended for these various purposes are not necessarily interchangeable; for instance, to use for deep therapy the measures intended for superficial therapy would probably subject the worker to serious injury.

I. *Diagnostic Purposes.*—In the case of screen examinations—

(*a*) The X-ray bulb to be enclosed as completely as possible with protective material equivalent to not less than 2 mm. of lead; the material of the diaphragm to be equivalent to not less than 2 mm. of lead.

(*b*) The fluorescent screen to be fitted with lead glass equivalent to not less than 1 mm. of lead, and to be large enough to cover the area irradiated when the diaphragm is opened to its widest. (Practical difficulties militate at present against the recommendation of a greater degree of protection.)

(*c*) A travelling protective screen, of material equivalent to not less than 2 mm. of lead, should be employed between the operator and the X-ray box.

(*d*) Protective gloves to be of lead rubber (or the like) equivalent to not less than ½ mm. of lead, and to be lined with leather or other suitable material. (As practical difficulties militate at present against the recommendation of a greater degree of protection, all manipulations during screen examination should be reduced to a minimum.)

(*e*) A minimum output of radiation should be used with the bulb as far from the screen as is consistent with the efficiency of the work in hand; screen work to be as expeditious as possible.

In the case of radiographic examinations ("overhead" equipment)—

(*a*) The X-ray bulb to be enclosed as completely as possible with protective material equivalent to not less than 2 mm. of lead.

(*b*) The operator to stand behind a protective screen of material equivalent to not less than 2 mm. of lead.

II. *Superficial Therapy.*—It is difficult to define the line of demarcation between superficial and deep therapy. For this reason it is recommended that, in the reorganisation of existing, or the equipment of new, X-ray departments, small cubicles should not be adopted, but that the precautionary measures suggested for deep therapy should be followed. The definition of superficial therapy is considered to cover sets of apparatus giving a maximum of 100,000 volts (15 cm. spark gap between points; 5 cm. spark gap between spheres of 5 cm. diameter).

Where the cubicle system is already in existence it is recommended that:—

1. The cubicle should be well lighted and ventilated, preferably provided with an exhaust electric fan in an outside wall or ventilation shaft; the controls of the X-ray apparatus to be outside the cubicle.
2. The walls of the cubicle should be of material equivalent to not less than 2 mm. of lead; windows to be of lead glass of equivalent thickness.
3. The X-ray bulb should be enclosed as completely as possible with protective material equivalent to not less than 2 mm. of lead.

III. *Deep Therapy.*—This section refers to sets of apparatus giving voltages above 100,000.

1. Small cubicles are not recommended.

2. A large, loffy, well-ventilated and lighted room to be provided.

3. The X-ray bulb to be enclosed as completely as possible with protective material equivalent to not less than 3 mm. of lead.

4. A separate enclosure to be provided for the operator, situated as far as possible from the X-ray bulb. All controls to be within this enclosure, the walls and windows of which to be of material equivalent to not less than 3 mm. of lead.

IV. *Industrial and Research Purposes.*—The preceding recommendations for voltages above and below 100,000 will probably apply to the majority of conditions under which X-rays are used for industrial and research purposes.

V. *Electrical Precautions.*—The following recommendations are made:—

1. Wooden, cork, or rubber floors should be provided; existing concrete floors should be covered with one of the above materials.

2. Stout metal tubes or rods should, wherever possible, be used instead of wires for conductors; thickly insulated wire is preferable to bare wire; slack or looped wires are to be avoided.

3. All metal parts of the apparatus and room to be efficiently earthed.

4. All main and supply switches should be very distinctly indicated; wherever possible double-pole switches should be used, and fuses no heavier than necessary for the purpose in hand should be used; unemployed leads to the high-pressure generator should not be permitted.

VI. *Ventilation.*—It is strongly recommended that the X-ray department should not be below the ground floor.

The importance of adequate ventilation in both operating and dark rooms is supreme. Artificial ventilation is recommended in most cases. With very high potentials coronal discharges are difficult to avoid, and these produce ozone and nitrous fumes, both of which are prejudicial to the operator. Dark rooms should be capable of being readily opened up to sunshine and fresh air when not in use. The walls and ceilings of dark rooms are best painted some more cheerful hue than black.

VII. *Radium Therapy.*—The following protective measures are recommended for the handling of quantities of radium up to one gramme:—

1. In order to avoid injury to the fingers the radium, whether in the form of applicators of radium salt, or in the form of emanation tubes, should always be manipulated with forceps or similar instruments, and it should be carried from place to place in long-handled boxes lined on both sides with 1 cm. of lead.

2. In order to avoid the penetrating rays of radium, all manipulations should be carried out as rapidly as possible, and the operator should not remain in the vicinity of radium for longer than is necessary.

The radium when not in use should be stored in an enclosure, the wall thickness of which should be equivalent to not less than 8 cm. of lead.

3. The handling of emanation should, as far as possible, be carried out during its relatively inactive state. In manipulations where emanation is likely to come into direct contact with the fingers thin rubber gloves should be worn. The escape of emanation should be very carefully guarded against, and the room in which it is prepared should be provided with an exhaust electric fan.

In view of the varying susceptibilities of workers to radiation, the Committee recommends that wherever possible periodic tests, *e.g.*, every three months, be made upon the blood of the personnel, so that any changes which occur may be recognised at an early stage. In the present state of knowledge it is difficult to decide when small variations from the normal blood-count become significant.

Sale of White City.—The proprietors, Shepherd's Bush Exhibition, Ltd., announce that the 100 acres of exhibition ground, with buildings, is offered for sale by private treaty.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Western Centre Summer Meeting.

The summer meeting of the Western Centre of the Institution was held on July 24th, and took the form of an outing. The members and their friends from both sides of the Bristol Channel assembled at Gloucester, trains from South Wales and Bristol being met by a fleet of charabancs, which conveyed them to Pittville Gardens, Cheltenham, where they were received by the Mayor (Miss Winterbotham, M.B.E.) and the chairman of the Cheltenham Electricity Committee (Councillor J. Moores). After luncheon the toast of "The Institution" was submitted by Coun. Moore, who humorously alluded to his early personal connection with the electrical profession, and paid tribute to the pertinacity of the electrical engineer in making his investigations of to-day the achievements of to-morrow. He wished the parent Institution every success in the future, and congratulated the Western Centre on the efforts it was putting forward to organise the electrical profession in the West of England and South Wales.

Mr. A. C. MacWhirter, in replying, stated they were proud of their Institution, and he was proud to be the chairman of the Western Centre. The Institution had a war record of which it was very proud; many of the effective inventions produced during that period emanated from its members. The toast of "The Mayor and Corporation of Cheltenham" was proposed by Mr. A. C. MacWhirter and responded to by the Mayor, who, in the course of a very graceful speech, said how pleased she was to welcome members of the Western Centre to Cheltenham. She congratulated the Institution on two points—the granting of the Royal Charter and the attainment of its jubilee, and the Western Centre on the inclusion of ladies for the first time in its annual summer meeting.

Mr. W. A. Chamen submitted the toast of "The Visitors and Ladies," which was responded to by Mr. A. S. Barnard (chairman of the North-Western Centre), who stated that his Centre could boast of two lady members, both of whom attended their meetings and sometimes spoke.



The I.E.E. Western Centre at Cheltenham.

After luncheon a visit was paid to the works of the Erinoid Co., at Stroud, the route taken by the charabancs being *via* Leckhampton, Birdlip, Cranham Woods, and Painswick. The process of manufacture of "Erinoid" was a source of great interest, especially as it is an industry captured from the Germans, and therefore new to most people. The spacious premises and its complete plant and equipment was a surprise, and quite in keeping with its beautiful surroundings. The return journey was made *via* the Slad Valley to Birdlip, where tea was partaken of. A hearty vote of thanks was accorded to Mrs. Corson and Messrs. Corson, Bache, Hood, Nairn, Langdon, Ostler and Allam, the Sub-Committee responsible for the working out of the details which ensured such an enjoyable outing to all those who participated. From Birdlip the journey was made back to Gloucester, where some members returned by the earlier trains to Bristol and South Wales, the remainder of the party paying a much appreciated visit to the cathedral.

During luncheon the annual meeting was held, the business of which comprised two items only. The declaration of the ballot for new members of the Committee showed that Messrs. Heath, Rogers, Sully and Fidler were elected. Hearty votes of thanks were accorded the South Wales Institute of Engineers and the governors of the Merchant Venturers' Technical College, Bristol, for the use of meeting rooms during the past session.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Brolt Neon Spark Gauge.

Correct ignition is an essential factor to the satisfactory working of all types of automatic and aero engines. Until comparatively recently there was no instrument available for testing the state of operation of a sparking plug under normal working conditions, but the Brolt neon spark gauge has been designed for this purpose.

The gauge—without " short-circuiting " or any other process liable to impair the efficiency of the magneto—utilises a very small amount of its energy to produce a luminous discharge of sufficient colour value to demonstrate, by day or night, the precise condition of the sparking plugs. The bright red glow is obtained by an electrical discharge through a tube containing neon gas.

The Brolt gauge, fig. 1, consists of four components :—

The ebonite container is a moulded tube of high insulating capacity, having an aperture through which the luminous discharge can be seen. The neon tube is about 2⅛ in. long and ¼ in. diameter, and is somewhat constricted in the centre in order to increase the brilliancy of the discharge. Nickel electrodes are sealed in at either end, and to each is attached a connecting wire.

The steel wool at each end of the tube serves a dual purpose; it forms a resilient packing for fixing the neon tube into the ebonite container, and is the conducting medium by which the current is conveyed through the electrodes. A brass cap secures the tube in position, and forms the contact base of the spark gauge.

When the cap of the gauge is brought into contact with the sparking plug it is influenced by the oscillatory discharge

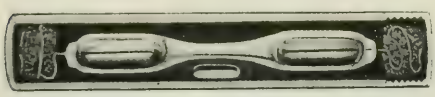


Fig. 1.—Sectional View of Neon Spark Gauge.

from the magneto whenever a spark passes in the ordinary course of ignition. A minute amount of energy passes through the neon tube and from thence to the ebonite case and through the hand of the operator to earth. In effect, therefore, the appliance resembles a miniature condenser in its method of operation. At the normal working the potential of the plug is sufficient to cause a red flash, and the rate and evenness of firing can thus be observed. Should the plug have become " fouled " or carbonised, or alternatively, if the points are too close, the potential is immediately reduced (either because of leakage or insufficient gap) and the neon tube will in these circumstances only flash feebly or intermittently. If the points are too far apart (*i.e.*, too large a spark gap) the potential is raised and the flash will become lurid in colour. Thus the motorist is enabled to visualise the spark operation from his plugs while the engine is still running.

The gauge may also be used for testing the continuity of the electrical circuit, and for locating any leakage which may occur in connection with the h.p. leads by simply placing the gauge along the outer covering.

The neon gauges are being manufactured for Messrs. Brolt, Ltd., of Rood End Road, Oldbury, in large quantities by Messrs. Siemens Brothers & Co., at their Dalston lamp works.

The " Utility " Toaster-Fire.

A triple-purpose electric fire has recently been put upon the market by Electrical Utilities, Ltd., 1-3, Shelgate Road, S.W.11. It consists of zig-zag spiral elements mounted in a

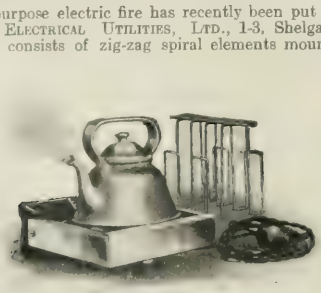


Fig. 2.—The " Utility " Toaster-Fire.

rectangular aluminium frame upon an enamelled cast-iron base, a polished aluminium reflecter, and a wire frame which lits over the element frame as shown in the illustration (fig. 2). Without the wire frame the device can be used as a radiator, the reflector being placed in position behind the elements. The frame converts it into a toaster, and, if desired, the heater can be laid flat, resting upon a foot forming a part of the reflector for the purpose of boiling a kettle. The loading is only 550 W, suitable for various voltages, and two yards of flex, with an adaptor are provided.

The " Lawrence " Heater-Softener.

The Lawrence Patent Water Softener and Sterilizer Co., Ltd., Parliament Mansions, Victoria Street, S.W.1, has produced an apparatus which combines in one plant the processes of softening and heating boiler feed-water. This appliance removes the carbonate hardness from the water and at the same time raises the temperature to about 210 deg. F. The illustration (fig. 3) shows the arrangement, and the action is briefly as follows :—Hard cold water is admitted by a

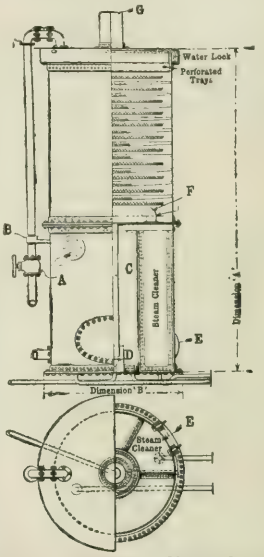


Fig. 3.—The " Lawrence " Heater-Softener

control valve and is divided into fine streams by special perforated water-locked trays and " locator " plates. Exhaust steam enters a self-contained steam cleaner and is specially distributed so as to obtain an intimate admixture of steam and water. The lower part of the heater acts as a settling tank from which the hot softened water is delivered into a storage tank, or directly, by pump, into the boiler. The deposit is collected on the " locator " plates, which are easily removable for cleaning without dismantling the apparatus. A special pattern has been designed for utilising exhaust heat from gas and oil engines instead of steam.

The " Chad " Wireless Battery.

Messrs. Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, E., have produced a special type of battery for energising the anode circuits of thermionic valves

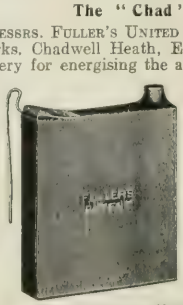


Fig. 4.—The " Chad " Wireless Battery Single Cell.

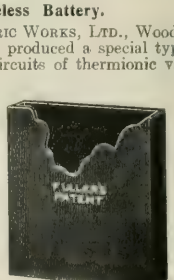


Fig. 5.—Ebonite Container.

for wireless reception purposes. This consists of eight cells, similar to that illustrated in fig. 4, connected together in series. These cells have a very high internal resistance, enabling them

to remain unused for long periods without deterioration. The electrodes are encased in an ebonite container (fig. 5), securing immunity from leakage from one cell to another. The assembled battery measures only 3¾ in. by 2 in. by 2¼ in., and has an e.m.f. of 12 V. The normal rate at which current is taken from the battery is about 3 mA; it is therefore recommended that, when possible, but particularly when two or more valves are used in "cascade," sets of batteries should be connected up in parallel to ensure more economical working.

ELECTRICITY AND SANITARIANS.

If there is any particular function in connection with the electricity supply industry which Mr. C. H. Wordingham has not exercised at some time or other, it would be interesting to hear of it.

Recently his attention has been directed a good deal towards the commercial aspect of the business, and he has not found it impossible to combine with the work of planning power stations, the no less necessary thought and initiative required to create new markets for their output.

At the instigation of an organisation with which we are all familiar Mr. Wordingham addressed the Conference of the Royal Sanitary Institute recently held at Bournemouth in a most interesting manner. It appears from examination of the papers issued by this influential body that the Bournemouth meeting was the 33rd in its history, and one may safely hazard a guess that it was the first at which the important relation between electricity and health had received attention.

Mr. Wordingham, who entitled his paper "The Brightening of the Home and the Lightening of Domestic Labour by Electrical Means," covered rapidly and clearly the principal applications of electricity to domestic work, and put before the meeting a few pertinent considerations which should by now have been made commonplaces in the public mind by those interested in the progress of the industry.

The speaker pointed out with regard to electric lighting that the price of the kWh was hardly worthy of consideration, its incidental savings and advantages being so great that it was practically a gift. He drew particular attention to the relation between electric heat and power in the home and the still diminishing supply of domestic service available in most places, showing how electricity helped in the difficult position caused by the shortage of servants, and might even go a long way to remedy that shortage by making them more comfortable in their work and giving them a feeling of increased status by removing drudgery and placing in their hands tools much superior to those to which they had been accustomed. He recommended the architect to consult with the electrical engineer, and everybody interested in the production and maintenance of homes and their equipment to consult with the "Housewife."

Mr. Wordingham is evidently seized with the urgent necessity for providing the more expensive pieces of electrical apparatus on hire or hire-purchase terms, and goes so far as to say that the time is ripe for the formation of well-financed companies to carry on this work, as is already done with many other home appliances desirable to everyone, but under present conditions difficult to pay for outright. Companies handling a big hiring business would be in a very strong position with regard to buying apparatus and standardising it.

The speaker, in concluding, referred to the necessity of simpler tariffs, easily understandable and designed to encourage the wider use of electricity.

In the discussion which has taken place in one of our leading daily papers with regard to the troubles of the gas consumer the leader writer remarks that: "The electricity meter still talks plain English"—this really may be taken as a motto for the framer of electricity tariffs. Many have already lost opportunities by putting forward charges, probably just and scientific, but too complex in detail and also by omitting to advertise their service or take the public into their confidence as they should have done.

It is reported that the discussion following Mr. Wordingham's paper was something more than brisk and that the disgruntled ones received from the author something almost more than plain speaking. One can only feel grateful to a busy man for taking the trouble to do this valuable work. In the electrical industry there is no desire, and never has been any desire, to take unfair advantage of powerful and valuable rival services, but there have been examples, by no means universal, where distinctly unfair tactics have been adopted to belittle the possibilities of electricity; in fact, the advertising of some of its competitors consists more in describing the alleged inefficiencies of electricity than in praising their own commodities.

Only recently circulars have come into our hands intended to push the claims of various kinds of solid fuel, or the apparatus for consuming them, and apparently the writers of these circulars could find no better argument than to draw comparisons between the costs of various kinds of fire burning raw fuel and the cost of using electric stoves for 16 or 20 hours a day at prices per kWh which would almost make them impossible for the briefest and most occasional work.

If competing methods of heating, lighting and cooking require to be pushed by comparisons with electricity at rates and for a manner of use which no sane person would adopt, it is pretty obvious that some of our competitors are viewing the progress of this industry with very great alarm.

An interesting impression which one carried away from this meeting is the receptivity of the medical man with regard to electricity—it was obvious in the discussion that little enough had been done to assist the doctor to understand what electricity can do in the home and how questions of cost and correct method of use affect it. At the same time it is obvious that the medical man is looking forward eagerly to the wider use of electric power and will welcome information and assistance from supply engineers and manufacturers.

In looking through the local papers some difficulty was found in discovering any reference to this particular meeting, and to the lively discussion arising from it, although much space was given to the Conference generally and to most of the subjects dealt with—it is true that in one column the title of the paper was printed with the exception of the words "by electrical means," but beyond that the only item in the local journal turning one's attention to electricity was the frequent reproduction of an advertisement referring to the pure air of Bournemouth which, apparently, is not so much due to the sea and to the pine trees as to the use of gas; this advertisement carried a statement that in the town there are 50,000 gas fires and 30,000 cookers operated by the same medium, so that there really seems to be quite a little business in front of the Bournemouth electricity supply undertaking, and it would be rather interesting to have a glimpse of the electrical position of Bournemouth at the time when the Royal Sanitary Institute is due to hold its Conference there once more.

It is obvious that conventions of this kind offer a most valuable opportunity to the electrical industry—it is possible in nearly all cases to put forward papers of interest and give information, quite apart from any advertising, which is welcomed gladly by the mixed bodies attending such meetings.

In connection with the Congress a small exhibition was held, and here again electricity was quite well represented, a good display being put up by the local electricity supply undertaking, and also by Messrs. Hoover, Rawlplug, and the Electric Appliance Co., Ltd., of Bournemouth.

REVIEWS.

The Beama Technical Cable Code. Imperial 4to (15 x 11 in.); 206 pp. London: The British Electrical and Allied Manufacturers' Association. Price £5 5s. net; packing, postage extra; inland 2s. 6d.; foreign 5s.

Notwithstanding the large number of telegraph codes already on the market, there is still room for a more complete technical code. Hitherto it has been customary for firms, whether manufacturers or merchants, to compile codes to meet their own particular requirements, and there is no question that these private codes, adapted as they are to a particular firm's specialities, and method of transacting business, will continue to be used. The British Electrical and Allied Manufacturers' Association, in catering for its members, among whom are manufacturers in every branch of the electrical and engineering trades, has endeavoured to produce a work which will not only standardise the private codes of its members, but will be also available for those other firms which feel the want of a special technical and engineering code.

The Beama Cable Code is beautifully printed on strong paper, and bound in a Kalamazoo loose-leaf binder, with the advantage that subscribers may insert fresh sections as they are published. Its contents have been compiled by Mr. John F. Shipley, M.I.E.E., who has had the assistance of the technical and commercial specialists connected with the firms in the Association, and this is itself a guarantee that the subject matter is reliable and complete. The phrases employed in the book are such as are frequently used in cabling inquiries, tenders and contracts, and they have been made as comprehensive as possible, and should meet the wants of the engineering trade. There are one or two errors in coding in Examples 8 and 9.

The Beama Cable Code is divided into 96 sections, each having an indicator, consisting of two letters ranging from AC to YR. Every section is carried out in a number of appropriate items, or tables of details, making each section complete in itself. Four of these sections consist of EP, commercial phrases (general engineering); ER, commercial phrases (details); ES, miscellaneous phrases; ET, technical phrases; 26 deal with figures—quantities, prices, and the like; and the remaining 66 sections are devoted to technical and electrical engineering matters, including accessories, batteries, condensers, cooling water apparatus, dynamos and motors, Diesel engines, gas and oil engines, steam engines (high speed and low speed), heating and cooking apparatus,

industrial instruments, scientific and telegraphic instruments, meters, centrifugal pumps, rotary converters, switch gear, transformers, turbines, turbo-generators, boilers, cranes, water turbines, electric vehicles, air compressors, electric furnaces, mills, hydraulic pipe lines, electric traction (cars, locomotives and permanent way), transmission lines, cables, lamps, and a number of small apparatus. From this list it will be seen that the claim made in the introductory chapter is justified, *viz.*, that the code should enable the export members of the Association to telegraph practically everything arising in the ordinary course of their highly-technical business, even to the extent of telegraphing a whole specification in detail."

The Beama Code is based upon the well-known lettered table system; that is to say, the subject matter is suitably arranged in sections, each section containing a sequence of appropriate tables relating to the subject of the section. Each section is provided with a two-letter indicator AC, AD, AF, &c. Similarly, each detail in the item tables bears code letters. To code a message the two letters indicating the section are first taken, and to these are added letters obtained from one detail in each of the Item Tables of the section indicated. The code letters are then formed into the usual ten-letter code-words, which, in the Beama Code consist of five two-letter vowel-consonant syllables.

In theory the system described appears both simple and economical; in practice, however, several disadvantages present themselves and affect the simplicity and safety of the system. Some pretentious codes based on this system have been published, but have met with poor success, probably owing to the difficulty of finding phrases when arranged in tabular form, the fact that a check is necessary when employing built-up code words, and the added complication as compared with the use of self checking five-letter code words. Had five-letter code words been made use of in the Beama Code the tables then would have had figure instead of letter indicators.

The Beama Code contains a most valuable amount of skilfully-arranged technical matter not hitherto to be found in a published code, and a good index is provided to facilitate the finding of the matter required. Further, as the code caters for the highly technical trade of engineering, it will doubtless be used by trained men, and not by the ordinary cable clerk. This is in its favour, but even a qualified engineer will find it somewhat of a task to have to conform to the 25 rules which are thought to be necessary for coding and decoding messages. About half of these rules refer to the use of ciphers for modifying the method of coding. Generally, the procedure is as already described, *viz.*, a two-letter indicator denoting the section is taken, to which are added the necessary code letters of the details from each Item Table. Should it be required to omit a detail from any Item Table, then one of the "Pass Ciphers" A, B, AB, or AH is coded to denote this. It is, however, often desirable to take two or more details from the same Item Table, and for this purpose a "Repeating Cipher AX," or a "Double Repeating Cipher OH" is provided. Having once used the AX or the OH Cipher it becomes necessary to indicate in the message that the repetitions cease, and for this purpose the "Stop Repeating Cipher EX" is required. Again, to gain economy, it may be desirable to pass from one Item Table to another Item Table in the same section. To accomplish this the "Bridge Cipher UX" must be employed. Further, it may be necessary to interpolate a maker's code word, or a sentence from another code, when the "Private Code Cipher IH," or the "Code Switch Cipher IX" is required. Should the message then continue from the Beama Code this must be indicated by the use of the "Code-Return Cipher EH," and so on. The following example, taken from the code, shows that great care is necessary in coding and decoding when the modifying ciphers are employed:—

Example 12.

Index cipher	YP	water turbines (detailed).
Bridge cipher	UX	(Q2).
Q2	AV	Item 14.
Repeating cipher	OH	———
Item 14	O	bucket separate from impulse wheel.
Item 15	J	of cast steel plates, steel blades.
Item 14	E	alternatively.
Item 15	G	material of wheel, cast steel.
Item 14	A	(pass).
Item 15	N	material of buckets.
Stop-section cipher	OX	———
Index cipher	AK	(materials Q6).
Item 1	AL	alternatively.
Repeating cipher	AX	———
Item 2	AW	aluminium bronze
Item 2	EC	delta bronze
Stop-section cipher	OX	———
Index cipher	YP	(water turbines).
Bridge cipher	UX	———
Q2	AZ	Item 16.
Item 17	A	(pass).
Item 16	K	two wheels, two jets each.

It will be observed that the modifying ciphers are most useful, if indeed not indispensable, in letter table codes; but they greatly complicate the work of coding and decoding messages and, to some degree, affect the most important question of all, *viz.*, *safety*.

In all codes, and particularly in those in which the subject matter or meaning of the message is dependent upon the preceding code word or indicator, it is most desirable—nay, necessary—that each code word should have some safe method of check upon the accuracy of the code words received. There are two reasons for the preference shown for five-letter code words; they are simple in use, and having a two-letter difference in five, if properly selected, they are reasonably safe. In the introductory chapter it is truly stated that "few cables arrive without mutilation." These mutilations or errors, for the most part, are caused by the changing, or dropping, of a dot or dash, or by faulty spacing in the Morse signals, in transit. In code words built up from tables, practically every combination of letters is employed, notwithstanding that many of them are dangerously alike, and they therefore hold out many possibilities of error from the causes enumerated. For instance, AB may be received as AC, AD, AH, AS, AX, AZ, EB, IB, or UB; AC easily becomes AB, AF, AK, AR, AY, E.C, IC, or UC; and so on throughout the whole of the vowel-consonant syllables. Should such mutilations occur, and they frequently do, unless there is some method of detection it is obvious that a code word—or may be the whole of the following code words—would be wrongly interpreted with disastrous consequences. At any rate, a prudent user of the Beama Cable Code would insist upon using a check for testing the accuracy of all code words received. A check system is provided for this purpose, but it is not suggested that its use is imperative, because a Check Indicator YX is provided to show when message is subjected to a check. Here, again, YX when telegraphed is liable to be received as YD, and YD is the indicator of the section for electric traction. As the same vowel-consonant letters are employed as section indicators for the code letters of details and for the modifying indicators, all of which are subject to mutilation, as already shown, it would appear that the checking device should be insisted upon in all messages. Here we see a disadvantage of the letter table system, for not only does a system of checking introduce its own complications but, in the Beama Code, it also reduces the economy at once by 20 per cent. There is a known and simple method of checking in existence which would dispense with the check indicator YX, and would take nothing whatever from the economy of the code words. The following example from the code will explain the method of employing the Beama Check:—

Example 13.

Index cipher	EP	(commercial phrases).
Item 1	AC	(go direct to item 6).
Item 6	AK	quote by telegram price and delivery for.
Item 7	AC	one.
Item 8	EB	delivered to site and erected, including all foundation work, but excluding import Customs duties.
Stop-section cipher	OX	———
Index cipher	IM	(cooling towers).
Item 1	O	natural draught type.
Item 2	D	principle left to you.
Item 3	AB	chimney construction.
Item 4	I	water capacity in imperial gallons per hour.
Item 5	C	(Q1).
Item 1 }	AD	(read from Items 3, 4 and 5 only)
Item 3 } Q1	EJ	20
Item 4 }	AC	00 } 200,000.
Item 5 }	AC	00 }
Item 6	E	average inlet temperature.
Item 7	G	in degrees F. (Q2).
Q2	YP	95
Item 8	I	to be cooled to lowest economic pressure.
Item 9	B	(pass).
Item 10	E	average air temperature.
Item 11	G	in degrees F. (Q2).
Q2	ON	60.
Item 12	AC	relative humidity in per cent. (Q2).
Q2	US	80.
Item 13	AK	shape of cooler, rectangular.
Item 14	A	(pass).
Item 15	B	(pass).
Item 16	AC	height of water inlet above tank top in feet (Q2).
Q2	EF	20.
Item 17	AB	(pass).
Repeating cipher	AX	———
Item 18	EG	include.
Item 18	AD	all bolts, nuts, screws and rivets for re-erection on site.
Stop-section cipher	OX	———

(i) Prefix the check cipher YX to the message to show that it is to be checked; it will then read thus:—

YXEPACAKACEBOXIMODAFIC
ADEJACACEGYPIBEGONAC
USAKABACEFABAXEGADOX

(ii) Split the message into 8-letter segments, thus:

YXEPACAK ACEBOXIM ODAFICAD EJACACEG
YPIBEGON ACUSAKAB ACEFABAX EGADOX.

(iii) Take from Schedule 1 the numerical value of each of the four syllables of a segment, double the total numerical value of each four syllables, and draw its value cipher from Schedule 2. The following will be the result:

						(Value cipher)
YX	EP	AC	AK			
1	5	2	8	16.	16 × 2 32	OJ
AC	EB	OX	IM			
2	3	6	5	16.	16 × 2 32	OJ
OD	AF	IC	AD			
9	4	6	3	22.	22 × 2 44	UB
EJ	AC	AC	EG			
9	2	2	7	20.	20 × 2 40	OW
YP	IB	EG	ON			
4	5	7	8	24.	24 × 2 48	UF
AC	US	AK	AB			
2	4	8	1	15.	15 × 2 30	OF
AC	EF	AB	AX			
2	6	1	9	18.	18 × 2 36	OR
EG	AD	OX				
7	3	6		16.	16 × 2 32	OJ

(iv) Add these value-ciphers to the corresponding 8-letter segments and thus compose 10-letter words.

YXEPACAKOJ ACEBOXIMOJ ODAFICADUB
EJACACEGOW YPIBEGONUF ACUSAKABOF
ACEFABAXOR EGADOXOJ.

In conclusion, the subject matter in the Beama Cable Code, as already pointed out, is all that could be desired for the purpose intended. The system upon which it is based, however, is somewhat complicated, and as the meaning of a message depends upon the correct receipt of the indicators and modifying ciphers, the employment of the check should be made compulsory in all messages. It is possible so to check messages without the loss of 20 per cent. economy necessitated by the use of the existing check system.

LEGAL.

Electric Lamp Globe Contract Dispute.

In the Mayor's and City of London Court, on July 28th, before Judge Jackson, Johnsen & Jorgensen Flint Glass, Ltd., claimed £59 against the British & Allied Electrical Agency, Ltd., Ely House, for white opal "Pixie" electric light globes supplied. Mr. Ronald Smith appeared for the plaintiffs, and Mr. Morgan May for the defendants. Mr. May said he wanted to take a preliminary point before the case was opened. The particulars of claim did not disclose any cause of action. The claim was for goods sold. Defendants wanted them for the *Daily Mail* Ideal Homes Exhibition, held in February, and asked plaintiffs to supply a certain number of globes. Plaintiffs had none in stock in London at the time, but they had at their disposal 110 gross of the same globes in Sweden. That did not quite meet defendants' wishes, they wanted them at once, and they did not want so many. They failed to do better elsewhere and they returned to the plaintiffs and said they were willing to take the 110 gross of globes. The first letter was sent on January 19th, when plaintiffs offered the globes at 10s. 9d. per gross. That letter said "awaiting your confirmation, delivery understood to be within four weeks here." Plaintiffs cabled to Sweden to dispatch the goods immediately, and they used all their endeavours to get the goods delivered at once. The conditions of sale were that delivery was to be as quick as possible without guarantee of any specific time. Defendants did not send a signed copy of the order as requested, and now said that they did not accept plaintiffs' terms as regarded delivery. Defendants wrote on February 2nd and said there were very few shipments from Kalmar, where the goods were, and plaintiffs said they would send them from Gothenburg, which they did. The vessel by which they came first broke her rudder and was then ice bound, and arrived on February 22nd in London. The previous day defendants cancelled the order, and said that the delay had occasioned them a loss, as they had had to purchase elsewhere. That was a repudiation before the time specified for delivery, February 21st. Plaintiffs refused to cancel the order and asked for the address to which they were to send the goods and then sent the defendants a dozen samples of the globes, as the defendants intended to sell them elsewhere. In cross-examination, Francis Ellis, plaintiffs' manager, admitted receiving a letter of January 19th, which contained the words "within four weeks from the date of 'phone order," but they did not take any notice of that. They never undertook to deliver the goods definitely within four weeks. For the defence, Mr. Albert T. Pollock, one of the defendants' directors and a buyer, was called, and he detailed a conversation which, he said, he had with the plaintiffs' witness Ellis in fixing up the contract. He distinctly told the plaintiffs that it was imperative that the goods should be delivered within four weeks. Witness further said that he did his best to get the plaintiffs to deliver the goods within four weeks, but he did not succeed. He told the plaintiffs he did not desire to act strictly according to law, but was prepared to assist the plaintiffs in disposing of the goods when they could not deliver them in time. Then Ellis said plaintiffs could not take any responsibility for them, but they would store them for a period free of rent. Ellis said the plaintiffs would try to dispose of the goods themselves, and suggested that they should divide the loss, but that was never agreed to. Then they received samples of the bulk.

In giving judgment, the Judge said it was very sad [illegible] the defendants that the goods were not delivered in time for the exhibition, but he could not understand why the defendants had bought bulbs elsewhere on February 16th, when they had given the plaintiffs until February 21st in which to deliver the goods. He need not come to a definite conclusion on the contract because, rightly or wrongly, he considered the delivery of samples as delivery of part of the bulk. Therefore, judgment must be given for the plaintiffs with costs.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by Messrs. Symes, Jones, Gibbon & Symmons, Chartered Patent Agents, 285, High Holborn, London, W.C.

19,378. "Variable [illegible] and wavelength [illegible]." B. [illegible] July 14th.

19,379. "Electrical measuring instruments." K. Edgcumbe and [illegible] Everett. July 14th.

19,380. "Lightning [illegible]." British Thomson-Houston Co., Ltd. (General Electric Co.). July 14th.

19,381. "X-ray apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). July 14th.

19,403. "Electrically-operated apparatus for advertising, &c." [illegible] Brown and H. G. Cocks. July 14th.

19,411. "Manufacture of thermionic valves, &c." H. St. J. de A. Donisthorpe. July 14th.

19,427. "Winding devices for paying-out and winding-in electric [illegible]." N. D. G. Robertson, R. D. Stow, and Wayne Engineering and Equipment Co., Ltd. July 14th.

19,430. "Manufacture of tungsten powder." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 14th. (Holland, July 20th, 1921.)

19,443. "Priming electric batteries." B. F. S. Baden-Powell. July 15th.

19,448. "Devices used in electric wiring systems." W. Osborn. July 15th.

19,468. "Wireless receivers." C. W. Green and G. Shaw. July 15th.

19,478. "Apparatus for taking up slack of flexible cable for electric [illegible], &c." J. H. Collie. July 15th.

19,496. "Electron-emitting cathodes and preparation of same." British Thomson-Houston Co., Ltd. July 15th. (United States, August 11th, 1921.)

19,497. "Electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. July 15th.

19,526. "Electric condensers." J. D. L. Bradwell and E. A. Reynolds. July 17th.

19,527. "Apparatus for ascertaining and indicating capacity of electric accumulator." P. J. Gundsley. July 17th.

19,528. "Sparking plug tester." G. W. Humphry and E. R. Humphry. July 17th.

19,531. "Electrophorus gas lighter." E. Zipperle. July 17th. (Germany, July 15th, 1921.)

19,532. "Couplers for electric tumbler switches." E. Wilcox. July 17th.

19,552. "Wireless receiving sets." L. B. Bignami and H. R. Hawking. July 17th.

19,560. "Generation of electrical oscillations by thermionic tubes." L. G. Preston and N. Shuttleworth. July 17th.

19,569. "Vacuum tubes, &c., for sparking plug indicators." A. [illegible] M. Denton. July 17th.

19,579. "Electrical switchboards." C. F. Atkinson. July 17th.

19,581. "Process for stabilising detector and reinforcing effect of electrolytic cells." D. Reichinstein. July 17th. (Germany, July 19th, 1921.)

19,595. "Automatic telephone [illegible] switching apparatus." [illegible] H. Baron (F. Aldendorff). July 17th.

19,597. "Telephone receivers." B. H. Morphy. July 17th.

19,600. "Ignition cables." H. Baechler. July 17th.

19,617. "Apparatus for electrolysis of water." I. Casali. July 17th.

19,625. "Apparatus for automatic connecting and disconnecting of electrical machine units." Akt. Ges. Brown, Boveri et Cie. July 17th. (Switzerland, September 10th, 1921.)

19,632. "Control of railway trains." W. J. Underwood. July 17th.

19,635. "Electrically-illuminated signs." J. Moiseiwitsch. July 17th.

19,641. "Wireless receivers." P. W. [illegible]. July 17th.

19,672. "Distributor brush and brush holder for motor [illegible]." M. M. Ward. July 18th.

19,687. "Five-electrode thermionic valve." W. E. E. Hare. July 18th.

19,686. "Electrically-illuminated signs, &c." J. Baron. July 18th.

19,702. "Device for opening and closing electric circuits." W. H. Scott and A. Wyatt. July 18th.

19,705. "Means for connecting steps and sliding doors of tramcars, &c." S. Okabe. July 18th.

19,708. "Illuminated sign lamp." International Reconstruction Edison Compagni and Wilson and Peters. July 18th. (Denmark, July 9th.)

19,720. "Electric heating apparatus." A. Boas. July 18th. (Switzerland, July 18th, 1921.)

19,722. "Steering [illegible] for engines." British Thomson-Houston Co., Ltd. (General Electric Co.). July 18th.

19,729. "Warning signal for ships' telegraphs." T. W. Main. July 18th.

19,739. "Protective covering for submarine cables." Felten & Guilleaume Carlswerk Akt. Ges. July 18th. (Germany, June 18th, 1921.)

19,742. "Printing telegraph transmitting instrument." E. C. R. [illegible] (Morkrum Co.). July 18th.

19,743. "Printing telegraph receiving instruments." E. C. R. [illegible] (Morkrum Co.). July 18th.

19,766. "Electric [illegible]." C. L. L. Bruce and A. McL. [illegible]. July 18th.

19,758. "Electric [illegible] signals." S. Eaton. July 18th.

19,760. "Telephone [illegible]." J. R. [illegible]. July 18th.

19,766. "Electric [illegible]." E. K. Hooper. July 19th.

19,767. "Electrical [illegible] for electric [illegible]." S. R. [illegible]. July 19th. (Germany, June 12th.)

19,788. "Holders for thermionic valves." A. F. Wells. July 19th.

19,795. "Overhead [illegible] for electric [illegible]." A. [illegible]. July 19th.

19,800. "Electric flash light lamp." Aktiebolaget Birka Regulator. July 19th. (Sweden, September 30th, 1920.

19,806. "[illegible] for thermionic valves." A. P. Welch. July 19th.

19,822. "Signal [illegible]." British Thomson-Houston Co., Ltd. (General [illegible]. July 19th.

[illegible] W. V. Scott. July 19th.

[illegible] for wireless installations." S. L. Forbes. July 19th.

[illegible] for wireless installations." S. L. Forbes.

[illegible] Parsons and J. Rosen [illegible]

19,864. "Starter for alternating-current machines." Siemens Schuckert-[illegible]. July 19th. (Germany, February 21st.)

19,885. "Electric power transmission systems." A. M. Taylor. July 20th.

19,897. "Automatic telephone systems, &c." W. D. Edwards and Relay Automatic Telephone Co., Ltd. July 20th.

19,914. "Coils for [illegible] wireless apparatus." E. C. Ash. July 20th.

19,916. "Electric advertising, &c., apparatus." A. E. Foxler and S. G. Higgins and C. T. Marks. July 20th.

19,919. "Electric lamps for kinematographic apparatus." Pathé Cinema Anciens Etablissements Pathé Frères. July 20th. (France, December 5th, 1921.)

19,925. "Electric water heater." Electric Fires, Ltd., and F. L. Newhouse and C. H. Smith. July 20th.

19,943. "Electrically-illuminated signs." General Electric Co., Ltd., and W. C. C. Hawtayne. July 20th.

19,944. "Adjusting mechanism for electric lamps." F. H. Morris. July 20th.

19,947. "Electric lamp bulb magazines for motor vehicles." W. H. Eggin-ton and O. Lucas. July 20th.

19,952. "Apparatus for repeatedly closing automatic switches." Akt. Ges. Brown, Boveri et Cie. July 20th. (Switzerland, September 10th, 1921.)

19,956. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 20th. (United States, September 10th, 1921.)

19,958. "Telegraph transmitting apparatus." Western Union Telegraph Co. July 20th. (United States, May 13th.)

19,963. "Wireless receiving systems." A. J. Hall. July 20th.

19,965. "Feed mechanism for strip charts, &c., for tramcars, &c." E. H. H. Gordon and L. W. Lewis. July 20th.

19,975. "Electrical heating means for evaporating fuel for internal-combustion engines." W. M. Harrison. July 20th.

19,977. "Servomotors." P. Salmon. July 20th.

19,979. "Electric primary batteries." M. I. David and E. E. Dutt. July 20th.

19,983. "Electric heating apparatus." Electric Heating and Hardware, Ltd., and F. J. Wineberg. July 21st.

19,984. "Electric immersion elements for kettles, &c." Electric Heating and Hardware, Ltd., and F. J. Wineberg. July 21st.

19,989. "Automatic means for limiting electric current intensity in continuous current circuits." V. Stobie. July 21st.

20,005. "Crystal detector for wireless signals." G. F. Hines. July 21st.

20,020. "Device for automatically maintaining direction of current in external circuit of a direct-current generator constant." P. V. Powell and P. Frost Smith. July 21st.

20,022. "Detector galvanometer." E. E. Moore. July 21st.

20,023. "Electric storage batteries." M. I. David and E. E. Dutt. July 21st.

20,033. "Electro-magnetic alternating-current rectifiers." E. W. Kitchin. July 21st.

20,034. "Apparatus for electrical transmission and reproduction of music, &c., in conjunction with kinematograph pictures, or separately." G. R. Judge and R. A. Storey. July 21st.

20,036. "Ventilating systems for dynamo-electric machinery." J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. July 21st.

20,039. "Telephone exchange systems." Coventry Automatic Telephones, Ltd. (R. C. Arter and F. R. McBerty). July 21st.

20,040. "Multiple range current transformer." Landis and Gyr Akt. Ges. July 21st. (Switzerland, July 22nd, 1921.)

20,062. "Automatic regulation of output of electric installation." M. Doloukhanoff. July 21st.

20,064. "Braking apparatus for electrically-propelled vehicles." C. J. Spencer. July 21st.

20,075. "Variable electric resistances, wireless tuning apparatus." A. T. Scott. July 22nd.

20,079. "Electric switches." A. G. Davies. July 22nd.

20,116. "Electric irons." H. Stansfield Dodd. July 22nd.

20,121. "Burglar alarm." W. S. Edwards. July 22nd.

20,123. "Alternating current protective apparatus." British Thomson-Houston Co., Ltd. (A. S. FitzGerald). July 22nd.

20,125. "Electric resistances." Metropolitan-Vickers Electrical Co., Ltd., N. E. North. July 22nd.

20,126. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). July 22nd

20,127. "Methods of controlling electric currents and potentials in wireless signalling, &c." Radio Communication Co., Ltd., and J. Scott Taggart and P. D. Tyers. July 22nd.

20,139. "Tidal-wave power stations." K. Cornehl and W. Schwarzenauer. July 22nd. (Germany, July 26th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

[illegible] "Microphones." J. Gardner. December 30th, 1920. (182,494.)

1921.

356. "Headlights for vehicles." J. M. Richardson. October 6th, 1913. (156,485.)

424. "X-ray photography." N. E. Luboshez. January 5th, 1921. (182,496.)

1,596. "Method of and means for regulating an electric central station and sub-station." R. Bosselmann. September 15th, 1919. (157,865.)

4,118. "Tanks for electrical transformers." O. Y. Imray (legal representative of O. Imray, deceased) (Pittsburgh Transformer Co.). February 3rd, 1921. (182,506.)

6,769. "Insulation of electric cables." C. J. Beaver and E. A. Claremont. March 1st, 1921. (182,516.)

7,052. "Electric fuses." H. J. Fuller. March 4th, 1921. (182,512.)

7,333. "Thermionic valves particularly applicable to wireless signalling." H. St. J. de A. Donisthorpe. March 7th, 1921. (Cognate application 14,052 21 [illegible] 182,516.

9,518. "Automatic and [illegible] telephone systems." Relay Automatic Telephone Co., Ltd., and W. D. Edwards. March 30th, 1921. (182,533.)

9,522. "Electric motor controllers." L. Satchwell. March 30th, 1921. (Cognate application 2,785/22.) (182,534.)

9,553. "Reciprocating electric motors and percussive tools embodying such motors." A. Bettica, G. Mazza and A. Macchioni. March 31st, 1921. (182,535.)

9,607. "Dry cell, particularly adapted for use with electric pocket lamps." J. Skorpik. March 31st, 1921 (Convention date not granted.) (160,828.)

9,664. "Call recording device for telephone instruments." R. B. Dunlop. April 1st, 1921. (182,542.)

9,732. "Process for simultaneously recording and simultaneously reproducing optical images and sound waves." E. Reisz. September 23rd, 1920. (Addition to 157,985.) (169,425.)

9,763. "Switches of the quick make and break type." J. B. Tucker. April 2nd, 1921. (182,553.)

9,825. "Electrically-operated bells or like signalling instruments." Sykes-Interlocking Signal Co., Ltd., W. R. Henderson, J. H. Tiddeman, E. S. and F. V. Russell. April 2nd, 1921. (182,558.)

9,882. "Wind-driven electric generating sets." G. Lambert. April 4th, 1921. (182,559.)

10,108. "Electro-fining glass furnace." W. G. Clark. April 6th, 1920. (161,192.)

10,476. "Trolley pole safety appliance for electric trams and the like." P. M. de C. Ireland. April 12th, 1921. (182,584.)

10,776. "Chronometric electric switches and like control devices." C. J. Stewart, W. W. Stainer and L. Burn. April 13th, 1921. (182,586.)

11,131. "Quick make and break electrical switches." F. Shergold and Edison Swan Electric Co., Ltd. April 16th, 1921. (182,591.)

11,182. "Combined electric fuses or safety devices and insulators." I. Valen. April 16th, 1920. (161,956.)

11,323. "Electrically actuated mechanism for producing sliding or rotary motion." E. N. Bray. April 19th, 1921. (182,592.)

11,460. "Electric train lighting apparatus." W. A. Pitt. April 20th, 1921. (182,595.)

11,516. "Automatic cut-out or switch for electrically-heated apparatus." H. Jaggi Zumbuhl. April 21st, 1921. (182,596.)

11,668. "Sparking plugs." T. J. Puplett. April 22nd, 1921. (182,599.)

11,844. "Contactor controllers for electrical purposes." R. F. Baerlocher. April 25th, 1921. (182,602.)

12,125. "Electric lighters for cigars and the like." A. Zecchini. April 27th, 1921. (Addition to 162,296.) (182,608.)

12,469. "Electric switches." R. W. Bill and H. Heath. May 2nd, 1921. (182,614.)

12,470. "Auxiliary electric light for use with acetylene lamps and the like as used on motor propelled vehicles." W. H. Date. May 2nd, 1921. (182,615.)

12,638. "Cable attaching device particularly applicable to the fixing of electric cables to carbon brushes." E. Gindre. May 3rd, 1921. (182,619.)

12,810. "Manufacture of metal tubes by electrolytic deposition." M. A. Juilien. May 4th, 1921. (182,623.)

13,391. "Current distributors of electric ignition systems." J. H. Runbaken. May 11th, 1921. (182,639.)

13,866. "Electric locomotives." R. L. Stanbrook and W. S. Mundle. May 17th, 1921. (182,653.)

14,673. "Arrangements for diminishing magnetic dispersion in electric transformers." Akt. Ges. Brown, Boveri et Cie. June 2nd, 1920. (164,017.)

15,737. "Power plants." British Thomson-Houston Co., Ltd. (General Electric Co.). June 7th, 1921. (182,655.)

15,823. "Electrical insulators." Metropolitan-Vickers Electrical Co., Ltd. July 7th, 1920. (166,113.)

15,911. "Electromagnetic chucking devices." F. Krupp Akt. Ges. July 26th, 1920. (Addition to 147,590.) (167,153.)

16,388. "Telephone systems." L. Drouet and A. Thomas. June 16th, 1920. (164,754.)

16,494. "Electric condensers." R. E. J. Varret. April 11th, 1921. (178,397.)

16,532. "Telephone systems." L. Drouet and A. Thomas. June 17th, 1920. (Addition to 164,754.) (165,036.)

16,840. "Loud-speaking devices for wireless receiving sets, telephones, telegraphs, and the like." J. W. Greenwood. June 20th, 1921. (182,671.)

17,506. "Arrangement and construction of electrodes in apparatus for electrolizing fused materials." T. Kolkin. June 27th, 1921. (182,679.)

17,525. "Electric switches." G. V. Twiss. June 27th, 1921. (182,680.)

18,847. "Electrically-controlled fluid pressure actuated motors for operating doors, gates, and other like members." F. B. Dehn (National Pneumatic Co.). July 12th, 1921. (182,690.)

19,474. "Methods of manufacturing bodies of tungsten alloys." British Thomson-Houston Co., Ltd. (General Electric Co.). July 19th, 1921. (182,699.)

30,280. "Electric switches." H. Lucas, O. Lucas and W. C. Turner. July 28th, 1921. (182,706.)

26,475. "Wireless telegraphy." H. Abraham. October 6th, 1920. (169,997.)

1922.

1,253. "Electric induction furnaces." O. Frick. January 15th, 1921. (174,084.)

4,602. "Closed circuit magnetic switches." Siemens & Halske Akt. Ges. March 3rd, 1921. (176,342.)

7,471. "Electric circuit interrupters." Metropolitan-Vickers Electrical Co., Ltd. March 14th, 1921. (177,159.)

Meters for River Gauging.—The Department of Scientific and Industrial Research has issued a treatise on current meters for use in river gauging, by Mr. A. Hogan, Ph.D., F.I.C. (H.M. Stationery Office. Price 1s. 6d. net). In view of the proposals for developing the power of rivers and streams for electrical purposes the appearance of this work is very opportune. The various methods which may be employed for registering the discharge of rivers, *e.g.*, the chemical, velocity area, and float methods, are reviewed, and the principles of the current meter are described. The conditions affecting the use of current meters are considered; a number of types are illustrated and described in detail, and the special advantages or drawbacks of each are given attention. The meters thus described include the Price, the Amsler, the Ott, the Stoppani, and others. A series of comparative tests carried out at Massena (New York) forms the subject of a chapter.

After Eight Years.—Eight years ago to-day—August 4th, 1914—is with us all a day of remembrance, for it was the day on which the Call to Arms went forth to all classes of the manhood of the British Empire. Though it is 3½ years since the Armistice was signed we are still deeply involved in the problems that the world war has left behind. Field-Marshal Haig, as president of the British Legion, has chosen this anniversary to issue a further appeal on behalf of the scores of thousands of deserving cases of distress amongst ex-Service men and the dependents of fallen comrades which Government provision does not touch. We recently urged our readers to support the fund, and we desire now to repeat our appeal to them to fulfil the solemn duty of remembrance that rests upon them by sending contributions to Field-Marshal Haig, care of Sir Herbert Brown, K.B.E., British Legion Appeals Office, 1, Regent Street, London, S.W.1.

THE

ELECTRICAL REVIEW.

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THE REGISTRATION OF CONTRACTORS.

A SPECIAL Committee of the Institution of Electrical Engineers recently considered the question of pressing for the compulsory registration of electrical contractors; this idea has been abandoned, but in its place a scheme is under consideration for voluntary registration. The proposal is to establish a "Registration Authority" as a corporation under the Companies Acts, which shall be composed of representatives of the I.E.E., the Royal Institute of British Architects, the Electrical Contractors' Association, the various electricity supply undertakings' associations, the B.E.D.A., the B.E.A.M.A., and certain others. The Authority is to possess the power of registering contractors and of laying down regulations to which electrical installation work must comply, and is to see that the registered contractors comply with such regulations.

In order to keep a close watch on the industry, Local Advisory Committees are to be constituted in various districts, consisting of one representative of the Supply Authorities, one of the I.E.E., and one of the Electrical Contractors, and these Committees are to look into the applications and advise as to the suitability of an applicant for registration. As regards the electricity supply undertakings which carry out wiring work, such undertakings are eligible for registration on condition that they include in their application the name of their manager, who must have certain qualifications. He must either have carried on business as an electrical contractor over five years, or have acted as a charge hand for a firm for such period, or have passed the final examination of the City & Guilds College for installation work, or some other examination of the same kind approved by the Registration Authority.

Needless to say, there is very decided opposition to the proposal in some quarters, and it is questionable whether some of the supply industry associations will support the proposals and be represented. It is obvious that if such associations are represented on the Registration Authority, they commit their constituents to support the registered contractors as against unregistered contractors, and so go a long way towards identifying the present scheme with the compulsory registration scheme.

The proposal on the lines suggested would be very far-reaching indeed. It would make the electrical contracting industry a "closed" industry. There is, of course, something to be said in favour of this. Everyone will naturally appreciate the difficulty that first-class contractors have when competing against irresponsible wiring firms which do shoddy work at cut prices, are always on the verge of bankruptcy, and are constantly fizzling out as one firm and reappearing as another. Registration by a responsible authority would tend to checkmate these undesirables. On the other hand, it would

make the trade, as we have said, a "closed" industry, and to a certain extent an artificially restricted one. From this point of view the proposed registration is directly against the interests of electricity supply undertakings, and to some extent against the interests of the public, since the obvious effect will be to keep prices up, especially if more "regulations" are laid down by the Registration Authority. Also the coupling of the registration of an electricity supply undertaking with its manager's name (making it dependent upon the continued employment of such managership for its registration is obviously open to objection.

But there is another and more fundamental objection from the supply undertakings' point of view, and that is, the saddling of supply undertakings with new responsibilities. At present the wiring of a house is a matter entirely between the consumer and the electrical contractor; the supply undertaking has nothing whatever to do with this. On the other hand, if the supply undertaking is represented on the Registration Authority and also on the Local Advisory Committee, the undertaking is possibly involved over the contractor chosen, and perhaps is brought into conflict with its prospective consumer over a matter in which it has no interest whatever. (It will be remembered that this was one of the difficult situations created by the trade-union action in refusing to couple up installations carried out by non-union labour.) Also the undertaking would be brought into conflict with the smaller contractors in the town who did not register, but who might be doing most valuable service to the undertaking by bringing in new consumers. In the case of municipal undertakings, the last consideration might lead to a very difficult situation, since such contractors, or men interested in such unregistered contracting work, might be quite big ratepayers and members of the Council. And all this possible friction would arise with no gain to the undertaking, but rather the reverse.

Then as regards the imposing of fresh regulations for wiring work, here, again, at present the undertaking takes no responsibility; its only concern is whether an installation is likely to cause trouble to the general circuit. On the other hand, if an undertaking is represented as suggested on the Registration Committee, it is once again faced with responsibilities. The undertaking has to see that installations comply with the rules of the Registration Authority, and has to interfere in a matter which does not concern it and on which it has no power to enforce its views. The undertaking would again be brought up against prospective consumers with no advantage to itself. As we have pointed out, therefore it is from the electricity supply industry that the chief objections will arise. So far as other Associations are concerned, such as the Royal Institute of British Architects, they, of course, have no immediate concern; the question does not materially affect their interests, and they can go to sleep on the Registration Authority. But the case is quite different with electricity supply undertakings, and as they are the chief section and the one whose support is really indispensable, it looks as though the proposed scheme has but little prospect of maturing.

Alexander Graham Bell.

If we may assume the possibility that anyone should be so far interested in the telephone as to be familiar with the extent of its use throughout the world, yet ignorant of its history, it must be matter for surprise not that the inventor is dead but that his death should only now have occurred. There is probably no prior example of so great a result from one man's work in that man's life time. Bell himself was ever ready to draw a distinction between his own share and that due to others. He gave public expression to the fact that the great developments in telephonic progress resulted from the work of many minds, but those many minds and many more besides, recognise that the basis of the whole fabric was the work of Bell himself. It was accomplished under difficulties and discouragements, but with the confidence and perseverance which come from the combination of superior knowledge of principles and something of the vision of the seer. Not fortuitous accident and very little lucky experiment contributed to his results. His was an invention of the mind, and promptly recognised as such. It was on its first introduction to this country that Lord Kelvin bore striking tribute to its merits, and expressed admiration of the hardihood of invention which devised such simple means for realising a mathematical conception. To Alexander Graham Bell the world owes a deep debt of gratitude. He will be mourned as one who accomplished much, yet asserted himself not at all. We condole with his family, his friends, and his associates in their loss.

The Exhibition of 1924.

Elsewhere in this issue we publish an article dealing with some of the arrangements that have been made in the preliminary stages of the organisation of the electrical and allied engineering section of the Empire Exhibition, which promises to command world-wide attention the year after next. We have already given a few particulars gleaned from different sources, and we are now able to give information drawn from the fountain head. It may be considered by some to be unfortunate that the material is only made generally available in what is really the height of the holiday season, when so many men are away or are preparing to leave for their vacation. It may have been available for the firms who are members of the B.E.A.M.A. for some time past, but electrical and allied firms who are outside the circle if they wish to have exhibits at Wembley Park, should promptly put in their applications for space.

Wireless Telephony.

The report of the Radio Research Board's Sub-Committee, which is referred to in some detail elsewhere in this issue, on the subject of the present position of wireless telephony in this country has been published at a critical moment. At a time when the subject is exciting so much general interest, and when the Postmaster-General, in collaboration with the principal manufacturing concerns, is attempting to initiate a broadcasting organisation, the views of this expert sub-committee are particularly pertinent.

Briefly, the conclusions come to are that wireless telephony over long ranges is in an extremely elementary stage, and no line of development is to be seen which would be likely to lead to its establishment on a commercial basis within a measurable period.

For medium-range working it is considered that in remote localities, where atmospheric and other interference is not excessive, it would be possible to establish non-secret wireless telephonic services using waves of the length usually employed by medium-power wireless telegraph stations of the same range. The power necessary for wireless telephony would, however, be much greater than that required for satisfactory communication over the same distance by means of wireless telegraphy.

In the case of short-range communication, the position is apparently more hopeful; it seems that the experimental work in the use of short wave-lengths of the order of 100 and 20 metres is expected to lead to the development in a reasonable time of a system of wireless telephony that will approach, approximately at any rate, to the requirements of a commercial system. There seem to be, however, few prospects of the latter being satisfied to anything like the same degree as is done by a land line, at any rate in the near future.

As was to be expected, the Sub-Committee finds itself unable to recommend the use of wireless telephony as a substitute for any other means of telegraphic communication, except in those cases where the special requirements cannot be met economically in any other way. An example of the commercial utility of wireless telephony is the broadcasting of intelligence for the

general benefit of the community, and it may also be convenient in the Fighting Services, shipping circles, &c., whenever secrecy is unimportant. But considerations of mutual interference—quite irrespective of anything else—rule out the use of the wireless telephone as a means of local communication. Probably its most important applications on a commercial scale are as a connecting link between ordinary land-line telephone systems and as a means of communication with isolated posts.

Finally, it is of interest to note that the Sub-Committee does not expect that the development of wireless telephony will be found to have been carried much, if any, further abroad than it has been in this country.

The Engineering Joint Council.

The formation of an Engineering Joint Council which is announced this week to co-ordinate certain functions of the leading engineering institutions, is an event of importance, and should lead to a better state of affairs in the science and profession of engineering as a whole.

To electrical engineers especially this should prove very valuable, having regard to the extent to which their functions encroach upon, or rather are inseparable from, all other branches of engineering. The object placed first in the list of purposes for which the Council has been formed is "to improve the status of engineers." This is of course one of the principles of all the constituent bodies, and it is apparently considered that the combined strength of these societies will have an important effect upon the position of their members. Another object is "to secure . . . the appointment of properly-qualified individuals to responsible engineering positions." This is a point closely associated with the question of status. The existence of such a Council may lead those who have the disposal of engineering appointments to use their power as a means of securing the best men, but there is no certainty that they will do so. The Council will not actually be able to "secure" this object, but as an advisory body it will be able to influence to a great extent the selection of engineers. We think that the last-named object of the Council will be of the greatest immediate advantage, *i.e.*, "to prevent the unnecessary duplication of activities." At the last annual dinner of the Junior Institution of Engineers, Mr. C. H. Wordingham complained of the vast amount of "proceedings" issued by the various engineering societies, in which duplication and overlapping were too often prevalent. Mr. Wordingham is an old apostle of institutional co-ordination and an opponent of technico-literary duplication, and on the occasion mentioned he was quite consistent in suggesting the compilation of a serial work, combining in itself all the best of each body's papers and discussions. Such a work would cover the activities of societies of all nations. Perhaps the Council will be able to operate earlier and reduce at the source the number of papers dealing with the same subject. We hope that every success will attend its efforts to make the engineering profession a "power in the land."

Co-partnership in Industry.

The speech of Lord Leverhulme at Port Sunlight should not be overlooked by anyone interested in industrial developments of the best sort. Throughout the speech he invariably addressed his audience as his "co-partners," as he is in a position to say that everyone employed by his vast organisation is a partner in the business and interested directly in the profits earned. The speaker appeared once again as a practical organiser losing no reasonable opportunity of making profits while at the same time showing himself to be prepared to utilise any possible chance for improving the position of those connected with the business. He laid great stress upon the contrast between the enormous development of applied science on the one hand and the halting unsatisfactory progress in the application of political economy on the other. In his view the world of men has not advanced equally with science with regard to its schemes of humanity. He spoke of the beginnings of co-partnership and of the contempt that was meted out to its pioneers by most of the leading industrialists of their day. Lord Leverhulme has believed in profit-sharing from the time he was a young man, and he has consistently applied it to his business. His company is now introducing benefits for all the co-partnership workers in the business on a generous scale, and absolutely as a free gift, without any contribution from the employé, but leaving unimpaired the company's rights of suspension and dismissal of any individual. Briefly summarised, the benefits now to be conferred are as follows:

During unemployment, owing to slackness of trade, a co-partner will receive such an addition to the State allowance as will make up his total receipts to half pay.

In case of illness, full pay will be given for four weeks or longer at the discretion of the company.

Each co-partner will be presented with a life policy of, at least, £100, and the company will pay subsequent premiums.

The amount of the policy increases in value according to the grade of employé or official interested until it reaches a figure of £1,000 in one class, £2,000 maximum for foremen, and £4,000 in the case of managers and directors.

Arrangements are also made by which if a co-partner retires, or leaves the company for any other reason, he will in ordinary circumstances be able to take his life policy with him, and by continuing the premiums on his own account retain all its advantages.

Lord Leverhulme gave the credit for the details of this scheme to his colleagues, but they in their turn declared that the honour rested with himself.

French Hydro-Electric Plant.

The French Minister of Public Works, recently replying to questions, stated that the total plant installed at hydro-electric works at the end of the war amounted to 1,500,000 h.p. At present the plant is estimated at 2,100,000 h.p., of which electrometallurgy represents 1,300,000 h.p. and traction 50,000 h.p. The capacity of the works in progress and to be completed in the next two years will be about 300,000 h.p. Since 1918 electric traction has only been placed in service on certain lines of the system of the Southern and the State Railways, the total length being 75 miles; but the works begun in the meantime will soon permit of the use of this method on a number of important lines. The Minister said that it is calculated that within a period of five years, lines of a total length of 930 miles belonging to the systems of the State, the Paris-Orleans, the Paris, Lyons and Mediterranean and the Southern railways will be electrified. The general programme of electrification of the railways provides for the completion of 5,500 miles of line in from 15 to 20 years.

Ball Bearings for Tramcars.

The mounting of the main wheel axles and motor armature shafts of tramway cars on ball or roller bearings is no new idea. Some 20 years ago the whole of the Southport tramway undertaking's cars were so fitted, and they continued to function satisfactorily, after certain initial troubles had been overcome, until the day when the undertaking was taken over by the Corporation. As a result of the adoption of roller bearings in the case cited, friction was reduced by such an extent that one man could push a car along unaided, and the power consumption on that system was one of the lowest in the country—under 0.6 kWh per car mile.

For some reason, however, the fitting of ball or roller bearings on tramcars has not become general practice. That decided advantages and economies are bound to follow the discarding of the plain bearing there is no doubt, and it is therefore appropriate to draw attention to certain National Physical Laboratory tests which are outlined elsewhere in this issue.

The reduction in the consumption of electricity of 22 per cent. per car mile which it is possible to bring about by the adoption of roller bearings would in itself seem to be sufficient to justify the condemnation of the present type of plain bearing.

FALSE MARKING AND DESCRIPTION OF GOODS WITH SPECIAL REFERENCE TO ORIGIN.

By THEODORE RICH.

Part II.—The Merchandise Marks Acts.

The Act of 1887 was the first comprehensive effort to promote common honesty in the marking and description of goods; its detractors have called it a protectionist measure, as if it was wrong to take steps to prevent "Free Fraud." It must be remembered that it was not merely intended to prevent foreign goods from being marked and described as British, to prevent goods from one district at home being sold as if they came from another, one maker's goods being sold as if they were made by a firm with a better reputation, but also to prevent, for instance, German goods being sold as French on the British market or in markets supplied through British trade centres.

In 1890 the Deputy Chairman of the Board of Customs said (paragraph 26): "The Act is not merely directed against what is to the detriment of the British manufacturer, it is against all false marking. To a certain degree it protects the French manufacturer against German imitations, and *vice versa*." (Paragraph 189): "The Act is of great importance to foreign countries as well as our own. It is an every-day occurrence to have goods coming from Germany with descriptions in French; we detain them (if not marked with the country of origin) just the same as we should if they were marked with descriptions in English."

There is no doubt that for a time at least the Act did a good deal to promote honest trading, not merely at home, but also all over the world, many of the sections being introduced into Colonial Acts. It is lamentable to note that after 30 years of alien infiltration and persistent wirepulling, some of the useful clauses have been set at nought by departmental instructions, and that we are now lagging where we ought to be leading.

The most persistent opposition and ridicule which has been offered to this Act and the minor amending Acts has been on the part of those who take up the attitude that, provided a certain practice leads to more profit, it must be legitimate, any criticism being met with the convenient excuse that "many others in the trade do it."

Certain proposals for strengthening the Act are now before Parliament; they will be dealt with later.

Clauses in the Act.

The Act deals, in Section 2, with the forgery of trade marks and with every person who "applies any false trade description to goods," persons so doing being liable, on conviction or indictment, to imprisonment for two years or a fine, or both, and on summary conviction, that is before a magistrate, to four months' imprisonment or twenty pounds fine, with an increasing punishment for a second conviction, the offending articles to be forfeited.

In Section 3 the expression "trade description" means any description, statement or other indication, direct or indirect, *inter alia* (*b*) as to the place or country in which any goods were made or produced.

The expression "false trade description" means one which is "false in a material respect as regards the goods to which it is applied, and includes every alteration of a trade description, whether by way of addition, effacement or otherwise."

According to Section 5 a person shall be deemed to apply a trade mark or trade description who—

(*a*) applies it to the goods themselves;

(*b*) applies it to any covering, label, reel, or other thing in or with which the goods are sold or exposed;

(*c*) places, encloses, or annexes any goods which are sold or exposed or had in possession for any purpose of sale, trade, or manufacture, in, with, or to any covering, label, reel or other thing to which a trade mark or trade description has been applied;

(*d*) uses a trade mark, or mark, or trade description in any manner calculated to lead to the belief that the goods in connection with which it is used are designated or described by that trade mark, mark, or trade description.

Section 10.—In the case of imported goods, evidence of the port of shipment shall be *primâ facie* evidence of the place or country in which the goods were made or produced.

Section 16 provides for the prohibition of importation of goods which, if sold, would be liable to forfeiture under the Act. Under sub-section (1) goods of foreign manufacture are prohibited which bear any name or trade mark being or purporting to be that of any manufacturer, dealer, or trader in the United Kingdom unless such name or trade mark is accompanied by a definite indication of the country of origin. Sub-section (4) is directed against cases in which there is a name of any place on the goods identical with or a colourable imitation of the name of a place in the United Kingdom, unless such name or trade mark is accompanied by an indication of the country of origin.

By an amending Act in 1891, Section 1, the Customs' entry relating to imported goods was deemed, by Section 2, a "trade description" applied to the goods, and the Board of Trade was authorised to prosecute offences in cases "appearing . . . to affect the general interests of the country, or of a section of the community, or of a trade." In 1894 the Board of Agriculture was authorised to act in certain cases. A further Act in 1911 deals with the furnishing of information by importers.

The sections of the original Act which have given rise to the most controversy are those dealing with place or country of origin, and the application of the Act to foreign goods in transit. It can be well understood that where articles have English words on them, or connected with them, in the absence of other indication, the buyer thinks that they are British, and, in accordance with the Act, goods having such words have to be marked with the country of origin.

It never has been part and parcel of the Act that all goods should have the country of origin marked on them. It is not unlawful for a dealer in the United Kingdom to put his name on to such goods, provided that the application does not result in a misunderstanding as to the maker of the goods or the country of origin.

Originally goods in transit were examined by Customs to see if they complied with the Act, but owing to the action of merchants who cared more for their own pockets than for national reputation, this practice has been abandoned by departmental order. This question will be dealt with later.

"Made in Germany."

Very clever propaganda has for years been organised by friends of "false trade description" to prove that the progress in German trade has largely been due to the provisions of the Merchandise Marks Act regarding marking of goods, which have enabled the foreign buyer to know where the goods handled by British merchants have come from, so that he could go to Germany or to some German merchant and buy them direct. There may be something in the argument, but nothing like that which is claimed by Germanophile merchants.

It is necessary to deal with this matter in some detail, as the same arguments are indulged in at meetings and committees regardless of a number of elementary factors which have influenced trade and business during the last forty years. In the first place, the average British merchant, unlike the merchants in many other countries, has for years given very little preference to British goods. He not merely often puts his own mark with a London address on foreign goods, called conveniently a "selector" mark, which in fact often does deceive as it is intended to deceive the ultimate purchaser, but he also frequently illustrates foreign goods with the aid of foreign blocks in his catalogues.

To put so much of the blame on the Act is to assume that the German commercial traveller, the German subsidised lines of steamers, the German subsidised clerks and agents in banks and business houses at home and abroad, the German Trade Press and catalogues have been non-existent, and also that the foreign merchant is an untravelled, non-observant, ignorant person.

Suppose the case where a British merchant has begun to build up a business with German goods with one of the hardware and machinery local merchants abroad; whether the goods have been marked "Made in Germany" or not, a German commercial traveller or local German business man, being an expert, will probably sooner or later spot the goods, in the warehouse or in the retailers' shops, and he then will offer the goods direct at a lower price. A man with experience in a particular trade can often spot not merely the country of origin, but also the maker of an article without looking at the label. In the old days before technical and trade journals, the telegraph, railways and steamships existed, the merchant was a very important link in the commercial chain. To-day there is a tendency for the consumer to get close to the producer, and for a manufacturer to appoint his own agent abroad. It is usual nowadays for some members of foreign firms frequently to come to Europe and visit London, Paris, Hamburg, and Berlin, where they are shown samples of the very goods they used to buy through London merchants.

The Influence of Merchants.

The merchant is not in the strict sense of the word a producer, he is either a commission agent or a vendor middleman; he can only justify his existence if he finds out or creates markets and demand for goods which but for his business would not otherwise exist, or gives facilities to his customers otherwise unobtainable. Many of those merchants who demand freedom of trade from the housetops, object to the marking of goods, otherwise freedom of information; they often show by their protests before marks and similar committees and their influence in Chambers of Commerce that but for secrecy regarding sources of supply they would lose some of their business, and quite properly too. Trade is hampered by the presence of too many intermediaries.

A country which cannot feed itself cannot live on *entrepôt* trade and merchants' commissions; it must either export competitive goods or minerals in return for food, or starve; matters are made worse in this country by the destruction of much of the invisible exports owing to the debt to the U.S.A. A merchant is entitled to handle German or any other foreign goods; we cannot export without imports, but a merchant who makes extra profits by facilitating self-deception by ultimate or other buyers should be severely dealt with.

At the present time, more than ever before, the interests of the manufacturer and operatives come before those of the middleman, although the last has had, and still has, very much too much say regarding national affairs.

Limitation of Dishonesty not "Protection."

To claim that national trade will be injured by the limitation of dishonest trade is to give a very poor testimonial to the nation as a whole, although some people in high places do not seem always to realise that a great deal of the "goodwill" of British trade rests on the "square deal." Dishonest action regarding the origin of goods injures everybody in the long run. The difficulty is that British law was founded on a basis of liberty and fair play; for example, an accused person is assumed to be innocent, on the assumption that the citizen, when left alone in his individual and collective capacities, would act honourably. Unfortunately during the last half century the country has been flooded with alien merchants and others, with alien interests to support, many of whom have apparently never been taught to play the game; so not merely have unfair practices been winked at and encouraged all round, but influence has been brought to bear to prevent the Customs and other Government departments from interfering with some of them. It is most amusing how the word protection, when used in any sense, seems to give some people a cold shudder, especially those who seem so anxious to increase their own profits regardless of the interests of the community as a whole.

Lord Russell of Killowen, in the case of "Kirschenboim *v.* Salmon & Gluckstein," said: "The buyer is entitled to know what he is buying, and to have that which he orders and pays for."

A witness before the 1890 Committee said (No. 2314), "We only want the public to know really what they are buying, and to-day they do not. . . . We want simply fair play for the British industry." In paragraph 2461, "no doubt from a moral point of view there is a great desirability that the well-earned reputation of a particular market should be preserved as far as possible for that market."

2474, "The (1887) Committee took evidence and was satisfied that frauds existed to an enormous extent, and that the reason of the fraud was that the goods had no indication of origin, or a false indication of origin." 2476. "The Act was not passed for the purpose of protecting our industry against competition of cheap manufactures; it was to protect our industries against importation into this country of . . . manufactures alleged to be English which were foreign."

Some of those people who persistently deceive their ultimate purchasers at home or abroad, as far as the administration of the law allows, take up the attitude that to tell the customer what he is getting, or to insist that he shall not be deceived by advertisements, catalogues, trade cards, or "get up," is to adopt a system of protection. The matter then becomes "politics," and it should not therefore be discussed in respectable technical journals or by technical societies.

Deceiving the Ultimate Customer.

It should be remembered in all questions relating to the marking of goods, that it is not so much the merchant and wholesaler who should be protected—they have specialists to advise them; it is the small retailer and the ultimate customer. In a case in 1824, before special trade-mark legislation came into existence, this was pointed out.

The public has prejudices, it is no crime to have them; the trader has no right to take advantage of them in order to make more money. This is specially the case regarding natives in the tropics.

If goods are got up to look like British or French goods, in other words to deceive, it should not be necessary for a purchaser to have to ask what things are; and the law should be framed so that as far as practicable if a deliberate misstatement is made verbally or in writing the trader can be punished, so that he cannot merely wink at deception and then wriggle out.

It is more equitable to penalise an employer for the misstatements of his employés out of which he benefits than to hold him liable for the consequences of the negligence of his employés over whom he has nowadays so little control.

The Patriotic Buyer.

It is notorious that many of those who shamelessly profiteered during the war are using every underground means to prevent interference with profiteering, that is to say, by importing and selling German or Japanese and other foreign goods as British. If the average English customer is shown two pocket knives, two lamp

holders, two samples of "flex" or cables, and he is told that one is British and the other is German or Japanese, he will only buy the latter if it is very much cheaper. The war has awakened in the large mass of the public a patriotic feeling, and many men realise that it is only fair that the buyer should know the conditions under which the goods he buys are made.

When the German Reparation (Recovery) Act was being drafted, which allowed of a tax up to 50 per cent. of the value of German goods imported, it was obvious that wholesale evasions would take place, the obvious safeguard being the adoption of the American system of compulsory marking of all German goods capable of being marked without injury, with heavy penalties for evasion, and, to protect the ultimate customer, penalties against deletion and false re-marking.

When the Bill was drafted, no clauses were put in making marking compulsory, although it was obvious that a large proportion of the population would only buy German goods at very much lower prices. The recent inquiry regarding German toys and the Safeguarding of Industries Act tended to show that while toy and fancy goods merchants might make perhaps 20 per cent. out of British-made goods, they often made 60 per cent. out of the German goods; therefore the incentive to deception is very great.

THE ELECTRICAL EQUIPMENT OF THE LONDON COUNTY HALL.

(*Concluded from page* 153.)

Cables and Wires.—It will be appreciated that the wide use which is made of electricity for lighting and power purposes in a building of this size has naturally necessitated a large scheme of conduit cabling. The Stella Conduit Co. supplied many miles of seamless steel screwed tubes of various diameters, and cast-iron boxes, all of which were specially made to comply with the strict conditions of the contract. A feature of the cabling is the neatness with which the cables have been run; from the main switchboards they are led *via* trifurcating boxes towards the roof of the basement, where they are supported in racks with ample clearance. The cables then radiate to points immediately beneath local control rooms, of which there are 110 on the various floors. The screwed steel conduit that protects the cable is concealed everywhere (to a large extent in air ducts).



Fig. 6.—G.E.C. Fittings in a Committee Room.

The actual total length of the main cables is some 3½ miles, and the complete contract for their manufacture and supply was entrusted to the Pirelli-General Cable Works, Ltd.

Three main classes of cable have been used in the installation—namely, paper-insulated, lead-covered, and steel-armoured cable; paper-insulated and lead-covered, but without steel armouring; and v.i.r. cable. In some positions three-core and in others twin-core cable is used. The sectional areas of the 3-core cables are 0.075, 0.12, 0.2, and 0.4 sq. in.; and the areas of the twin-core cables are 0.1 and 0.2 sq. in.

Hooper's Telegraph & India-Rubber Works, Ltd., furnished special pure rubber insulated flexible wire for use in the corridors, &c., and for connecting up certain fittings on the principal floors as well as the wire for the electric clocks.

All the wiring for the lighting of the building was carried out by the main contractors and builders of the Hall, Messrs. Holland, Hannen & Cubitts, Ltd. The wainscotting, in each room is screwed on; behind it is run an iron channel 1 in. deep and 2 in. wide, with a sprung-on cover. Any auxiliary leads for the room can be housed in this channel, so that should it be desired at some future date to alter or add to the lighting in any room, it can be accomplished without destroying the surface of the walls and floors.

Motors.—The whole of the motors used in the building, excepting certain lift motors, were supplied by Messrs. Crompton & Co., Ltd., and are generally of standard types. In a number of cases, however, such as the lift motors and those driving most of the ventilating fans, they have been specially designed to meet the requirements as regards silent operation, and the results are highly satisfactory. The panels to control the motors were supplied by Messrs. Bray, Markham and Reiss, Ltd., and have been standardised so as to simplify the renewal problem. No less than 60 motors, aggregating some 350 h.p., have already been installed, and standardisation as far as possible is a feature of every phase of the work, being calculated to make for economy and simplicity in the maintenance of the plant.

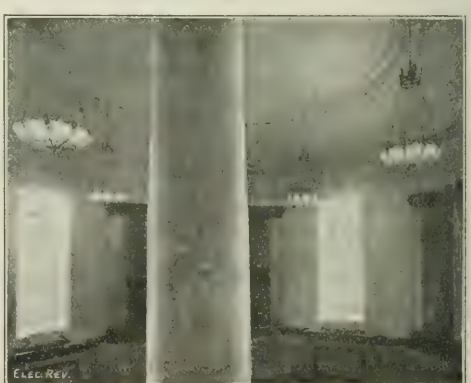


Fig. 7.—Faraday Fittings in the Council Chamber.

Lifts.—In a large building such as the one we are concerned with, a complete system of lifts is a necessity, seeing that there are seven floors, a basement, and sub-basement. A total of 21 lifts have been installed, of which eight are service lifts, seven passenger lifts, four book lifts, and two goods lifts; their position are shown on the plan (fig. 1).

Messrs. Waygood-Otis, Ltd., were responsible for five of the large electric passenger lifts, two of which are capable of carrying a load of 42 cwt. at a speed of 250 ft. per min., travelling a height of 106 ft.; the cars

are 7 ft. 3 in. by 7 ft. 1 in. by 7 ft. 6 in. high. The three smaller ones will each carry 24 cwt. at the same speed, the cages being 5 ft. 3 in. by 5 ft. 6 in. by 7 ft. 6 in. high. The winding machines are of standard design. In the case of the larger lifts the ropes are six in number, and for the smaller ones four in number. The controller provides for smooth and gradual acceleration and deceleration. Provision is made against over travel in either direction.



Fig. 8.—Faraday Fittings in the Education Committee Room.

The three smaller lifts, in addition to being operated from the car by an attendant, are fitted with a system of dual control, so that by a change-over switch the control can be altered to full automatic system. With this arrangement, after busy hours when the attendant is not available, any person can use the lift with ease and safety. The cars are fitted with screw grip safety gear under the car and operated by a governor which is set to actuate the gear in the event of the car attaining an excessive speed in either direction. The gear comes into action gradually and so avoids sudden shock. During the busiest half-hour in the morning one of these lifts carries 385 passengers. Flash light position indicators are fitted to all the lifts, and arranged so as to show on each floor the position of the lift in the shaft at any time.

The Express Lift Co., Ltd., supplied in all three passenger and thirteen goods lifts. Two of the former are capable of dealing with loads of 24 cwt. at a speed of 250 ft. per minute, and 20 cwt. at 300 ft. per minute respectively; the third passenger lift is designed for a 10-cwt. load at 150 ft. per minute. Twelve of the service and book lifts will take 1 cwt. at 100 ft. per minute, and the remaining unit is for 15 cwt. at the same speed. The control of this firm's lifts is also arranged for the lifts to be worked by the attendant on the car-switch system during rush hours, and automatically during slack periods. It should be noted that when automatic working is in force, the lifts do not work on the top speeds, referred to above, but on a second speed approximating to 120 ft. per minute.

The smaller goods lifts have a special form of full automatic push-button control, which enables them to be sent from and to any floor which may be desired. The governors are installed in the motor rooms, which are situated above the lift shafts. Should any of the lifts exceed the maximum speed in either direction, the speed governor operates a switch which brings the controller to the "off" position, thus cutting off the power supply to the motor and applying the brakes. If, in spite of this, the lift still travels at a speed above the normal maximum, the speed governor operates a trip which brings the safety gear into action; the lift is then definitely stopped within two feet. This type of safety gear ensures that a lift, even if travelling at a speed of 400 ft. per minute, can be brought to rest without causing any inconvenience to passengers.

An interesting point in connection with the installation of the lifts is that one of the goods lifts was erected and in commission within ten days in order to meet the urgent requirements of the L.C.C.

Lighting.—A large and handsome building such as the one we are concerned with must be equipped with electric light fittings, which must not only be efficient as lighting units, but must also be in harmony with the architecture and the scheme of decoration of the rooms. It should be mentioned that all the switches controlling the lighting circuits were supplied by the Edison Swan Electric Co., Ltd., flush-type tumbler switches being used in most cases; the larger units are controlled by knife-type switches concealed in the walls.

The whole of the lamps used, both vacuum and gasfilled, will be manufactured and supplied by English Electric and Siemens Supplies, Ltd. As the lighting arrangements are not yet finally completed, full particulars as to quantities and types cannot be given. The main feature from an illuminating engineering point of view, however, is that semi-indirect lighting units are employed in conjunction with gasfilled electric lamps.

In the Council Chamber, committee rooms, offices, and galleries, general illumination is provided by means of lamps in bowl fittings having glassware which effectively screens the brilliance of the filament without undue absorption of the light from the lamp. Thus, a highly efficient scheme of general illumination is obtained for a minimum current consumption. At the moment a large number of gasfilled lamps of 60, 100, and 300-watt capacity are in use. For local or individual lighting, where it is necessary to supplement the general illumination, and for the corridors and minor spaces, standard vacuum type lamps of 30 and 10 watts capacity are being employed. Some indication of the number of lighting points may be gathered from the fact that the total lighting load provided for is 750 kW, and from

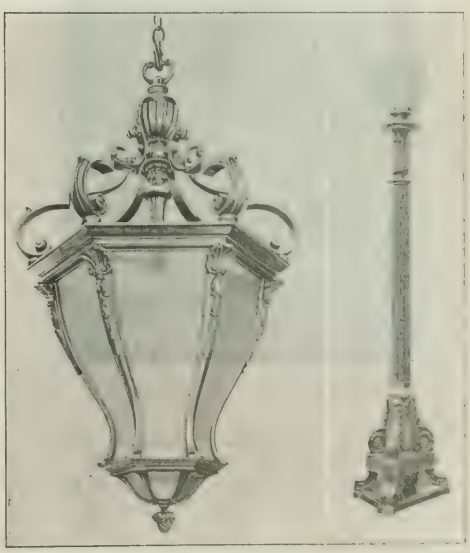


Fig. 9. Galsworthy Lantern at Library Entrance.
Fig. 10. Bromsgrove Staircase Standard.

ten to fifteen thousand lamps of various types will eventually be installed.

The General Electric Co., Ltd., manufactured a large number of fittings which were all specially designed in collaboration with the architect so as to be in keeping with the general architectural scheme. All these fittings have heavy cast bronze metalwork, and are equipped with various types of ornamental glassware.

The Entrance Hall may be considered as a typical example. Here cast bronze pendants, with 20-in. diameter "satin" finished glass bowls, are provided for the main lighting; the "Corona" suspension chains are also of real bronze, and lampholder covers of the same material are provided to hide the holders and necks of the lamps. Four torch fittings were also provided for this hall; each has four arms fitted with flambeau shades, and special provision is made for easy wiring and access for cleaning. The torch fittings are arranged for fixing to the mantlepieces. The fittings designed for the lobbies of this entrance hall are somewhat unusual. Owing to low headroom, pendant fittings would have fouled the doors when the latter swung open. A special bronze ceiling fitting with a shallow "satin"

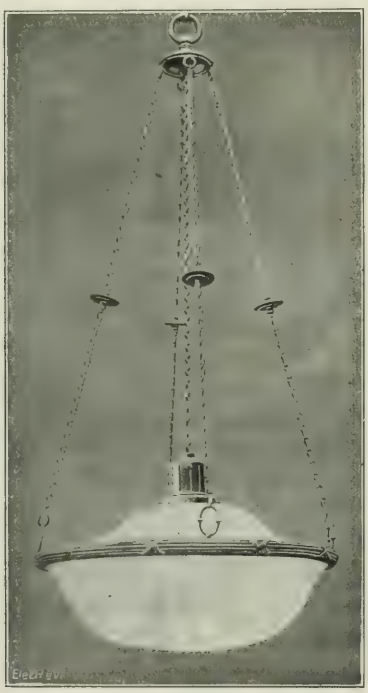


Fig. 11. Osler Dish Pendant.

finished glass dish was therefore designed, the top reflector with the lampholder being sunk into the roof, allowing the cast band carrying the dish to be flush with the ceiling.

The Tea Room and Library are equipped with pendants similar to those in the entrance hall. The members' reading and refreshment rooms derive their main illumination from eight bowl fittings, each equipped with a 24-in. "Perlux" dish. The combination of this beautiful glass with the rich bronze mounts gives a most striking effect, which is not spoiled as so frequently happens by a view of the lampholder and lamp neck—these being hidden by bronze tassels. Subsidiary lighting in these rooms is provided by 12 bronze wall brackets with octagonal backplates. Each has two arms carrying "Equiluxo" glass shades. Two "Perlux" bowl fittings of similar design to those already described, but 36 in. in diameter, and eight wall brackets are provided for the two large committee rooms, see fig. 6.

Messrs. Faraday & Son, Ltd., supplied the four large bowl pendants in cast and wrought bronze (each 5 ft. in diameter) for the Council Chamber (fig. 7); the massive six-branched electroliers and the two-light wall brackets for the Education Committee Room (fig. 8), as well as a number of obscured-glass dish pendants and two-light wall brackets for other positions of lesser importance; the firm carried out all the work in its London premises.

A handsome cast bronze lantern (fig. 9) was supplied by Messrs. Galsworthy, Ltd., for the terrace entrance lobby; this fitting is 4 ft. 9 in. high and 2 ft. 6 in. across its largest diameter. In addition, this firm provided 101 2-light Georgian wall brackets for the chief offices, and also a plainer pattern of bracket for the lavatories.

The elegant bronze standards on the fine marble staircase (figs. 3 and 10) were made by the Bromsgrove Guild, Ltd.; they are six in number and about 7½ ft. in height, each having an opal glass globe 22 in. in diameter, containing a 300-watt lamp. This firm is also executing the lamp standards and pylons for the main entrance, circular carriage-way, members' terrace, and covered-way; they are, however, not yet in position.

The last illustration (fig. 11) is of one of the 24-in. dish pendants supplied by Messrs. F. & C. Osler, Ltd.

In general, the offices are illuminated by ceiling lights, about 300 of which were supplied by Messrs. Best and Lloyd, Ltd.; they are fairly plain bowl fittings with chains and rings that harmonise with the doors and furniture of the rooms. The hundreds of yards of corridor have been lighted by small bronze ceiling fittings, to the number of about 500, supplied by the same firm, at the apex of each domed arch. The domes are of "satin" finished opal glass, as is the case with all the lighting glassware throughout the building.

Some 600 sphere pendants have been supplied by Messrs. Paul W. Rands.

Clocks.—Practically every room in the building will have one or more electric clocks in it. There are at present some 700 dials in use, each circuit of 100 being controlled by a master clock, the energy being derived from a Chloride battery. The clocks were supplied by Messrs. Gillett & Johnson.

Telephone Exchange.—Of interest is the fact that the County Hall houses a busy telephone exchange, in which the 10-position switchboard is provided with 35 lines in and out of the building, and no less than 650 internal extensions. The exchange is a war-time relic, inasmuch as it was originally installed by the G.P.O. for the use of the Food Controller when he and his staff occupied the unfinished building. It has since been adapted to L.C.C. requirements, but the existing equipment is only temporary, for it is intended to substitute for it within eight months' time, it is hoped, an automatic exchange to deal with anything up to 900 instruments. When the conversion has been made this will be the first private automatic exchange in London to be connected directly to a public P.O. exchange and the largest of its type in the country.

Annunciators.—The London County Council is much like a small Parliament—it has its whips and its division lobbies, &c. So also must its members—wherever they may be—be informed of what is passing in the Council Chamber when a debate is in progress. To provide for this requirement a system of "division bells" and annunciators, similar to that in use in the House of Commons, has been installed.

The whole of the apparatus supplied by the Sterling Telephone and Electric Co., Ltd., in this connection was specially constructed, and consists of division bells for the purpose of calling the members together when a division is about to take place in the Council Chamber. The installation consists of about 80 bells fixed about the premises, in corridors, committee rooms, the library, refreshment bar, and at any point where members are

likely to assemble. They are of a somewhat novel construction, and differ from the ordinary type of electric bell.

An electromagnet provided with the usual form of armature and hammer is fitted, with the striker resting between two 4-in. cone-shaped gongs; the movement is a single-stroke one. When the circuit is closed the armature is attracted and the hammer strikes one gong; when the circuit is broken the armature is released, the hammer falls back and strikes the second gong. This cycle of events takes place about once a second, and the gongs being tuned in thirds, the result is a pleasant non-irritating, but none the less persistent, ding-dong. There is practically no part of the building in which the bells cannot be heard.

The controller for operating the bells comprises a small motor mounted on an iron bed plate, and geared to a shaft which carries ten substantial brass cams, each one of which is arranged, when revolving, to make contact with a hinged contact arm. The bells are arranged in ten sections, the circuit of each section being closed by its respective contact on the controller. The system is under the control of the clerk in the Council Chamber. When a division is about to take place, the switch, placed conveniently to hand, is turned so as to start the controller and complete the circuits to the bells. The latter are kept ringing for two minutes, after which it is assumed that all members are present, and the division takes place.

The annunciators were supplied by the Exchange Telegraph Co., Ltd., and are operated, as are also the division bells, by means of a 50-Ah, 60-cell battery of accumulators supplied by the Chloride Electrical Storage Co., Ltd. The 12 printers—there will eventually be 14—which announce the subject being discussed in the Council Chamber, are arranged in two circuits, six in each, and the electrical portion of the mechanism is most ingenious.

Lightning Protection.—With regard to the protection of the building against lightning, the L.C.C. was advised by the National Physical Laboratory. This involved a study of the available literature on the subject, especially in connection with the experience obtained as to the effect of lightning on buildings of a similar design from an electrical point of view. One of the most important factors is that modern steel-frame buildings provide a practically perfect "earth" connection from the roof supports down to the ground. The metal work is, however, inside the shell of the building, and the N.P.L. report was largely concerned with the electrical properties of structures of this type. Assistance was also available from the knowledge obtained from the properties of electricity as used in radio transmission; the report to the L.C.C. dealt with these matters in some detail, and suggested the general lines on which it appeared desirable that protection should be provided. Lightning-conductor points are erected on all the chimneys, the copper strip being bonded to the steel structure of the building, which contains some 10,000 tons of steel. This work was carried out by Messrs. W. J. Furse and Co., Ltd., and it is believed to be the first example of this method of protection against lighting being adopted on a large scale.

Finally, a word of praise is due to Mr. C. W. Humphreys, chief engineer, and to Mr. Chas. A. Baker, M.I.E.E., assistant engineer (electrical) and chief electrical inspector to the L.C.C., for the very able manner in which they tackled a very exacting task.

WHY?

By *S.* LEES.

The immutability of things mundane abounds in perplexing inconsistencies, inherent naturally and artificial. Engineering practice seems to be singularly prone to this defection. The inconsistencies of the office with the works, and the works with the finished job on site are proverbial, and 'twas ever thus.

In no other branch of electrical engineering, perhaps, is there more marked inconsistency than in the lack of proper understanding shown by maker and designer to a thorough appreciation of all that is necessary in the manipulation of electrical apparatus operating under average work-a-day conditions obtaining in industrial service.

For instance, the importance of preserving a uniform clearance around the air-gap of a commercial a.c. induction motor cannot be overstated, and makers concern themselves in no mean manner in this direction by issuing informative literature wherein attention is directed to the dire effects resulting to the machine if the air-gap be allowed to thin down to vanishing dimensions. Advisory hints are given on the use periodically of the conventional feeler-gauge as a means of avoiding trouble. All of which is, no doubt, very commendable wisdom. But to satisfactorily gauge the air-gap of any electromotor one must needs first get proper introduction for a suitable "feeler" before reaching the "gap." On modern machines the performance of this operation should be readily and easily achieved without undergoing the necessity of removing unwieldy, heavy, and awkwardly-placed doors, covers, grids, end-shields, brackets, and the like, oft-times *mis*-named inspection covers, and fitted with weird fastenings that would puzzle a Houdini in their doing and undoing. Why should a certain machine, which shall be nameless, described as of the "protected type," be possessed of egregious sectional cast-iron end cover overhanging the air-gap by many inches (and thereby preventing access for checking clearances), and barely clearing the rotor end turns of the winding? To reach the gap without removing the said end-covers one would require to put a feeler gauge through an impossible series of gymnastics; it is a physical impossibility even to "visualise" the air-gaps, as is often resorted to as an alternative expedient in an awkward case. For a rated "protected" machine, the design would not have been materially affected by the provision of suitably-placed inspection or feeler apertures in the end-covers.

It would often prove helpful, especially to surveyors, if machines of the enclosed type carried some indication as to the dimensions of the original air-gap clearances. Such figures could easily be stamped on the name-plate, and would often obviate the absurd discrepancies which frequently appear between the maker's certificates and an outside inspector's reports, and which often prove productive of prolonged contentious correspondence. The maker is rarely far wrong, but, of course, his shop facilities for checking, &c., are not available for the surveyor on site, and the latter, painstaking and conscientious though he may be, will, as likely as not, have his findings upset by many mils of superfluous varnish or a *cheraux-de-frise* of burred metal around stator or rotor core. Nor can the "lift" always be tried, nor is it appreciable to the touch, hence that blessed adjective "apparent," prefixed or suffixed as required. Many engine-builders state their cylinder clearances by typing, usually on flanges; so why not electromotor makers?

So-called removable ventilating grids fitted with wire netting of absurd mesh and fixed from the inside of end covers are irritating to a degree, especially in cases of urgency, and in the very nature of things "trouble" and breakdown jobs are always importunate. And we

must not forget that the manager—non-technical though he may be, perhaps—needs a lot of persuading that the hour or so taken up in preliminary scouting before actually getting at the cause of the trouble was unavoidable. He sees first and foremost lost production, and, secondly, fails to appreciate, and probably rightly so, why it should be necessary to enter through the back door to unfasten the front gate, so to speak. Perhaps the less said the better about an inspection door whose catch fastening fouls the brush-gear; and that solid cast-iron end covers (detachable) of some 30 lb. avoirdupois held by plain projecting lugs are somewhat unnecessary on a fairly modern 10 h.p. d.c. machine, will hardly be denied.

Urgent jobs seem, cussed-like, to be always of the 99 per cent. order; the remaining 1 per cent. might be conceded the proportion of motor bearings that will permit of proper gauging by feeler in position; it is indeed none too easy to make an optical survey of the internal economy of the average bearing, and it becomes an almost physical impossibility to probe one's digits through the cap-hole. Some sort of periscope might prove a real boon for exploring the ramifications of bearing oil-wells. Those shabby contraptions variously described as bearing-caps, covers, lids, &c., are often simply receptacles for dirt and dust, or open the wrong way, if hinged; if loose, they are ill-fitting and require inordinate digital dexterity to remove, or else are of the fiendish 56-lb. spring-snap kind that trap one's hands, leaving blisters to carry on with for a week.

The saving effected in cost by dispensing with silly apologies for oil-gauges (so called), on perhaps any but three-figure powered machines, might be usefully expended in improving many of the motor terminal features found on a.c. and d.c. machines alike. It is pretty safe to say, even at this day, that a really satisfactory service terminal device, safe and easy of access, facilitating coupling and uncoupling without the use of special tools, having dependable insulation that will withstand "roughing," and of 100 per cent. conductivity is still—as the advertising quack proclaims—"a long-felt want!" Speaking of terminals, in perhaps no other detail of the modern motor is there such a lack of sound design shown as in the numerous impractical forms of terminal arrangements so common curiously on machines of otherwise unimpeachable character. With the exceptions of very few makes, internal terminals and similar connections are quite inaccessible without at least partially dismantling the machines. Surely this should not be so. Further, if makers universally observed the practice of legibly marking in simple characters all terminal connections, so that a wrong coupling would be all but a human impossibility, such an innovation would be welcomed alike by all. And again, the conventional terminal "lug," almost invariably of the eyelet kind, has many inherent defects, and so might be much improved. Siemens and others contemporary over a quarter of a century back, used terminals on their machines which were models of sound design, and the cone socket seldom, if ever, failed.

We suppose in these enlightened days that there is some real and unavoidable engineering necessity for the decided dimensioned discrepancy between the front and back-end shaft journals, so common a feature of current design—say, of machines of over 50 h.p. But what logical reason, economic or otherwise, can be urged for different diameters of shafts in 10 h.p. and 12 h.p. respectively, motors of exactly similar type throughout, catalogued as standard? One realises the absurdity of such vagarious design in the bewildering stock of "spares" carried in cases where scores of machines increasing by almost fractional increments of horsepower are installed. The following list shows the different types of bearing bush fitted to a "standard" enclosed ventilated 20-h.p. motor by six different makers:

No. 1. Phosphor-bronze (or brass) bush. One oiling-ring.

No. 2. Phosphor-bronze (or brass) bush. Two oiling-rings.

No. 3. Phosphor-bronze, white metal lined. One oiling-ring.

No. 4. Phosphor-bronze, white metal lined. Two oiling-rings.

No. 5. Cast-iron, white metal lined. One oiling-ring.

No. 6. Cast-iron, white metal lined. Two oiling-rings.

Such unnecessary want of uniformity seems incomprehensible.

One almost feels constrained to ask whether or no a real necessity exists for the so-called oil-thrower (of the conventional ring form) which is almost invariably fitted to electro-motors. This kind of fitment does not seem to be in much demand on other machinery running at high speeds, too, and the prevention of oil escaping from bearings should not be looked upon as such a difficult problem. The vicious V-rings cut in the shaft of a modern motor cannot be too strongly condemned; likewise those shafts of uniform diameter from the end of the core sleeve or spider, as may be, to the bearing journal. And the average run of oiling-rings strikes one as being a very crude affair, either too heavy or too light. Few are just right; many have a wicked tendency to whirl out of their proper groove, and, hanging impotently on the bush, provide the opportunity which is seized. A simple attachment would effectually prevent such an eventuality, and also serve to guard against damaging oiling-rings when removing or reassembling bearings or shafts. Why does not someone raise a voice against that class of so-called standard motor whose extended shaft does not carry a standard stock-size pulley without thereby blocking out the driving-end bearing oil-hole? And surely it should be practicable to remove motor end brackets or covers without having to withdraw the armature or rotor, as may be, at the same time. A goodly printer's column could be devoted to the shortcomings of machine shaft design, but as this subject might, perhaps, prove too controversial, the writer will content himself by making a not unreasonable suggestion to *all* makers that it would not materially increase its cost if every machine shaft turned out were given a legible identification number (showing its relation to the frame also) stamped preferably on both ends of the shaft.

It seems a shame to have to strip a thoroughly sound winding just to fit a new shaft, but this is no figment of the imagination, as quite a large number of motors are so designed that there is no alternative, owing to the impracticability of withdrawing the old and fitting a new shaft without damaging more or less seriously the winding or core structure. Most motors are fitted with a dust cap or cover over the free end bearing, these being almost invariably fixed by tiny B.A. threaded screws. Might we plead for a bigger screw without the same propensity for hiding itself as its smaller relative; anyhow, anything above 1/16-in. Whitworth is easily found in most works. Some makers recess the bearing nose and press-fit a sheet-metal plate, which is extremely difficult to remove without damaging plate or bearing. Obviously, no great amount of ingenuity would be required to devise a dust-proof and easily detachable screwless cap or plate for this purpose.

The subject of brush-holders and brushes would probably prove more controversial than that of shaft and bearing design. Great things were expected with the birth of B.E.A.M.A., but standardisation is not yet, but then, of course, neither is the Millennium! Still, one might—not unreasonably either—expect by now something more tangible and real in the way of, shall we say, interchangeability at least of the wearing details which require periodically renewing. It might not be out of place to remark on that odious type of brush-holder fitted with a bonding cord which terminates in a plug-pin, the said pin having a nasty knack of protruding inwardly and damaging the commutator by grooving the surface. And then there is the bonding

strip which should provide the straight path between its holder and the spindle, but unfortunately fails in its function, giving rise to those mysterious (?) burnings out of the moving parts of the brush-gear. One forbears saying the rude things applicable to those awful contraptions which still carry on (anyway, the owner does), even when the brush is worn out. That there exists a real need for a pattern of brush-rocker that cannot be moved beyond allowable limits, according to type of machine, will be denied by few. Let us whisper that the best Continentals guard against the frail human element in providing for such a lapse.

One may, possibly, be excused for feeling strongly on the question of protective covers or grids as used on a.c. slip-ring gear. Some curiously divergent designs are to be seen on quite modern machines; for instance, one well-known maker employs a pressed light sheet steel case in stability not unlike a bully-beef can, whilst another uses a massive cast-iron box nearly half a hundredweight avoirdupois, which is held up by means of a couple of ridiculously small wing bolts of the domestic fuse-box variety. Picture the first-named, being a metal canister about 10 in. long by 9 in. in diameter, secured to a flanged extension piece on the machine bearing housing by means of three 3/16-in. bolts, 10½ in. in length, the said bolts being inserted through corresponding holes provided in the outer or dished end of the cover. (Really it makes quite a nice game finding the hole, or the joy at holding up a cast-iron case of some 56-lb. weight, and at the same time wrestling with a couple of insignificant and refractory wing-nuts should fill one with delight.) And lest we forget, it should be remembered that both of these fitments appear on certain modern machines; and, in addition, the covers being totally enclosed, obviously it is necessary to remove them for inspection of the interior. A type of cover (*sic*) which has as its chief merit (?) that of cheapness, is the familiar strip of sheet metal which is banded around the commutator bracket or slip-ring case, as may be, and secured in place by one or more wing-bolts. It is quite common to see such covers made up in one piece 10 ft. long and over, and up to a foot wide. Such covers are extremely awkward things to handle safely, and the work of putting on or taking off may, in certain circumstances, be attended by considerable danger—say by an operative when standing on a ladder, or in the close vicinity of live apparatus, open gearing, &c., not to mention the risk of making a foul on the machine itself.

The question of standardisation of design of motor bases, and particularly as regards the dimensions of the feet, is long overdue. Speaking of bases recalls painful recollections of damaged fingers caused through stubborn holding-down bolts to slide-rails objecting to peaceful persuasion in removal. Perhaps in the fulness of time a slide-rail or base-plate capable of being readily and easily attached and detached without the risk of losing bolts or nuts temporarily, unless suspended in the time-honoured fashion by means of a piece of string, will not be beyond the resources of the modern progressive shop. The shipping about of machines in situations where a crane or even simple "blocks" is not available, is nearly always a slow and laborious process. A method of facilitating the transport of machines, up to fairly big sizes running well into three-figured power, where no lifting is required, is to mount the motor, say, on rollers or wheels, one to each foot of the machine. These can be made massive and after the style of the conventional furniture castor, and, if adjustable, would carry any size of machine. If some ingenious maker would incorporate a simple, inexpensive device in his machines which would obviate the use of those back-breaking pieces of piping, or even the more up-to-date trolley or bogey, he would no doubt reap a rich harvest.

The fitting of bolts and nuts in more or less inaccessible positions and requiring the employment of special angular spanners, out-size box-keys, and the like, is inexcusable in these days, and the use of large-size bolts (quite common up to ¾ in. diameter), having slotted heads, should, and quite rightly too, be tabooed. There are surely plenty of equally suitable and certainly more efficient patterns available for almost any conceivable application. Such large-sized bolts are somewhat of a nuisance and commonly get badly damaged or defaced by rough handling—often unavoidable—in a manner never intended by the designer.

On machines described as being of the self-ventilating type, many of the fans or propellers fitted call for severe criticism. Much might be excused on the score of ignorance of wind mathematics by those responsible for their design, but nothing for the crude fitments so often used as a "fan." Fancy a modern machine fitted with a multi-blade fan runner having its pressed sheet-metal hub held to the machine shaft simply by a series of punch pops projected from the said hub on to the shaft—this is not fiction, but hard fact.

The writer fancies that even cable makers (tough folks though they may be) must sometimes feel grieved to see their beloved stuff mutilated by being savagely drawn through tortuous tracks in ungetatable places, such as behind rotor slip-ring cases and housings, under stator frames and commutator pits, often requiring the aid of blocks and tackle, if not for their insertion, at any rate for their withdrawal, or to unite cable to binding post.

Nor is it an uncommon thing to find slip-ring gear provided with short-circuiting and brush-lifting attachments which are unmarked as regards "on" and "off" positions, and which, in addition, only *pretend* to raise the brushes. As to the machines which have "earthed" rotors, of course nobody ever will want to know if or where so arranged, so the good makers thereof don't worry about giving this information. Apropos of which, no doubt some engineer-surveyors could tell interesting stories.

Loosely attached metal plates indicating conventional diagram connections placed in close proximity to bare metal terminals obviously are objectionable, as are also blue paper prints similarly fixed by mucilage; as is fairly well known, the latter forms a quite good conductor, especially if moist, and most printing paper is hygroscopic.

Any mention of machine name-plates should be outside the scope of these notes, but even those simple but useful adornments fall short of the standard of Cæsar's wife. For instance, machines are commonly found bearing a name-plate, but no serial number thereon, and armatures and rotors abound which carry no identification marks whatever. There seems to be a shyness, too, in some quarters about stating the h.p. or kW, and it would appear as if the space religiously allotted to the amperes were sacred, if the virginity of the plate be any criterion; rotor volts are practically unknown, except, perhaps, to the Continentals. Particulars of weight, of course, nobody expects to find on a name-plate; such information is available in the shipping columns of makers' lists—sometimes. Some name-plates are attached to machine frames in a very paltry manner. The writer has come across examples held on by tiny wood screws, and even brass tacks driven into wood plugs. A word might be said regarding the reprehensible practice one occasionally finds of the original maker's name-plate being changed or altered, usually during installation or when passing through dealer's hands. This is apt to lead to confusion, and any craving for advertisement by an interested party would surely be fully met by attaching an additional plate.

A certain type of power plant, the product of a British maker who shall be nameless, is turned out bearing its maker's name and class, but no further particulars as to voltage, capacity, or even a serial number. The absence of such, almost in a sense vital, information is often the cause of much confusion and dispute in cases of survey for valuation and insurance, and the annoyance and vexation arising through the lack of the necessary means of proper identification of individual machines may present a more serious aspect than that Gilbertian quandary "which was which he could never make out."

E

A SIMPLE AND INEXPENSIVE METHOD OF TESTING INDUCTION MOTORS.

By F. A. COOK, B.Sc.

There are probably many engineers in charge of plant using alternating current as a means of power supply who supervise the repair and rewinding of their own machines as occasion demands.

In a large number of manufacturing works the motors are comparatively small, say up to 60 or 100 h.p., and of a similar type.

After rewinding, the question of putting the motor on to full or even overload for a period arises, as many motors have to be placed in positions where handling is difficult, and when once on site it is desirable to know that no trouble will arise.

It is therefore the object of this short article to describe a method adopted by the writer, which, although it does not involve any new principle, does not appear to be thoroughly appreciated by all concerned.

The advantage of this method of loading a machine is that it does not involve the expenditure of much energy, only the losses of two machines have to be supplied—a consideration when dealing with large machines—and does not require a special brake or dynamo to which the motor can be belted and the electrical energy obtained dissipated in resistance.

Two similar machines are desirable for the test, not necessarily, however, rated at the same speed. The procedure is to fit different size pulleys on to the two motors, to belt these together, with the result that one

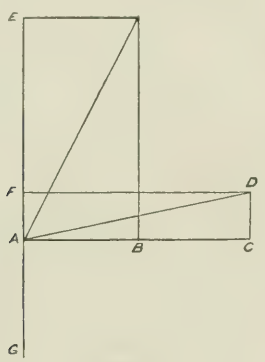


Fig. 1.

will run above the synchronous speed of its rotating field—this machine will then become a generator. A couple of stout battens and slide rails on to which the motors can be bolted are all that are necessary in the way of foundations.

By varying the amount by which one machine runs above synchronous speed in the case of squirrel-cage motors, and in the case of wound-rotor machines by adjustment of the rotor resistance in addition, the amount of load on the machine which is motoring can be varied.

For example, a 4-pole induction motor on a 50-cycle circuit will have a synchronous speed of 1,500 r.p.m., and, when loaded, will run with about 5 per cent. slip, *i.e.*, to 1,575 r.p.m., and, allowing for 3 per cent. slip of driven motor up to 5 per cent. above synchronous speed, *i.e.*, at 1,575 r.p.m., and, allowing for 3 per cent. slip of belt, this will require a pulley ratio of 1,425/(1,575+3 per cent.×1,575)=.875 to 1. That is, a 10-in. dia. pulley on the motor will require an 8¾-in. dia. pulley on the generator. Slight differences can be made up by variation of the belt tension.

The current input from the line to two machines coupled in such a manner will be fairly large, but will be at a very low p.f., as it has to supply the magnetising current and current for I^2R, iron and friction losses.

In the sketch (fig. 1) AB is the magnetising component of current to motor; BC is the magnetising component of current to generator; AE is the power component of current to motor; AG is the power component of current from generator; AF is the losses of both machines (difference of AE and AG); and AD is the current from the line at a low p.f.

This test does not aim at obtaining the efficiency of any motor, although this could be done by employing suitable wattmeters.

It will be agreed that to run an induction motor light does not give an indication of what will occur on load, since, supposing the rotor resistance is high owing to running of solder through overload, the no-load speed will be in order, but on load the speed will drop unduly, whereas by loading one machine to its full-load amperage by the above method, running it for, say, six hours and taking the speed, one is able to say definitely what the performance of the motor will be when fixed in position.

WATER-POWER FOR THE FARM.

By W. FRANCIS LLOYD.

Farmers and estate owners in this country are not fully aware of the advantages that may be derived from the modern small water turbine, the development of which has now reached a high state of efficiency.

What the average farmer does not realise is the amount of power which can be obtained from a fairly small stream at a low cost. The power obtained from the old-fashioned water-wheel often misleads the farmer in this respect. The power output of a modern water turbine—a very small machine compared with a water-wheel—is roughly twice that of the latter, owing to the fact that the water-wheel has a low mechanical and hydraulic efficiency, while the modern water turbine develops more than 80 per cent. of the theoretical power.

For the purpose of illustration we will consider a stream having a flow of 6 cubic feet per second and falling gradually from one place to another having a difference in level of, say, 15 feet. Provided this difference in level occurs in a reasonably short distance, an embankment, wall, or open wooden flume could be put up in order to concentrate the drop in level at one point, as is done in the case of water wheels. A water turbine to drive a dynamo could then be installed at this point to give an output of 8 brake horse-power.

It should be remembered that 8 horse-power is sufficient to light continuously 100 40-candle-power ordinary incandescent lamps, or twice that number of "half-watt" type lamps.

The farmer probably does not need to be told what use he could make of 8 horse-power during the day-time.

The Dry Months.—What happens in the summer-time when the flow of water is diminished?

In large hydro-electric schemes ample provision is made for this contingency by transforming small valleys into storage reservoirs which conserve the surplus water of the wet season so as to provide the requisite quantity of flow in the dry season. Medium-sized water-power schemes, which do not possess the advantage of natural features to provide such storage, have recourse to stand-by sets of oil or steam power to supplement the decreased output of the water turbines during the two or three dry months.

In very small developments, such as the one we have considered above, the plant is usually designed for the minimum flow of the dry season, the surplus water of the wet season being allowed to run to waste. A larger continuous output could be economically obtained by designing the plant for the average quantity of flow, and where storage is impossible utilising a stand-by set for the dry months. However, when the load consists chiefly of lighting demands, it is nearly always possible to arrange for a day-to-night storage of water by providing a small pond of sufficient capacity for

storing water from the stream during the day, to provide the normal output at night. In this case no standby set will be necessary. As regards power, the demand is at its lowest during the dry months, and some operations can be wholly postponed until ample power is available.

Cost of Plant.—Now comes the all-important question of cost. The cost of the 8-horse-power turbine, dynamo, switchboard, &c., for the above development would be in the neighbourhood of £200, which is not more than what a petrol or oil-engine lighting set of the same output would cost. But, of course, in the case of the water-power set, there is the additional expense of constructing the water intake, which would vary considerably with the nature of the local conditions. Against this, however, must be offset the extremely low operating cost and greater reliability of the water-power plant. Apart from the attention required for turning the turbine on or off, the only running expense is the replenishment of grease cups—an exceedingly small item. The writer knows of cases of water turbines which have run day and night for 20 years with very few stops. The annual bill for fuel, repairs, renewals, &c., for an oil or petrol set presents a very different story. In making a comparison it is only fair to take into consideration the annual operating expenses.

Since the war, considerable impetus has been given to the study of the possibilities of water power in this country, owing chiefly to the high cost of coal and other fuels. Despite the commendable prominence given to the subject by the Press, owners of estates have been slow to realise the opportunities lying at their very doors. In the meantime these water powers are running to waste.

THE ELECTRICAL EXHIBITION OF 1924.

We have now received from the Director of the B.E.A.M.A. a little more information regarding the arrangements, so far as they have been made, for the Electrical and Allied Engineering Section of the British Empire Exhibition, which takes place at Wembley Park in 1924.

We stated some weeks ago, on the authority of an announcement which appeared on the back cover of *Beama* that the Section would be organised and space allocated by the B.E.A.M.A. under the direction of a special committee representing all branches of the electrical industry; it was announced that space would be reserved according to priority of application. In our issue of June 30th, in a leading article entitled "Looking Ahead," we dealt with the importance of the exhibition and with the World Power Conference which is to be held while the exhibition is in progress. It is unnecessary, therefore, for us to discuss these matters further now.

We are officially informed that an arrangement has been entered into between the British Empire Exhibition authorities and the B.E.A.M.A., under which "practically the whole organisation of the electrical and allied engineering section" is placed in the hands of the Association, which takes responsibility for letting the space allocated to the Section. We are also advised that the work of organisation is well in hand. The word "practically" seems to suggest the existence of some sort of limitation which will probably disclose itself as matters proceed.

The earlier statement that space would be reserved according to priority of application seems to be varied, according to present information, for while it is to be noted that all British manufacturers of electrical machinery and appliances are eligible to exhibit in the Section, whether members of the Association or not, and while inquiries have already been received from outside firms, B.E.A.M.A. members have the right of the first call on the space. They, too, are also entitled to a share of any profits resulting from the success of the undertaking, to which outside firms will doubtless be contributors.

This, it will be recognised, is somewhat different from the arrangement in force at some previous electrical exhibitions originated by our electrical manufacturers when all exhibitors were entitled to a rebate off the rent paid for space, with the chance of receiving an additional amount back out of any surplus profits earned.

A form of application for space has been issued, and we understand that applications are being received in gratifying numbers, and that space is being allotted. Contracts are made between individual exhibitors and the Exhibition Company, but application must be made through the B.E.A.M.A.

Arrangements are being made with the Exhibition Company, in conjunction with the consulting engineers, Messrs. Sparks & Partners, for the complete equipment of an electrical power station, which it is proposed to erect in the section. Naturally, this power station will itself form an important exhibit, but presumably it is too early to state whose plant will be installed or whose apparatus will be used in the equipment of the restaurant kitchen.

It is understood that the Inland Revenue authorities, in dealing with trading accounts submitted to them by exhibitors, will treat the cost, as and when incurred, of participation in the Exhibition, on the same lines as the cost of advertising generally, and in normal cases will take no exception to such expenditure being admitted as a deduction.

A descriptive pamphlet, entitled "Electrical and Allied Engineering at the British Empire Exhibition, 1924," has now been issued. It gives the names of the B.E.A.M.A. Council, which is "virtually" the controlling body, and of the co-operating committee, which represents various other electrical and allied interests. A meeting of this committee will be convened after the holidays.

We give below the names of the officials and of the Executive and Co-operating Committees:—

General Manager of the British Empire Exhibition.—U. F. Wintour, C.B., C.M.G.

Assistant General Manager.—Major E. A. Belcher.

Consulting Civil Engineer.—E. O. Williams, B.Sc., A.M.I.C.E.

Consulting Electrical Engineers.—Chas. P. Sparks and Partners.

Executive Committee.—Messrs. B. Longbottom (chairman); S. Z. de Ferranti; R. K. Morcom; M. J. Railing; John Taylor; D. N. Dunlop (director); C. Rodgers (secretary).

Co-operating Committee.—Ll. B. Atkinson (The Cable Makers' Association); J. W. Beauchamp (The British Electrical Development Association); A. G. Beaver (The Electrical Wholesalers' Federation, Ltd.); H. H. Berry; D. A. Bremner (The British Engineers' Association); A. C. Cramb (Incorporated Municipal Electrical Association); Dr. W. H. Eccles; J. E. Edgecombe (Electric Lamp Manufacturers' Association of Great Britain); E. T. Ruthven Murray (The Incorporated Association of Electric Power Companies); Colonel Sir A. M. Ogilvie, K.B.E., C.B., V.D., R.E., (Institution of Electrical Engineers); H. Clifford Palmer; W. Riggs (The Electrical Contractors' Association); C. H. Wordingham, C.B.E.

The imperial significance of the exhibition is emphasised in the early part of the pamphlet. A general plan is included, showing the proposed lay-out of the whole exhibition grounds. The electrical and allied engineering section will be situated in the northern half of the Machinery Hall, and this section is repeated on a lay-out in detail and the charges for space.

A Hint to Britain.—The London (Ontario) City Council will shortly take up the matter of a proper regulation and licensing of buses. It is claimed by some of the aldermen that it is unfair to make the street railway pay its share of the cost of paving on streets where its lines run, and permit buses to run with only the payment of a comparatively small licence fee.—*Electrical News.*

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

Imperial Wireless Chain.—On August 1st Mr. Hurd asked the Postmaster-General whether he had considered the suggestion that an Imperial Wireless Council should be appointed, to include representatives of the Dominions and India, so as to establish the fullest possible co-operation in the development of wireless facilities within the Empire; and whether he could make an announcement on the subject.

Mr. Kellaway said that questions of policy relating to Imperial wireless communication were at present referred to and, subject to the Cabinet, decided by the Imperial Communications Committee, of which the Secretary of State for the Colonies was Chairman, and on which the India Office was represented. Whether it would be desirable to include direct representation of those Dominions controlling Imperial wireless stations would be considered when the Dominions had decided upon their policy.

Sir Harry Brittain asked the Postmaster-General what support he was receiving from the different parts of the Empire in furtherance of the wireless chain; and what was approximately the earliest period within which this form of inter-Empire communication might be completed.

Mr. Kellaway said that the revised scheme of Imperial wireless communication had been communicated to the Indian and Dominion Governments and, until replies were received, he was unable to answer the question.

Mr. Hurd asked whether the representatives of the Canadian Government had yet reached this country for the discussion of Canada's relation to the Imperial Wireless Chain; and, if not, when they would arrive.

Mr. Kellaway said that the answer to the first part of the question was in the negative. The Canadian Government had appointed its representatives, but so far as he was aware, had not fixed a date for their departure.

Broadcasting.—Mr. Percy asked the Postmaster-General if negotiations for the institution of wireless broadcasting had yet reached a satisfactory conclusion, and if he could make a statement on the matter; and whether he would arrange for a demonstration of wireless in some convenient room in the House for the information of members.

Mr. Malone asked for particulars of the broadcasting services company or companies which were to be formed.

Mr. Kellaway said that he regretted he could not arrange for a demonstration before the adjournment of the House, but, subject to the consent of the authorities, he would endeavour to do so in the autumn. The formation of the company or companies referred to was still the subject of negotiation between the wireless manufacturers, and he was not able to make any further statement as to its constitution. The Articles of Association would be subject to his approval. The security against a monopoly would lie in the fact that any *bonâ-fide* manufacturer in this country would be eligible for membership, and apparatus manufactured by him would be admissible for use under the licence.

Mr. Kellaway made a further statement on wireless broadcasting on August 4th. He said that it was a physical impossibility to have a large number of firms broadcasting. Any qualified firm of electrical manufacturers could provide the instruments, but that could not be the case in the provision of the actual broadcasting services. He hoped that, within the next fortnight, the firms concerned would have come to an arrangement regarding the control of the broadcasting service. The profits of the company were to be limited to 7½ per cent. For the control of prices of receiving instruments, he relied on the ease with which manufacturers could obtain licences. He regarded it as essential that this new form of communication, in all its aspects, should be under British control.

The Scarborough Order.—On August 4th Mr. Manville asked the Parliamentary Secretary to the Ministry of Transport whether he could give any reason for the undue delay in connection with the confirmation of the Scarborough Electricity (Amendment) Special Order, 1922, the order having been forwarded to the Electricity Commissioners in an agreed form on May 30th last.

Mr. Neal said that he could not agree that there had been any delay. The Order was received from the Electricity Commissioners for confirmation on July 8th, and the statutory notice of intention to confirm the Order was sent to the promoters' solicitor on July 11th. The period required by statute for lodging objections was not less than 21 days. The latest date fixed by the Minister for posting objections in the present case was August 5th.

Royal Assent.—On August 4th, the Royal Assent by Commission was given to the following Bills:—Electricity (Supply) Bill; Ayr Burgh (Electricity) Bill; Grampian Electricity Supply Bill; North Metropolitan Electric Power Supply Bill; Telegraph (Money) Bill; Post Office (Pneumatic Tubes Acquisition) Bill; Bristol Tramways Bill; London County Council (Tramways and Improvements) Bill; and the Black Country Tramways and Light Railways Bill.

The Adjournment.—Parliament rose for the summer adjournment on Friday, August 4th, and will reassemble on Tuesday, November 14th.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wireless Valve Sets.

Mr. V. Delebecque has touched on points of great concern to prospective wireless apparatus purchasers and manufacturers.

Apart from crystal sets, which are toys unless you live next door to a broadcasting station, two large concerns hold master patents on essential inductive coupling methods generally used with valve sets. True, permission is given to amateurs to make experiments infringing these patents, but they may not buy such complete, or incomplete, sets ready made, neither can the manufacturer obtain a licence to build such sets on royalty. The deadlock deters good-class firms from entering the field, and minor ones already in resort to subterfuge and the sale of ex-Government apparatus, royalty free.

Although the broadcasting scheme seems slow there is enough doing in the ether to interest the skilful amateur, but the manufacturer is on uncertain ground, technically and financially, and concerning component parts, production already exceeds the demand.

The daily Press, in booming wireless telephony prematurely, for the sake of advertisement, has done a lot of harm, and would have been better directed to a demand for freedom of design for broadcast receiving sets of British manufacture on a reasonable royalty basis.

H. Leslie Dixon.

London, E.1, *August 2nd*, 1922.

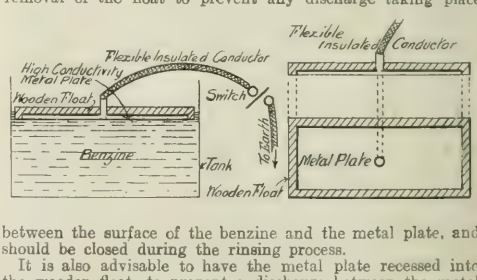
Removal of Static Charge.

In reply to your correspondent, "F.W.F.," in your issue of August 4th, I think the entire removal of the static charge from the surface of the benzine would be extremely difficult.

I would, however, suggest as an experiment, that the apparatus shown in the accompanying diagram be given a trial, and I venture to think this should meet with some measure of success.

The apparatus consists of a light wooden float, made to cover the surface of the benzine. Attached to the bottom of the float is a plate of high conductivity metal (preferably aluminium) riveted to which is a metal rod which passes through the centre of the float to an insulated flexible conductor, connected through a switch to earth.

This switch should be kept open during the immersion or removal of the float to prevent any discharge taking place



between the surface of the benzine and the metal plate, and should be closed during the rinsing process.

It is also advisable to have the metal plate recessed into the wooden float, to prevent a discharge between the metal plate and the sides of the tank taking place.

The apparatus would be inexpensive, and simple to make, and I would like to hear the result of a test by this method.

Horace J. Arthur.

Wolverhampton, *August 5th*, 1922.

I should be interested to know whether "F.W.F." has tried enclosing his fabrics in a bare wire basket, or "Lobster Pot," effectively earthed by means of a flexible earth wire, prior to immersion.

Walter E. Rogers, A.M.I.E.E.

Shepherd's Bush, W.12,
August 7th, 1922.

Belgian Electrical Signalling Apparatus.

We notice that on page 125 of your issue dated July 28th, 1922, under the above heading there appears a small paragraph relating to the special works which our company has established at Ruysbroeck, near Brussels, for the manufacture of railway electrical signalling apparatus, which conveys the impression that we have only recently undertaken the manufacture of this material. The actual fact is that we have been manufacturing this apparatus in Charleroi since the year 1910, but owing to the very large developments which have since taken place, and the volume of orders placed with us, we found it necessary to establish the special works in

question, and at the present time have orders in hand for the Belgian State Railways, and for other customers, which will keep us fully occupied for at least 18 months.

As the paragraph in question conveys an erroneous impression, we shall much appreciate your giving publicity to this explanation.

Ateliers de Constructions Electriques de Charleroi.
JOHN H. BUNTING,
British Manager.

London, S.W.1,
August 3rd, 1922.

Small Private Generating Stations.

The attention of the Electricity Commissioners has been drawn to a paragraph entitled "Small Generating Stations" on page 723 of the ELECTRICAL REVIEW of May 26th, and to an article entitled "The Village Power Station" on page 43 of the ELECTRICAL REVIEW of July 14th.

The latter article commences with the sentence: "Following the notification that small *public* generating stations below 50 kW capacity may be started without permission being obtained from the Electricity Commissioners. . . ."

This statement is not in accordance with the facts, as the notification dated May 12th, which was issued by the Commissioners to the electrical Press and others, referred definitely to small *private* generating stations.

The Commissioners feel that you will no doubt wish to issue a correction on the above point.

Electricity Commission,
R. T. G. FRENCH,
Secretary.

London, S.W.1, *August 4th*, 1922.

A Proposed Christian Order of Industry.

In the ELECTRICAL REVIEW of August 4th, the writer of the leaderette on "A Proposed 'Christian Order of Industry'" has expressed the "belief that the leavening influence of Christianity is operating in hundreds of unrecognised ways *because it is operating freed from the objectionable restrictions and shibboleths of orthodoxy.*"

May it be permitted, sir, to me—who, for the last 45 years, have looked to the ELECTRICAL REVIEW as to a valued friend—to express regret that the leaderette writer, in assigning the reason described in those of his words which I have italicised, has infringed the hitherto—under present circumstances—laudable exclusion of religious controversy from your columns?

What could be more conducive to polemical strife than the way in which your writer has associated "orthodoxy" with alleged "objectionable restrictions and shibboleths"?

The dictionary* meaning of orthodoxy is "soundness of opinion or doctrine; belief in the genuine doctrines of scripture: *orthos*, right, *doxa*, opinion—*dokeo*, to think."

* Chambers's Etymological Dictionary of the English Language.

Incidentally, the foregoing definition, of course, rightly presupposes the existence, amongst us, of a consistently authoritative teacher and expounder of scripture.

Finally, your writer, sir, would appear to think either (1) that your readers have no use for Christian orthodoxy, or (2) that those who, like myself—for good reasons, with heart and soul accept the same, may, with impunity, be slighted.

Edward Raymond Barker.

London, *August 7th*, 1922.

Upon opening your issue dated 4th inst., I had to rub my eyes and scan the title of your journal, just to make certain that one of my weekly technical papers had not fallen into the hands of the "Society for the Furtherance of Christianity." I note that you were both amused and surprised at the suggestion that the "F.B.I." was behind the latest move; be that as it may, it is absolutely certain that the Church is behind the move.

Christian principles indeed!—What exactly does that cover? The Christian principles which are applied by avowed Christians to-day, with all their narrowness, bigotry, intolerance, and everlasting "Be content brother, you are sure of a harp or some other musical instrument in the next world, so don't mind what happens to you here?" I do not expect you to allow your valuable pages to be taken up by a theological discussion, but I think the statement that Christianity has any leavening influence, is open to very serious doubt, in fact if you examine Christianity, you will find that it has not only not benefited mankind, but has always acted against the mass (usually in the most horrible and cruel ways) for the benefit of the few. There is also another way of looking at your support of the movement. You have readers who may embrace some other religion (there are a few hundred equally authentic others) and again a number "sans" religion. Does it not strike you that you may appear to them just a little one-sided, when you use your pages to boost any particular crowd? I trust you will see your way to publish this, and if I may venture a suggestion, let the REVIEW remain a technical and scientific journal without sect or creed.

Reason.

August 7th, 1922.

[It is obvious that the purpose of our leaderette has been fulfilled. Every movement for assisting toward a solution of industrial troubles is legitimately within the scope of an industrial journal, but we have no intention to allow our pages to be occupied with theological discussions. It will do no harm to any of our readers to secure a copy of the re-statement from the Secretary, who no doubt will welcome an expression of their views, but the peaceful columns of the ELECTRICAL REVIEW are not the place in which to let loose the spirits which so often accompany religious controversy. We cannot publish any more letters.—EDS. ELEC. REV.]

BUSINESS NOTES.

Bankruptcy Proceedings.—J. R. NORRIS (Acme Electrical Co.), electrical engineer, 80, Warley Road, Blackpool.—First meeting, August 11th, at the Official Receiver's offices, Preston; public examination, September 22nd, at the Court House, Blackpool.

H. S. ROGERS, electrical engineer's sales manager, 21, Derby Street, Walsall.—First meeting, August 14th, at the Official Receiver's office, Wolverhampton; public examination, August 16th, at the Court House, Walsall.

Company Liquidations.—I.T.E. ELECTRIC CO. (1907), LTD.—Winding up voluntarily. Liquidator: Mr. D. H. Jeboult, 9, Walbrook, E.C. Meeting of creditors, August 16th, at the liquidator's office.

BROTHERTON EDISWAN TUBES & CONDUITS, LTD.—Meeting of creditors, August 14th, at the Victoria Hotel, Wolverhampton. Liquidator: Mr. R. H. Johnston.

ELECTRICAL DEVELOPMENT & FINANCE CORPORATION, LTD. A meeting of members is called for September 5th at 90, Cannon Street, E.C., to hear an account of the winding-up from the liquidator, Mr. W. B. Stone.

ELECTRICAL MAINTENANCE CO. (LIVERPOOL), LTD.—A meeting of members is called for September 5th at 8, Victoria Street, Liverpool, to hear an account of the winding-up from the liquidator, Mr. J. Airey.

Dissolutions of Partnership.—KIRKBY & LIVESAY, engineers, Lloyd Bank Buildings, King Street, Manchester.—Mr. T. M. Kirkby and Mr. A. G. Livesay have dissolved partnership. Mr. Livesay will attend to debts and continue the business in his own name.

MESSRS. SALES & ASH, 11, Chichester Rents, Chancery Lane, W.C.2.—Partnership dissolved. The business is now being carried on by Mr. G. W. Sales, under the style of Sales & Co. All debts will be attended to by Mr. Sales.

THE NOTTINGHAM RADIO SUPPLIES, dealers in electrical wireless apparatus and fittings, 3, The Poultry, Nottingham.—Mr. G. A. Litchfield and Mr. H. Walker have dissolved partnership. Mr. Litchfield will attend to debts and continue the business under the same style.

Trade Announcements.—MESSRS. HEWETT & CO., of 315-317, High Road, Chiswick, London, W.4, are now wholesale electrical factors.

The new address of the BASTIAN ELECTRIC CO., LTD., is 58, Haymarket, London, S.W.1.

Catalogues and Lists. MR. H. B. TURNER, 79, Playford Road, N.4.—An illustrated leaflet, describing the "Unit" time switch for electric signs, window lighting, &c.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—August stock list of motors and dynamos.

MESSRS. JAMES McMILLAN & CO., Clun House, 17, Surrey Street, W.C.—Catalogues No. 701, giving details of an electric iron, and No. 702, describing an electric soldering iron, both of Norwegian production.

THE BRITISH THOMSON HOUSTON CO., LTD., Rugby.—Descriptive List No. 4,221-B, containing numerous illustrations, with details, of automatic circuit-breakers (air-break) of various types. Also Price List No. 5,115-B, giving prices, &c., of a.c. hand-operated starting and regulating rheostats; and Price List No. 4,501-D, dealing with lightning arresters for d.c. circuits.

ENTERPRISE MANUFACTURING CO., LTD., Electric House, Grape Street, Shaftesbury Avenue, W.C.2.—Net trade price list of cables, wires, conduits, lampholders, switches, fuseboards, and other electrical accessories.

MESSRS. JOHN MUSGRAVE & SONS, LTD., Bolton.—An illustrated reprint dealing with the Musgrave steam extraction engine.

PRICE'S ELECTRICAL SUPPLIES, LTD., Caxton House, 58, Great Charles Street, Birmingham.—Monthly net trade price list of electrical accessories of all descriptions.

Measurement, Ltd., 34-38, Provost Street, City Road, N.1.—List A-2, giving an illustrated description, &c., of house-service a.c. watt-hour meters.

For Sale.—By direction of the Disposal Board, Mr. C. D. Phillips will sell by auction on August 16th and following days at Swindon, plant and machinery, including electrical plant, cable, &c. (See our advertisement pages to-day.)

Book Notices. "Electrical Engineers' Pocket-Book," 487 pp. (2nd edition). London: International Correspondence Schools, Ltd. Price 10s. 6d.—Although this is called a second edition it is actually the first edition of an electrical pocket book, the previous work being a mechanical-electrical work. As stated in the preface, the book does not consist merely of a collection of tables and formulæ, but aims at imparting information in a continuous manner. Following this rule, it opens with a hundred pages on mathematics, in which a condensed treatment of the principal elements of calculation is given. After this there appears a short section on physics and chemistry, as related to engineering, and then a large number of pages are devoted to mechanical details, i.e., power transmission, boilers, &c. The electrical section commences at magnets, and passes to induction coils, alternating currents, the construction and operation of electrical machinery, transformers, converters, transmission, secondary batteries, wiring, illumination, &c., finally dealing briefly with electric traction and electro-chemistry. Much has been squeezed into a small compass; the book is a kind of "electrical review," which may be employed in conjunction with more detailed treatises.

"Seventeenth Annual Report of the Rand Water Board" (year ended March 31st, 1922); 63 pp. and 4 diagrams. Johannesburg: Hortons, Ltd.—The report states that during the year two sets of electrical remote-control equipment were installed in connection with the Zwartkopjes bore-holes, one American and one British. While the former was found to be satisfactory the latter was incomplete. Severe electrical storms again affected the working of the pumping plants at Zwartkopjes and Zuurbekom; the former was shut down on fifty occasions for an aggregate of 67 hours, and damage was done to the extent of £29; Zuurbekom was closed down on 27 occasions, aggregating 95 hours, the cost of damage being £56.

The *Journal* of the Junior Institution of Engineers, Vol. XXXII. Part 11. August, 1922. London: Percival Marshall and Co. Price 2s.—This number of the *Journal* contains a portrait and biography of the President (Mr. C. H. Wordingham, C.B.E.); a paper on "The Utilisation of Water Power," by Capt. H. Whitaker, late R.E.; reports of visits to the Pirelli-General cable works and the Kearney high-speed railways, and index of proceedings.

Journal of the American Institute of Electrical Engineers, Vol. XLI. No. 7, July, 1922. New York: The Institute. Price $1.

"The Henley Telegraph," June 1922. (32 pp.) Price 8d. post free.—The staff magazine of Messrs. W. T. Henley's Telegraph Works Co., Ltd., still holds its own as the most literary of its kind. Apart from a number of interesting notes and articles, this issue contains an appreciation of Sir George Sutton, Bart., and a list of the firm's recent contracts.

"The Metropolitan-Vickers Gazette," June and July, 1922. Price 1s. per copy.—The first of these two issues contains an article on battery locomotives for industrial shunting yards, notes on development in power-station switchgear, &c. The July number contains a paper read before the American I.E.E. by Mr. A. P. M. Fleming, C.B.E., upon "Some Developments in Insulating Materials and Processes in Great Britain"; "The Jointing of Metals," by Mr. S. J. Nightingale; and "Co-operative Electricity Supply in Switzerland," by Mr. E. M. Johnson.

"Sierra Leone Railway: Administrative Report for the year 1921" (46 pp.). Freetown: Government Printing Office.—This gives full details of passenger and goods traffic; matters affecting *personnel*; accounts of various departments, &c.

The *Journal* of the Institution of Electrical Engineers, Vol. 60, No. 310, June, 1922. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—This contains the 13th Kelvin Lecture on "Electricity and Matter," by Sir Ernest Rutherford, F.R.S.; the following papers:—"Electric Motor Starters," by J. Anderson (with discussion); "Phantom Telephone Circuits and Combined Telegraph and Telephone Circuits, worked at Audio Frequencies," by J. G. Hill; and "The Thermionic Triode as Rectifier," by E. B. Moullin, M.A., and L. B. Turner, M.A.; also discussions on "Starters" and "Single- and Three-phase Commutator Motors." Another feature includes recommended practice for the study of untreated electrical insulating papers.

Annual Outing.—The annual outing of the London staff of the City Electrical Co. (C.E.C., Ltd.) took place on Saturday, July 29th, Brighton being visited in charabancs. At the luncheon the health of the firm and the managing director, Mr. H. E. Ellis, was toasted. Mr. Ellis, in his reply, referred to the continued progress of the business. The organisation arrangements were in the hands of Messrs. E. Youldon and T. H. Goldsmith, to whom gold-mounted brass were presented.

Telephone Manufacture in Australia.—Replying to a question as to whether telephone parts could not be manufactured at the Lithgow Small Arms Factory, as was proposed some time ago, the Postmaster-General declares that the trouble is that a factory working solely on telephone material could turn out in one year more than would be required by the department for several years. Recently Mr. Poynton communicated with English firms, asking whether they would be prepared to inaugurate the manufacture of telephones in Australia. The replies received indicated that the firms would undertake the works provided they were guaranteed a certain amount over and above cost price, but the Government could not see its way to agree to this.—*Reuter's Trade Service* (Melbourne).

Projected Electrical Exhibition at Brussels.—*Le Soir* reports a recent meeting of leading Belgian engineers and industrialists to discuss the holding of an international electrical exhibition in Brussels in 1925. A commission was formed to make preliminary arrangements. Another meeting is to be held in October, at which proposals will be put forward regarding the organisation of national and industrial groups and sections.

Reduction in Railway Rates.—Considerable prominence has recently been given to the reduction in railway rates, which came into force on August 1st, 1922, some papers having stated in large headlines that this reduction amounts to 25 per cent. on existing rates. This is not the case, the reduction being from 200 per cent. to 175 per cent. of pre-war rates, or 12½ per cent. The reductions in the flat rate bring the total reduction to approximately 15 per cent. Whilst electrical traders are grateful for small mercies they regard this reduction as quite inadequate to induce them to send all their traffic by rail, and it is felt that the reduction in rates is not commensurate with the reduced costs of wages and materials. No reduction whatever was made to the traders last year when the reduction in transport wages, amounting to about £20,000,000 per annum, took place, to say nothing of the reduction in the costs of material. One should not overlook the fact that the railway companies have very largely increased their reserve insurance and depreciation funds during the years 1913 to 1921. The London & North-Western Railway Co., for example, increased its reserve fund by over £10,000,000 during this period, and the aggregate funds of all the railway companies amounted on December 31st, 1921, to £71,500,000. With a view to stimulating trade, manufacturing concerns frequently reduce their prices, even when manufacturing costs do not appear to justify it. Much more should the railway companies adopt a liberal policy in their present circumstances in the interests of the whole trade of the country, upon which, of course, the prosperity of the railways depends. Another point to bear in mind is that the reductions do not apply to through traffic between the English and Scotch railways, as the Scotch companies have made no reductions.

The Russian Electrical Industry.—A report has recently been submitted to the Gosplan (Government Planning Section) on the position of electricity in Russia. The report goes over the extremely unsatisfactory condition of the electrical economy of the country, particularly of the electrical stations, the plant in which is very much worn, so that 50 per cent. is quite unusable, and the remaining 50 per cent. in many cases is coming to its end. It is observed that the electrical equipment factories, though in difficulties, make a somewhat better showing. They were not so hard pressed during the Revolution as the stations, so that the wear is not so great, although about 55 per cent. of the equipment is worn out. The factories are without means of recuperation, and the financial position of the industry, whether in trusts or otherwise, is extremely difficult. The indebtedness of the various factories amounted to no less than 43,134,200 roubles for wages alone by May 1st. The possibility of realising goods and thus raising money is small. The question has arisen of bringing some pressure on the defaulting departments of the Government to pay what they owe to the respective electric concerns to which they are indebted; and further, the Government Planning Section, on behalf of the electrical industry, has recognised the necessity for controlling the issue of permits for importing goods, so that the foreign trading section may be prevented from importing such goods as may be protested against.

A Long-Service Battery.—Another instance of the longevity of "Exide" batteries has been provided by one of the Chloride Electrical Storage Co.'s customers. This battery was fitted on a "Cadillac" car eight years ago, and after running 40,000 miles and providing energy for lighting and starting, is still in service. An automobile agent estimated the battery's effective life at two years.

Local Libraries and Commercial Information.—As the result of co-operation between the local Chamber of Commerce and the public libraries, there is available at the Croydon Reference Library a complete set of town and trade directories, year-books, time-tables, codes and maps, in addition to ordinary books on business; also a vertical file of clippings, articles, pamphlets, &c., on current business and public questions has been compiled and is maintained with the co-operation of a business committee.

The Yorkshire Electric Power Co.—At the celebration of the 21st anniversary of the formation of the company, briefly reported in our last issue, Mr. W. B. Woodhouse, engineer and manager, outlined the company's history. He pointed out that the first year's revenue was only £900, whereas last year it amounted to about £400,000. The company's mains extended from the borders of Derbyshire in the south, to Otley in the north; and from the borders of Lancashire in the west, to Goole in the east. Although progress had been rapid, still further developments were to be looked for in the near future.

Chinese Import Trade.—The rapidity with which China is being industrialised is referred to in the recently issued report for 1921 of the Chinese Maritime Customs, and some striking figures are quoted in illustration of the movement. For example, machinery for the textile industries was imported to the value of 26.7 million taels in 1921, as compared with 6.9 million taels in 1920 (the tael averaged 4s. in value in 1921). The imports of propelling machinery doubled in value during the same period. Of the total value of 26.7 million taels (say £5,300,000) of imported textile machinery, £2,200,000 represented imports from Great Britain, £1,500,000 those from the United States, £850,000 Canadian, and £720,000 Japanese. International competition is obviously keen. With regard to electrical needs the tendency is towards the installation of larger units, *e.g.*, of 1,000, 2,000 and 5,000 kW. The sale of small lighting plants has been adversely affected on this account, and also because of bad trade conditions. Yet imports of electrical materials and fittings amounted in value to £2,600,000 last year, or more than double the figure of the preceding year. The Japanese have held the market for wires and cables, porcelain insulators, &c., the Dutch for lamps, and the Americans for better-class fittings and glassware.

Manufacture of Asbestos Products in Canada.—According to *Reuter's Trade Service* the manufacture of finished asbestos products in Canada (which supplies 80 per cent. of the world's production of the raw material) is shortly to be undertaken by the Johns Manville Co., an American concern, which is already operating plants at Waukegan, Illinois, and Manville, New Jersey. The plant will be established at Asbestos, Quebec, at a cost of approximately $1,000,000.

Price Reductions.—Messrs. Henry Wiggin & Co., Ltd., Birmingham (selling agents: Lionel Robinson & Co.), are making considerable reductions in the prices of their "Ferry" resistance wires and "Glowray," "Redray," and "Brightray" nickel-chromium wires for cooking and heating apparatus.

Australian Government and "Dumping."—A Reuter dispatch from Melbourne reports Mr. Hughes, the Prime Minister, as stating that the Commonwealth Government will shortly introduce an amendment to the Preservation of Industries Act, with a view to dealing more effectively with "dumping."

Annual Sports.—On Saturday, July 29th, the Chloride Electrical Storage Co., Ltd., held its sixth annual flower show and second annual sports at Clifton Junction. The weather was not too propitious, but for all that the exhibition was decidedly successful, and a large proportion of the sport events was successfully completed. An inter-works tug-of-war between the Chloride Co. and Messrs. Pilkington's Tile and Pottery Co. resulted in a win for the Chloride Co. for the second year in succession. The famous Besses-o'-th'-Barn band played to an attendance which numbered at least 1,800. The Chloride Co.'s playing fields, tennis courts, bowling green, gardens, and canteen were looking their best, and came in for much admiration.

Manufacturing in Holland.—The report of the Hengelosche Electrische en Mechanische Apparaten Fabriek (Heemaf), of Hengelo, for 1921, complains loudly of German competition, and states that this rivalry and the small demand rendered it impossible to work on a remunerative basis. Having regard to the uncertain conditions and the expected long continuance of the depression, the directors had considered it desirable to restrict operations and not further increase the stocks of manufactures. At present the export business in the principal products largely exceeds the inland turnover, although great difficulties are experienced through the constant changes in the import duties of the countries to which exports are forwarded. As the company's production of motors only forms a portion of the total number of motors sold monthly in Holland, the chance exists of a considerable improvement in the home trade in this branch on a further increase in German prices. There are grounds for expecting that the amount of the turnover necessary to cover the working expenses will be realised in a measurable period, and the future is therefore looked forward to with more confidence than was the case a year ago. After appropriating the reserve fund of 928,000 florins, a debit balance of 720,000 florins has been carried forward. The report adds that favourable prospects exist of obtaining a share in the contracts in connection with the electrification of the railways both in Holland and

A Belgian Company.—The Société de Constructions Electriques de Belgique reports that the results obtained in 1921-22 were satisfactory having regard to the general crisis and the difficulty of further developing activity at the old works at Liége. The new installations at Herstal would be nearly completed in the new financial year, when the company would possess works with modern equipment. Among the orders received were those for a complete sub-station in Brussels and the supply of two 10,000-kW turbines for Ghent. A licence had been acquired for Belgium for the construction of the Swedish Ljungström turbine, and the company [illegible] able to construct both the steam portion and the electrical parts of these machines. The net profits earned in 1921-22 amount to 2,112,000 fr. on share capital of 40,000,000 fr., as compared with 1,918,000 fr. in the previous year. It is proposed to pay a dividend at the rate of 30 fr. gross (6 per cent.) per share, being the same rate as in 1920-21.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries. Notices of objection to any of the applications can be entered within one month of the dates mentioned below.

Aristophone. No. 425,816. Class 8.—Wireless telephone and telegraph instruments and gramophones. C. F. Elwell, Ltd., Craven House, Kingsway, London, W.C. July 26th, 1922.

Parasol. No. 425,501. Class 13.—Sparking plugs. R. W. Robins and Co., Ltd., Park Place, Cardiff. July 26th, 1922.

Cosmos. No. 425,744.—All goods in class 16. No. 425,745. Class 50.—Electric insulators, electric insulating materials and preparations. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. July 26th, 1922.

Sunshine. No. 418,865. Class 6.—Electric vacuum cleaners and electric ironing machines. The Wise McCluny Manufacturing Co., 443, Park Street, New Philadelphia, O., U.S.A. (F. Heron Rogers, 181, Queen Victoria Street, London, E.C. August 2nd, 1922.

Magdynette. No. 425,961. Class 6.—Machines for electric current generation and ignition purposes. Joseph Lucas, Ltd., Great King Street, Birmingham. August 2nd, 1922.

De-Os. No. 423,525. Class 13.—Electric lamps (ordinary), parts thereof, electric lamp fittings, holders, shades, and reflectors. Osram Gesellschaft, 11-14, Ehrenbergstrasse, Berlin, O.17, Germany. (Cruickshank & Fairweather, 65-66, Chancery Lane, London, W.C.) August 2nd, 1922.

Ocelit. No. 426,094. Class 4.—Carbons for electrical purposes, and graphite, raw or partly prepared, for use in manufactures. Eugene Conradty, trading as E. Conradty, 9, Spittlertorgrabe, Nuremburg, Germany. August 2nd, 1922.

Lead.—Messrs. James Forster & Co., in their report dated August 5th, state:—"Consumption in the electrical cable trade has increased considerably since the engineers' strike, although it is now easing off. The domestic trade in sheet and pipe lead is on the increase, and more virgin lead than usual is being used in this direction, owing to a falling off of scrap lead. The market here is heavily 'bull,' which may affect values later, but we do not anticipate much change either way."

Importation of Machinery into Australia.—A deputation from the Iron Trades Council which waited upon the Premier of Victoria requested that contracts for machinery and other work should not be allotted to firms outside Victoria. Members, after stating that approximately 500 men in the trade were out of work, contended that more machinery was being imported by the Electricity Commission than was necessary. The Premier replied that every proposal to import machinery was carefully scrutinised by the Ministry. It had to be remembered that it would be better for the State to lose a few contracts than to overload unduly the capital cost of the Morwell electricity scheme.—*Reuter's Trade Service* (Melbourne).

Engineers' Wages.—As stated briefly in our last issue, a conference to discuss "payment by results" took place between the Engineering Employers' Federation and the A.E.U. on August 3rd. Although no official statement was issued, the *Daily Telegraph* understands that the suggested terms would have enabled the average skilled worker to earn at least 33⅓ per cent. more than the present time rates. The conference lasted throughout the day, but broke up without having reached any conclusion and without arrangements being made for its resumption.

It is to be noted, however, that under the terms of the last agreement the employers agreed not to enforce the piecework system for a certain period to enable the unions to consider the matter. As this term has now expired, it is anticipated that a certain number of employers will introduce payment by results without further discussion.

South African Electrical Trade.—According to the *South African Mining and Engineering Journal* for July 15th, the prices of electrical wares generally are firming. "Everybody to day is selling goods which cannot be replaced at present prices. . . . . Germany seems finished for the time. One cannot get stuff from her, at any rate, not at the prices lately ruling. British prices are firming, too, and they were expected to advance locally within a short time." People who have been holding over their installations for lower levels seem now to be beginning to realise that prices will go no lower, but will rather advance and cost considerably more in about three months, and they are now about to rush in and get their jobs done cheaply. Many owners of [illegible] and business plans, who have been hanging on for months for still lower prices, are now realising that they will not be able to obtain electrical wares cheaper.

LIGHTING AND POWER NOTES.

Ashford (Kent).—Electricity Supply.—The Urban Council has decided to engage a consulting engineer to prepare a report and scheme for an electricity undertaking for the town.

Australia.—Victoria.—The Electricity Commission has recommended the Victorian Government to proceed with the hydro-electric scheme for Goulbourn Valley and the north-eastern district of Victoria. The estimated cost of the undertaking is £962,000.—*Reuter's Trade Service* (Melbourne).

Bath.—Year's Working.—The total revenue earned by the electricity undertaking (engineer: Mr. F. Teague) during the year ended March 31st last was £50,310, comparing with £45,495 in the previous year. The expenditure on revenue account rose from £38,070 to £39,388, leaving a gross balance of £10,922 (£7,425). Capital charges amounted to £14,341, as against £9,396, causing a net deficit of £3,419 as compared with a loss of £1,971 in 1920-21. The amount of energy sold remained at about the same level, the figures for the past two years being 2,675,592 (1920-21) and 2,670,543 kWh.

Billericay.—Electricity Supply.—At a recent meeting of the Rural Council a letter was received from the Wickford and District Electricity Supply Co., Ltd., asking for the Council's sanction to an application for power to supply electricity to the district. The Council decided not to oppose the application.

Blackburn.—Year's Working.—The report of the borough electrical engineer (Mr. P. P. Wheelwright) for the year ended March 25th last states that the revenue totalled £116,446, as compared with £110,165 in 1920-21. Working expenses amounted to £87,282, as against £91,949, leaving a gross profit of £29,164 (£18,216). Capital charges, &c., absorbed £34,896, and crediting £1,391 bank interest, the net result was a deficit of £4,340, comparing favourably with a loss of £10,472 in the previous year. The capital account shows an expenditure of £368,136 upon the new station (described in our issue of October 21st, 1921), and £16,491 upon feeders, distributors, services, &c. The sales of energy totalled 10,244,361 kWh, as compared with 9,102,394 kWh, and the maximum demand rose from 6,005 to 6,394 kW.

Brazil.—Hydro-Electric Scheme.—In order to meet the increasing demand for electrical energy, the Brazilian Traction, Light and Power Co. has recently acquired the rights to utilise the water power of the River Parahyba, about 100 miles from Rio de Janeiro, for the development of 140,000 h.p. A new company, to be known as the Brazilian Hydro-Electric Co., is being formed to carry out the scheme, the whole of the shares, however, being held by the first-named concern.

Bolton.—Year's Working.—The accounts of the electricity undertaking (engineer: Mr. W. J. H. Wood) for the year ended March 31st last, show a total revenue from all sources of £269,237, as compared with £273,530 in the previous year. The working expenditure amounted to £166,166, as against £186,350 in 1920-21, leaving a gross balance of £103,070 (£87,180). Capital charges absorbed £84,400, leaving a net profit of £18,670 (£27,779). Of this balance £16,578 was appropriated as capital expenditure out of revenue, and the remainder carried forward. The energy sold increased from 30,208,980 to 31,876,014 kWh, a satisfactory increase, having regard to the depressed condition of industry.

Canada.—Ontario.—The Hydro-Electric Power Commission of Ontario has issued a report upon the Nipigon development, in which an ultimate plant capacity of 30,000 h.p. will be operated by the Cameron Falls. The Commission has been subjected to the criticism that the cost of power from this source will be higher than the contract price of power supplied by the Kaministiquia Power Co. In reply, the Commission states that the company was not in a position to deal with the demand in this district, but it admits that, owing to delay in commencing the work, the estimates have been exceeded by about 1¾ million dollars.

China.—Hanyang.—$150,000 is being raised at Hanyang, Hupeh, for the erection of an electric light plant. A preparation bureau has been established.

Colchester.—New Power Station.—The Town Council has engaged Mr. W. C. C. Hawtayne, M.I.E.E., to prepare a detailed scheme for the erection of the suggested new power station at the Hythe.

Continental.—Russia.—A Moscow journal says that from May 1st delivery of fuel has been made against payment to all the Petrograd factories, including the combination of the Petrograd town electricity stations. The result has been that this combination has been reduced financially to very low water. The quantity of energy sold by all the stations of the combination in the month of April amounted to 6,700,000 kWh. The expenditure on fuel considerably exceeded the revenue, amounting to 60,000,000 roubles, or more than twice the sum to be received for energy sold. The statement goes on to enumerate all the other outlays, amounting to about 100,000,000 roubles, against 28,000,000 roubles to be received, and then only in case of smooth working; that is to say, the income is 28 per cent. of the expenditure, to be added to which positive loss there is the credit taken by the subscribers, besides numerous deductions for one reason or another in payment of the accounts, all which, though enumerated carefully, would occupy too much space to recapitulate. The issue from the *impasse* that suggests itself is to rate the power relatively to the cost of its production. This, however, cannot be done, as the tariff is fixed by superior authority. All that can be done in reducing the cost of fuel has been done, says the report quoted. The fuel used now is considerably less than in 1921-20, 1919, or even 1917. And it is to be noted that the fuel now delivered to Petrograd is of exceedingly inferior quality. The petroleum is dirty and watery, and the peat contains a large proportion of earth. Further, it is impossible to effect more economies for want of piping, boilers, and economisers.

Dorking.—Proposed Price Increase.—Edmundson's Electricity Corporation has applied for power to increase the maximum charge for electricity from 10d. to 1s. per kWh, with a minimum payment of 15s. in the winter quarters and 10s. in the summer quarters.

Greenock.—Price Reduction.—The report on the working of the electricity undertaking for the past year shows a balance of £14,258, and the Electricity Committee has recommended a reduction in the charges for electricity of 1d. per kWh for lighting and ½d. per kWh for power.

Exeter.—New Sub-station.—The Town Council is constructing a large permanent sub-station at the Lower Market to replace two or three underground sub-stations in the neighbourhood which are incapable of further extension.

Farnborough (Kent).—Electricity Supply.—The Parish Council has under consideration a proposal put forward by the West Kent Electric Co., to supply the district and Keston and Hayes with electricity.

Formby.—Electricity Scheme.—The Urban Council has adopted a scheme submitted by Mr. James Scott, electrical engineer, under which a supply of electricity will be taken from the London & North-Western Railway Co. Mr. Scott is to prepare a report and plans for submission to the Electricity Commissioners.

Glasgow.—Exhibition Houses.—Following on the experiment at Riddrie, the Corporation proposes, in connection with the Mosspark housing scheme, to construct two houses with electrical appliances and two houses with gas. These will show visitors the extent to which electricity and gas can be used for domestic purposes.

Glossop.—Proposed Increased Charges.—The Urban Electric Supply Co. has applied to the Electricity Commissioners for power to increase the maximum charge for electricity from 10d. to 1s. per unit, with a minimum charge of 15s. for each winter quarter and 10s. for each summer quarter.

Hastings.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £3,483 for mains.

Helston.—Electricity Supply.—The Town Council has under consideration a proposal for lighting the town with electricity, and a meeting of the burgesses is to be called at an early date to ascertain what scheme would be acceptable, and whether it should be on the lines of a municipal undertaking.

Hoddesdon.—Electricity Scheme.—An electricity company is being formed for Hoddesdon, Broxbourne and district, which proposes to obtain electricity from the North Metropolitan Electric Power Supply Co. A capital of £5,000 is required before a start can be made with the scheme; about £2,000 has already been promised.

India.—Trichinopoly.—The Municipal Council, at a recent meeting, finally confirmed the terms of agreement with the Metropolitan-Vickers Electrical Co. for the introduction of electric lighting in the Trichinopoly municipal area. A local company will be floated and the Metropolitan Co. will manage the concern for a period of 15 years. The work will be commenced within three years and the company has agreed to supply power for all municipal purposes at a rate not exceeding 3 annas per unit, and for private services at 6 annas per unit.—*Indian Textile Journal.*

London.—St. Pancras.—There was a profit of £23,129 upon the past year's working of the electricity undertaking. It is proposed to distribute it as follows: Writing-off of balance of outstanding loan on certain plant, £3,182; transfer of £1,815 to the working balance, bringing it up to £10,000; transfer of £2,000 to reserve; and contributing the remainder, £16,132, to the relief of rates.

Southwark.—The report on the working of the electricity undertaking for the past year shows a surplus of £4,000.

Rawtenstall. Revised Charges The Corporation has adopted the following scale of charges to power consumers:—500 kWh per month, 2.5d.; 1,000 kWh, 2d.; 2,000 kWh, 1.5d.; 1,500 kWh, 1.15d.; all additional energy, 1.1d. per

kWh. For demands exceeding 200 kW for consumers under agreement:—30,000 kWh per month, 1.05d.; 60,000 kWh, 1d.; 110,000 kWh, .95d.; 160,000 kWh, .9d. Over 160,000 kWh to 210,000 per month, .85d.; over 210,000 kWh, .8d.

Shrewsbury.—Price Reduction.—The Town Council has reduced the surcharge of 100 per cent. on the charges for electricity for all purposes to 75 per cent. as from the June quarter meter readings.

South Africa.—Pretoria.—The Municipal Council is seeking power to raise a loan of £750,000 for public works. It is proposed to allocate £400,000 for the installation of a power station.

TRAMWAY AND RAILWAY NOTES

Birkenhead.—Year's Working.—The report for the year ended March 31st last of the manager of the municipal tramways (Mr. C. Clarke) has come to hand. This shows that the total revenue was £137,845, as compared with £152,304 in the previous year. The total working expenditure amounted to £103,394, as against £116,060, leaving a gross profit of £34,451 (£36,244). Interest, sinking fund, and income tax absorbed £31,919 (£32,211), and the final result was a net profit of £2,532, as compared with £4,033. The number of passengers carried was 17,966,065 and the car-mileage 1,150,558; the previous year's figures were 22,182,390 and 1,286,921 respectively. It was found necessary during the year to raise the fares, but they have now been restored to their former level.

Exeter.—Extensions.—The Town Council has instructed the surveyor to submit an estimate of the cost of extending the tramway service to Hamlyn Lane, on the Pinhoe Road route.

London.—"Tube" Stations Closed.—During the present week, consequent upon the continuation of the reconstruction of the City & South London Railway, the following stations have been closed:—Euston, King's Cross, Angel, City Road, and Old Street (partly). To prevent inconvenience to passengers, an adequate special omnibus service has been instituted.

L.C.C. Tramways.—The Highways Committee recommends that application be made for a prolongation of the time allowed for the completion of certain tramway extensions authorised by the London County Council (Tramways and Improvements) Acts, 1909, 1910, 1914, and 1915.

Quieter "Underground" Trains.—According to the *Daily Mail*, Professor A. M. Low has successfully carried out experiments with a new system of car construction aiming at the reduction of noise on the "Underground" railways. It is expected that the companies will adopt the system in the design of future rolling stock.

Manchester.—Proposed "Tube" Railway.—The Manchester City Council is again considering the construction of an underground railway to relieve the traffic congestion in the city. It is stated that plans and approximate estimates have been made, the cost working out at between £750,000 and £1,000,000 per mile for a length of 15 miles. It is interesting to note that the city's tramway undertaking has only cost £2,000,000.

South Africa.—Pretoria.—The Municipal Council proposes to expend £50,000 on the tramway system, and power is being sought to raise a loan for the purpose.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—New Wireless Stations.—Investigations are being made, says the *Electrical News*, for the purpose of erecting three wireless telephone stations in the northern parts of Manitoba, which would eventually link up with the wire system. One of these stations would be erected at The Pass, another probably at Norway House, and the third at Churchill, or another point to be decided on. The apparatus would be designed to deliver 500 watts to the antenna system; under proper transmitting conditions the stations would have a range of several hundred miles. It is hoped to have The Pass station, at least, in operation this year. Under present conditions communication north of the 53rd parallel is limited by the speed at which men or dogs can travel, in summer by canoe, in winter by sledge. Always during spring and "fall" there is a season of six weeks during which the formation or breaking up, as the case may be, of the ice renders any kind of travel impossible; thus, under present conditions during nine months of the year, communication between civilisation and the northern outposts is necessarily slow and arduous; during the remaining three months all communication is at a standstill.

France.—Regulations for Wireless.—The departmental committee appointed by the French Under-Secretary of the Post Office to inquire into the regulation of wireless installations, has drawn up its report. It is expected that rules based on the recommendations will shortly be issued. The broad principle followed is that receiving apparatus may be freely used after formal registration, while sending apparatus can only be installed by private individuals on the authorisation of the Under-Secretary of State acting on the advice of a mixed committee of officials and experts. Sending installations will be divided into five classes—private stations, stations for financial news, scientific stations, mobile stations (*e.g.*, ships)), and amateurs' installations. There will be a limit of wave length.—*The Times.*

New Wireless Station Opened.—Direct wireless communication between France and New York was established at midnight on August 6th by means of the wireless station at Saint-Assise. A few minutes after the message had been dispatched New York announced that it had been received at the rate of 80 words a minute, says *The Times*. The new station is situated near Melun, not far from the Forest of Fontainebleau, and has been named "Radio-France." The installation is 50 per cent. more powerful that that of Bordeaux. Three new sets of apparatus are shortly to be erected at the Saint-Assise station, which will then be four times more powerful than the Bordeaux station and 35 times more powerful than the Eiffel Tower station. From Saint-Assise five or six messages can be dispatched simultaneously, at an average rate of 100 words per minute per message. Thus it is computed that Saint-Assise can send 36,000 words an hour, or nearly 1,000,000 words a day.

This station will in future carry on all wireless communication between France and America, and is worked from Paris by means of the long-distance control system. The central office near the Bourse will pick up, by means of six receiving centres in the suburbs, messages destined for transmission from Sainte Assise, and will automatically pass them on across the Atlantic. In addition direct communication has already been established with Argentina and China. Another development of wireless telegraphy in France is the inauguration of direct communication between Bordeaux and Saigon, with a tariff over 2 fr. a word cheaper than the ordinary cable rates. The next step is to be the equipment of six colonial stations for transmission, which at present can only receive messages, at Martinique, Guinea, Rufisque, in West Africa, Djibouti, in East Africa, Brazzaville, in Equatorial Africa, and Tananarivo, in Meridional Africa. This work completed, it is proposed to construct, probably in 1926, two stations in the Pacific, which will complete the chain of communication linking up 90,000,000 inhabitants of France and her colonies.

Tibet.—Telegraphic Communication.—Telegraphic communication has been established between Lhasa, the capital of Tibet, and India.—*Daily Mail.*

The Telephone Service.—Public Call Offices.—There are approximately 11,400 public telephone call office cabinets in England, Scotland, and Wales; of the total 1,476 are situated in railway stations, on piers, and similar semi-public places that are privately owned, and 2,206 are in shops and on other private premises. In London there are 3,600 cabinets, of which 1,277 are official and 2,322 in railway stations, shops, and otherwise privately controlled. In Scotland there are over 900 cabinets.

Proposed Orkney Service.—Orkney is the only county in Scotland without a telephone service, but the *Orkney Herald* announces that an abridged outline of the proposed system to be installed at Kirkwall—and it presumes throughout the county—was recently given by the district manager of the service at Aberdeen. The Town Council has appointed a committee to consider the matter.

Uruguay.—State Telephone Service.—We learn from the *Review of the River Plate* that, although the matter has been kept very quiet it has transpired that an agreement has been entered into for the purchase by the State—or perhaps we should say by the Post Office—of the Uruguay Telephone Co., which is an English joint stock concern, and the oldest, and by far the largest, of the two telephone companies operating in Montevideo. The purchase price is $700,000. For the present the "Uruguaya" will be worked by the Western Electric Co. until the State subterranean system, for which the latter holds the contract, has been constructed, when the older company will be absorbed. The *Review* regrets the disappearance of a British enterprise that, with all its faults, has done good service in its time, and was the pioneer in introducing the telephone in Uruguay. Welcomed at first, of late years it has not received fair treatment at the hands of the Government—but it is not singular in that respect, for unfair treatment of foreign enterprises which stand in the way of Government plans of absorption is a phenomenon unfortunately not confined to Uruguay in the present day.

United States.—Cable Interruption.—Communication between the United States, Ireland, France, Germany, and Northern Europe, through the Commercial Cable Co., was interrupted on the morning of August 7th, probably because of the seizure of the station at Waterville (Ireland) by the Irish Irregulars.—*The Times.*

Wireless Restrictions.—When Congress reassembles this month it will consider the assignment of new wave lengths for use in the U.S.A., and will probably "zone" the country, or classify the broadcasting stations.—*T. & T. Age.*

Wireless Telegraphy.—New Imperial Chain Station.—The daily Press announces that negotiations are in progress by the Post Office authorities for the erection of a new long-range wireless station that will involve a capital outlay of £1,000,000 and an annual charge of approximately £500,000. The site for the new station will probably be at Bourne, Lincolnshire, and it is said that the aerials will be a mile long and half a mile broad. The suggested new station is probably the outcome of the Government's recent change in policy whereby it is proposed to increase the length of the "links" in the wireless "chain" of stations from 2,000 to 4,000 miles.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph refers to the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Victorian Electricity Commission. October 2nd. Ten surface feed-water heaters; 6 surface vapour condensers; 12 feed-water evaporators. (See this issue.)

December 18th. Victorian Electricity Commissioners. Supply of a complete brown coal-handling plant.

November 4th. Transformers, induction regulators, and switchgear. (See this issue.)

Brisbane.—September 20th. Postmaster-General's Department. Supply and delivery of switchboard apparatus and parts. (Sched. No. 559.)*

Melbourne.—Victorian Railways. October 11th. Electric storage battery with accessories and spares (Cont. 35,090). October 18th. Motor generator set and static transformer (Cont. 35,089.)*

Belgian Congo.—December 20th. Belgian Ministère des Colonies (5e Direction), 20, Rue de Namur, Brussels. Installation and operation of a system of electrical energy distribution at Elizabethville, in the Belgian Congo.

Czecho-Slovakia.—Kaaden.—Machinery and electrical equipment for new water-power station. Direktion des Städtlichen Elektricitäts, Kaaden, Czecho-Slovakia.

Edinburgh.—September 5th. Corporation. Conversion of two overhead cranes from mechanical to electrical operation. (August 4th.)

Huddersfield.—August 12th. Electrician's work required in conversion of premises, Northumberland Street, into picture theatre, for Freedman's Pictures, Ltd.—Stocks, Sykes and Hickson, architects, 1, St. Peter's Street, Huddersfield.

Leeds.—August 15th. Tramways Committee. Reconstruction of tramway track, Cardigan Road. Mr. J. B. Hamilton, general and commercial manager, 1, Swinegate, Leeds.

London. — Metropolitan Asylums Board. August 30th. Supply and erection of electric storage battery at the Grove Fever Hospital, Tooting Grove. (See this issue.)

H.M. Office of Works. September 5th. Supply of electrical and mechanical engineering labour in daywork in Cardiff. (August 4th.)

Islington.—September 20th. Electricity Department. Two water-tube boilers with stokers, draught system, steel chimneys, steam piping, &c.; cooling towers, ponds, pipework, &c. (See this issue.)

Manchester.—August 22nd. Tramways Committee. Permanent way points, tongues, crossings, and hardened steel centres; electrodes for welding. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

August 24th. Electricity Committee. Two steel ash wagons and a lifting sling. (August 4th.)

August 31st. Electricity Committee. Supply and completion of two coal grabs. (Spec. B38.) (See this issue.)

Matlock.—August 17th. Sewerage Contract No. 11. Electric generators and motors and pumping plant for Urban District Council. Specifications, &c., from Messrs. J. Diggle and Son, Civil Engineers, 14, Brown Street, Manchester.

New Zealand.—October 24th. Mangahao Power Scheme. Copper wire. November 21st. Battery booster-transformer. Specifications may be obtained from the office of the High Commissioner.

October 3rd. Mangahao Power Scheme. Power-house and sub-station transformers; travelling electric cranes; ventilating [illegible] and 110,000-V insulators.*

September 30th. Teviot Electric Power Board. One horizontal turbine, Francis type, coupled to a 125-kW, 3-phase, 50-cycle, 3,300-V generator; one 7.5-h.p. Pelton wheel; one 5-kW motor generator set; and complete switchboard and power station equipment.*

Wellington.—City Council. Erection of a large reinforced concrete power station at Shag Point.

Oxford.—August 15th. Oxford Electric Co., Ltd. One 1,000-kW turbo-alternator and condensing plant; and one 500-kW conversion plant (3,000 V, 3-phase, to 1,100 V, d.c.), complete with switchgear. (July 21st.)

Reigate.—August 22nd. Town Council. H.p. concentric and l.p. twin paper-insulated cable. (See this issue.)

Rochdale.—August 16th. Union. Installation of automatic telephone system at Dearnley Institution. (August 4th.)

Rumania.—Constantza.—Direction Général du Port. Six 3-ton electric cranes and two excavators (continuous current at 440 volts supplied by the Port authority). M. Erbiceanu, Director Général du Port de Constantza, Rumania.

Stockton-on-Tees.—August 31st. District Fund, Gas, and Electricity Committees. Stores, &c., for three months. (See this issue.)

Tasmania.—Hobart.—October 2nd. City Council. 750-kW rotary converter and transformer and 550-volt, d.c. switchboard panel. Further particulars are due to arrive at the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2, about the middle of August.

Warrington.—August 14th. Electricity and Tramways Committee. High and low-pressure paper and lead-covered cable, and earthenware conduits. (July 28th.)

Wimbledon.—August 31st. Electricity Committee. One 3,000-kW turbo-alternator, condensing plant, and accessories. (July 28th.)

* A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Blackburn.—Board of Guardians. Accepted. Installation of standard electric lights and inside fittings.—C. T. Briscoe & Co.

London.—The Spearing Boiler Co., Ltd., has secured the contract for two water-tube boilers, each of a normal evaporation of 52,650 lb. per boiler, together with Ferguson superheaters, chain grate mechanical stokers, and forced and induced draught plant, for the Charing Cross, West End and City Electricity Supply Co., Ltd.

Northampton.—Town Council. Accepted:—A. Stark and Co., Ltd., for the reconstruction of certain tramways in the town (£5,971).

South Foreland.—Wiring the Old Lighthouse, South Foreland, residence of Sir Wm. Beardsell.—J. Martin, Dover.

NOTES.

Proposed Visit to Gennevilliers.—The Union d'Electricité (controlling the Gennevilliers power station) has found it necessary to alter the provisional date of September 22nd, and it is now probable that the visit will take place early in October. One of our representatives will be in Paris during this week to complete arrangements, which will be set out in an early issue and communicated to those who have already signified their intention of visiting the station.

Other engineers who are contemplating the visit should communicate with us as soon as possible, so that the approximate number may be known.

Appointments Vacant.—E.h.p. plumber-jointer, for the Wolverhampton Corporation electricity department; deputy city electrical engineer (£750 to £1,000), for the City of Bradford electricity department; shift engineer (£376), for the Lancashire Electric Power Co., Ltd.; South African Railway electrification: Engineer in connection with the transmission system (£700 to £850), engineer in connection with the distribution system (£600), engineer for the track equipment (£600). (See our advertisement pages to-day.)

Belgian Electrical Museum.—The Chambre Syndicate des Electriciens, with the support of the Société Belge des Electriciens, has nominated a committee to draft a scheme for the creation of a National Museum of Electricity. A free *locale* for the projected museum has been offered by the Union des Associations Internationales in the Palais Mondial au Cinquantenaire, at Brussels.

Fires.—Glasgow.—Damage was recently caused by fire in premises occupied by Messrs. Walker & Co., medical electricians, Garnethill, Glasgow.

Two buildings, containing electrical appliances, switchgear, &c., at the Aitken Colliery, Fifeshire, have been destroyed by fire. The electricity generating station, which supplies the driving and haulage power throughout a wide area, was saved.

530 Applications.—For the post of engineer, with electrical experience, able to do running repairs to motors (wage £4 5s. per week) in the Vale of Leven, near Glasgow, there were 530 applicants.

Fatality.—Thos. Basil Mather, aged 33, shift engineer at the works of the Lancashire Electric Power Co., Outwood, Radcliffe, Lancs., was cleaning a portion of the switchgear on Monday when he received a fatal shock.

North-West Midlands Electricity District.—The conclusion arrived at by the Electricity Commissioners as a result of the inquiry that was held at Wolverhampton in February last with respect to the above district, have come to hand too late for publication this week. Briefly, it may be said that the Commissioners are of the opinion that the district as provisionally determined should be confirmed (subject to minor modifications) and that the promoters' scheme (also subject to certain modifications) will materially improve the supply of electricity within the area. They approve of the proposal to immediately extend the system of interconnection now existing between generating stations in the district and of the proposal to construct the first section of a capital station at Rugeley.

A Joint Electricity Authority is to be constituted, but the Commissioners are unable to accept the Walsall Corporation's suggestion that there should be a separate district with a separate Joint Authority for the southern portion of the area. Moreover, it is thought that the proposed extension of the Birchills station would not be practicable. Fuller details will be given in our next issue.

Automatic Train Control.—On another page we summarise the report of the Automatic Train Control Committee appointed by the Ministry of Transport. It is interesting to note that a report on the same subject has recently been made by the U.S. Interstate Commerce Commission—which, however, does not issue recommendations, but *orders*. Forty-nine railroad authorities were ordered to install automatic train control systems, and although forty of them entered an appearance to show cause why the order should not be enforced, the only modification made was an extension by six months of the time given to complete the installation. The arguments against the order, according to the *Railway Review*, were that the art of train control had nowhere passed the experimental stage; costs were too high; the number of systems being so large militated against the selection of the best; and other points, characterised as "an attempt to establish all sorts of imaginary difficulties." The diverse character of the conditions upon the different railway systems precluded definite general estimates of cost, but the Commission instanced a number of cases in which automatic control had been installed. The Order made by the Commission gives a full specification of the purposes and requirements of any system of control adopted, and, in general, the points dealt with agree very closely with the recommendations of the British Committee. It is ordered that each company affected must file with the Commission, on or before January 1st, 1923, a complete plan of the signalling system employed, and upon the first day of every month thereafter a report must be submitted upon the progress made with the installation of automatic train control. The time for completion was originally fixed for July 1st, 1924, but, as stated, the date has been altered to January 1st, 1925.

Temperature Limits in Large Machines.—At the annual Convention of the A.I.E.E. at Niagara Fall, Ontario, in June last, Mr. P. Torchio, chief electrical engineer, New York Edison Co., reviewed the above subject, pointing out that the present Institute standards allow a maximum limit of 105 deg. C. for fibrous insulation and 125 deg. C. for mica insulation with an allowance of 150 deg. C., subject to special guarantees of the manufacturer. In high-voltage machines of large size, the effect of actual copper temperatures higher than 105 deg. C. may cause softening and disappearance of binding materials, bulging of insulation, and consequent powdering of insulation under periodic pounding of copper on softened material, and ionisation at voids so created. Operating experience of four large machines demonstrated the above effects to repeatedly take place in machines operating at copper temperatures of 150 deg. C. None of these effects were noted in machines operating at copper temperatures of 105 deg. C. or under. Two machines have safely operated for over three years at maximum copper temperatures of 130 deg. C. Incorrect conclusions may be made as regards the safe temperature limits by judging the performance of machines unless actual copper temperatures are known. Lower ambient temperatures and fractional loads may reduce the operating temperatures from 25 to 35 deg. below the assumed limits. Machines designed for high temperatures are less efficient than machines designed for low temperatures, in one instance the difference being as great as several hundred kilowatts at all loads. The calculation of ventilation of large machines is relatively uncertain; it is of importance to aim at a conservative limit rather than set it too near the danger point. From the standpoint of economy as well as for greater safety, it appears that large machines should not be operated at higher copper temperatures than 105 deg. C. This means that with outside air ventilation seldom exceeding 20 deg., the maximum standard limit with the standard reference of 40 deg. ambient should be 125 deg., equivalent to 85 deg. maximum rise at the copper. In all cases where the room air is close to 40 deg. the maximum copper rise should be limited to 65 deg. Other correlated and important features discussed incidentally in the paper are the typical proportionality of life at different temperatures for fibrous insulation, and the new tentative conventional allowance for reducing to maximum copper temperature, readings taken outside the insulation.

Metropolitan-Vickers Roll of Honour Unveiled.—The unveiling of the roll of honour in memory of the members of the Metropolitan-Vickers Approved Society who fell in the war took place on August 2nd in the workmen's canteen of the company's Trafford Park works. There was a large assembly, including relatives of many of those who fell. The ceremony commenced with the reading, by the Rev. Henry Mitchell, M.A., of an appropriate passage from the ancient author of Ecclesiasticus. In the course of his remarks the chairman (Mr. R. W. Rowe) mentioned that during the period of the war, out of a total male membership of 2,301 covering that whole period, 924 men joined the Colours. Out of this large number 74 men failed to return, and, he added, it was to their memory that this tribute of regard was to be paid. On behalf of the members of the society, and in memory of the dead, whose names appear on the roll of honour, he therefore requested Captain Hilton (managing director of the company and president of the M.V. Approved Society) to unveil the memorial. Following the unveiling the Rev. Henry Mitchell pronounced a short dedication. An expression of appreciation of the two gentlemen who had been good enough to unveil and dedicate the memorial was given by Mr. A. Walmsley (secretary of the society). The singing of the National Anthem brought the ceremony to a close.

Service Notes.—Electrical Artificer Joseph H. Harpum, serving on H.M.S. *Vernon*, torpedo school ship at Portsmouth, was the only candidate who sat for the examination for warrant rank recently, and passed. It has been intimated that Lieut. H. R. Latimer (Electric Lights Co.) City of Edinburgh Fortress Engineers (Territorial Force) has relinquished his commission, to which he was appointed in the corps in 1915. He was for some time employed on the staff of the Scottish Command; he retains the rank of lieutenant.

The Metallic State.—Recent advances in our knowledge of the structure of the atom have added very little to the elucidation of the nature of the metallic state, and in this connection a very suggestive paper by Prof. C. A. Kraus, in the June number of the *Journal* of the American Chemical Society, will be of interest. According to modern views the metals owe their characteristic properties to the presence of negative electrons free to move within the body of the metal. Electronegative elements, such as chlorine, owe their characteristic property of forming anions to the fact that they are capable of forming stable complexes (the ions) with one or more negative electrons. Metallic properties may be expected only in such substances as do not contain sufficient electronegative elements to engage the negative electrons supplied by the more electropositive constituents, or otherwise, in which electronegative elements are lacking. The smaller the affinity of an element or group for the negative electron the more electropositive will it appear, and the more readily will it enter into reaction with more electronegative elements. The assocation of negative electrons with positive metallions, which is supposed to make up the structure of a metal, has some resemblance to a salt. At very low concentrations the negative electron may no longer possess the freedom of motion characteristic of the metallic state, and it is known, for instance, that mercury vapour is a very poor conductor. The metal may, under such conditions, exhibit salt-like properties, and intermetallic compounds may also show resemblances to salts. There are many such compounds which have properties in harmony with this view. The more electronegative elements in such compounds are supposed to have a negative charge. The compound Na_3Sb is then similar to Na_3N or Na_3P. The question is raised whether the apparent deviations of intermetallic compounds from the valency relations may not be due to the tendency of electronegative elements to form complexes. This is shown in the compounds NaN_3, KI$_3$, &c., and it is suggested that something of the kind occurs in such compounds as Na_4Sn, Na_3Sn, Na_4Sn_3, NaSn, and $NaSn_2$. The atoms in such complexes, however, may not all function in the same manner. The property of metallicity is not an atomic one; it is due to the negative electron, and the rôle of the positive constituent is a secondary one. Many reactions in liquid ammonia solution, and the existence of substituted ammonium amalgams and substituted ammonium radicals in liquid ammonia solution support the views expressed. As an example it is stated that tellurium reacts with a solution of sodium in liquid ammonia to form a white crystalline precipitate of the typical salt-like compound Na_2Te. On further addition of tellurium this goes into solution with the production of complex tellurides, Na_2Te_3 and Na_2Te_5, which form strongly coloured solutions, similar to those of alkali-metals, and when precipitated form solution exhibiting metallic properties.—*Nature*.

Wireless Ship Control.—One of the outstanding features of the naval exercises off the Isle of Wight on August 1st, was the control of the 16,500-ton *Agamemnon* by means of wireless at a speed of 15 knots from the destroyer *Tuscan*. It is said that the ship was not only steered in this manner, but that her engines were also started, stopped, and controlled while running, by the same means, the boilers being fired with oil fuel.

United States Water-power Development.—The Federal Power Commission reports that there is more water power development under way in the United States than at any previous period in the nation's history.

Applications for water-power developments filed with the Commission have reached a total of 321, and involve approximately 20,000,000 h.p., or more than twice the existing water-power installation of the country. In the last year, after the first flood of applications had come in, they aggregated 6,000,000 h.p. of proposed installation. Up to June 30th last, the report states, the Commission had authorised a total of sixty preliminary or survey permits and forty-nine licences, eighteen of the latter for transmission lines, the permits involving an estimated installation of 2,386,000 h.p., and the licences for power projects aggregating 1,932,000 h.p.—*Reuter's Trade Service* (Washington).

INSTITUTION NOTES.

Engineering Joint Council.—It is announced that proposals for closer co-operation amongst the leading engineering institutions, which have recently been under consideration, have now received the approval of the Institutions whose representatives met in conference, namely, the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, and the Institution of Electrical Engineers, and that an Engineering Joint Council composed of representatives of these bodies has been formed.

Among the objects of the Joint Council will be to improve the status of engineers, to secure the better utilisation of their services in the country's interests and the appointment of properly qualified individuals to responsible engineering positions, and to prevent the unnecessary duplication of activities.

It is anticipated that, at a later stage, the number of bodies represented on the Joint Council may be increased, but this at present remains a matter for future consideration for the Joint Council and the institutions concerned.

Institution of Electrical Engineers.—Examination.—It is proposed to hold the Associate Membership Examination in London and at other places (at home and abroad) towards the end of October, 1922. Entry forms and full particulars can be obtained from the Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C.2.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

On Wednesday last week a very large and enthusiastic gathering was held at the Cannon Street Hotel for the purpose of making a presentation to Sir George Sutton, Bart., the chairman and managing director, upon whom so well-merited an honour was recently conferred by His Majesty the King. The presentation took place prior to a Bohemian concert, and it was made on behalf of the staff of W. T. Henley's Telegraph Works Co., Ltd., and Henley's Tyre and Rubber Co., Ltd. Mr. A. E. Salmon, the secretary, presided over a company numbering about 350. Those present included Mr. Percy Rosling (general manager), Mr. A. A. Campbell Swinton and Mr. W. J. Potter (directors), Mr. Henry Savage (manager of the Woolwich works), Mr. R. O. Wright (manager of the Gravesend works), Mr. C. H. R. Thorn (manager for India), Mr. J. Traxler (manager of the Tyre Co.), Mr. W. F. Bishop (the sales manager), the managers of the company's branches throughout the Kingdom, and a large proportion of the staffs from the company's head offices, Woolwich and Gravesend works and branches. As Lady Sutton entered the hall with Sir George she was presented with a handsome bouquet consisting of scarlet and white carnations, lily of the valley and asparagus fern. The presentation to Sir George took the form of an illuminated address and a silver inkstand.

The welcome given to Sir George and Lady Sutton was most enthusiastic. "He's a jolly good fellow" being most heartily sung. Sir George was deeply moved. Mr. Salmon, in asking Sir George to accept the address of congratulation from the staff upon the honour that had been conferred upon him, first welcomed Mr. A. A. Campbell Swinton, the new director. He proceeded to refer to the pride which all branches of the staff felt in the magnificent work which Sir George had done for the company. They were proud of the eminence to which he had attained in the electrical industry. Mr. Salmon said that he had been closely associated with Sir George for close upon thirty years, and was in a better position than almost anyone there to testify regarding the value of his work in bringing the business to its present huge proportions. Sir George had always been mindful of the interests of the staff. An announcement would shortly be made respecting the recently completed Foreman's Pension Fund, which scheme would ultimately cost the company close upon £40,000. The speaker referred briefly to the presence of Lady Sutton and her interest in the welfare of the staff, and subsequently read the terms of the illuminated address.

Sir George Sutton, on rising to reply, was greeted with long and hearty applause. He said he had been faced with many difficult positions in the course of his career with Henley's, but none was more difficult than that one. The history of Henley's company during the last forty years was the history of his own commercial career. Forty years was a long time. He believed he was the oldest servant in the service of Henley's company. The dignity which had lately been bestowed upon him had not been conferred solely because of the success which Henley's company had achieved. There were other reasons, but the basis of all of them was the success of the company, because it had been the success of the company that had made those other reasons possible—the public work and other things which he had been able to do notwithstanding the close service and attention given to Henley's company. Sir George proceeded to try to trace clearly the rise of the company, and to name those who had been associated with him in the development of the concern, from Mr. Henley—who died forty years ago—Mr. Hatton, and Mr. Salmon, to Mr. Percy Rosling, the present general manager.

The concert which followed the speeches was very successful, every item being greatly appreciated.

Sir Alexander B. W. Kennedy has joined the board of the Westminster Electric Supply Corporation, Ltd.

The marriage took place at St. Peter's Church, Dyrham, near Chippenham, on July 15th, of Mr. Percival Grice, A.M.I.E.E., second son of Mr. Grice, of Richmond House, Aylestone, Leicester, and Miss Beatrice Lena Millership.

According to Press reports Mr. Samuel Insull, of Chicago, is at present in London.

In the July issue of the *Telephone News*, of America, the following interesting remarks appear under the title "Telephone engineers honoured in America and England.":—

"An unusual measure of international tribute has been paid to the engineering forces of the Western Electric Co. and its allied companies. Coincident with the election of Frank B. Jewett, vice-president in charge of engineering and manufacturing departments, to the presidency of the American Institute of Electrical Engineers, word has been received from the other side of the Atlantic of the selection of Frank Gill, European chief engineer of the International Western Electric Co., to head the Institution of the Electrical Engineers in Great Britain. Mr. Jewett, who is one of the best-known telephone engineers in the United States, was elected a vice-president and director of the Western Electric Co. last year after a score of years' activity with the Bell system. He was appointed assistant chief engineer in charge of all development and research work at the laboratories of the American Telephone & Telegraph and Western Electric Companies in 1912, and four years later was made chief engineer. During the war Dr. Jewett served as a colonel in the signal corps. He was an advisory member of the Special Submarine Board of the Navy, and contributed much toward the perfection of devices for detecting hostile submersibles. The perfection of wireless telephony is one of the greatest undertakings completed under his supervision. Mr. Gill has been associated with the International Western Electric Co. since July, 1919, when he took over the supervision of all its many extensive engineering problems throughout Europe, Africa, and the Near East. Prior to that date he had been a member of the firm of Gill & Cooke, the well-known electrical engineers, of London. Mr. Gill was for many years chief engineer of the National Telephone Co., of Great Britain, and only severed his connection with the active side of telephone operation when the system was taken over by the British Government."

Mr. John J. Ash has left the British Thomson-Houston Co., Ltd., where he was employed for many years in their Industrial Control Department. He has now entered into partnership with Mr. R. J. D'Arcy Hart, M.A., A.M.I.C.E., at 70, Victoria Street, London, S.W.1, where they are carrying on business as engineers under the name of Ash & Hart.

The marriage of Dr. J. W. Nicholson, F.R.S., president of the Röntgen Society, and vice-president of the Physical Society to Dr. Dorothy Wrinch, who is described as the first woman lecturer in mathematics at Cambridge, took place at Surbiton on Wednesday last week.

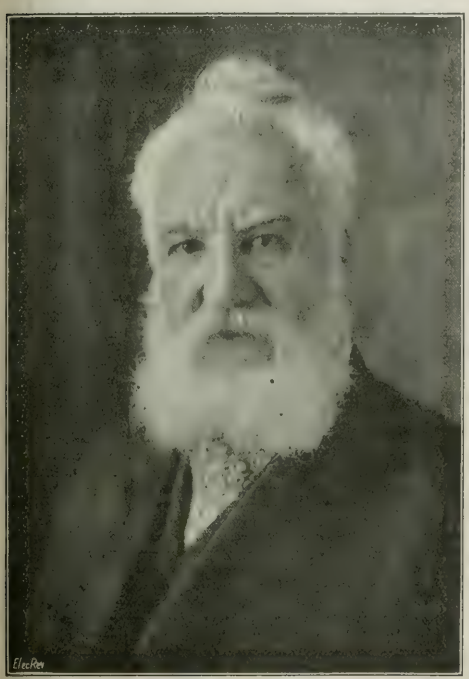
Obituary.—Alexander Graham Bell.—With deep regret we announced in our last issue the death, on the 1st inst., of the inventor of the telephone.

Alexander Graham Bell was born in Edinburgh on March 3rd, 1847, the son of Alexander Melville Bell, author of "Visible Speech," and grandson of Alexander Bell, author of "The Practical Elocutionist." Graham Bell followed the profession of a teacher of elocution as had his father and grandfather before him. The successive generations of the family advanced the art in accord with the developments of science and, in preparation for his subsequent career,

Graham Bell's educational course included the principles of anatomy, and the practice of music. Sound in general and speech sounds in particular were matters of much interest to him in his early years. As an exponent of his father's method of "visible speech" he became as a boy acquainted with Alexander Ellis and also with Wheatstone, who aroused his interest in speaking machines.

On the acoustic side Bell was well equipped to investigate the transmission of sounds, but he had no electrical experience. With a view to repeating Helmholtz's experiments in the transmission of vowel sounds he experimented, in 1867, with ordinary telegraph apparatus in the vain effort to cause the continuous vibration of a tuning fork by means of electromagnets.

In August, 1870, Bell's father left England with his family and took up his residence in Canada, near Brantford, Ontario. In the following year Graham Bell was in Boston advising the Board of Education regarding the application of his father's system of visible speech in the teaching of deaf mutes. It was in Boston that his earlier interest in the electrical transmission of sounds was revived, and he conceived the idea of a system of multiplex telegraphy by means of tuning forks of different pitch. As his experiments progressed his aims widened, and he sought the transmission not merely of



The Late Alexander Graham Bell.

telegraphic signals but of the voice itself. He wrote to his parents on March 18th, 1875: "Such a chimerical idea as telegraphing vocal sounds would indeed to most minds seem scarcely feasible enough to spend time in working over. I believe, however, that it is feasible, and that I have got the cue to the solution of the problem." The acoustic side was well within his grasp. How to transform the undulatory aerial wave into an electrical equivalent and re-transform to an aerial wave again was his immediate quest. In the same letter, above quoted, he records his interview with Prof. Henry, "I felt so much encouraged by his interest that I determined to ask his advice about the apparatus I have designed for the transmission of the human voice by telegraph. I explained the idea, and said 'what would you advise me to do, publish it and let others work it out, or attempt to solve the problem myself?' He said, he thought it was 'the germ of a great invention,' and advised me to work at it myself instead of publishing. I added that I felt that I had not the electrical knowledge necessary to overcome the difficulties. His laconic answer was 'Get it!'" That Bell got it the world knows, and that he was not long in getting it may be seen from the fact that his patent bears date within a year of his letter, and this patent covered all practical methods of speech transmission.

Remarkable as was the invention perhaps the characteristics of the inventor were still more remarkable. He restrained his enthusiasm within the comprehension of his financial supporters, who sought multiple telegraphs as a paying proposition, and would have regarded the attempt at speech transmission as energy wasted and money thrown away. But when the feat was accomplished they were able to realise its value and promote its use for the benefit of the world, the inventor, and themselves. He outlined the exchange system in a letter to the London financiers who were promoting the business here, but he contented himself with suggesting that the private lines then contemplated should be run through a central office, permitting subsequent intercommunication when the time was ripe for it. Bell was remarkable, too, for his modest bearing. He was content to have accomplished, and never enlarged upon his claims. He entered into no angry controversy with rivals, nor sought credit from later developments which had followed in the train of his own invention.

In later years, as our photograph shows, Bell had acquired a leonine appearance, but this was more than misleading. He had a quiet confidence and a graceful charm which were attractive to all who came in contact with him. On one of his infrequent visits to the land of his birth and training, though no longer his home, he spoke during an evening spent with a few electrical friends less about the telephone than about the developments of flying machines, then in the future, but in his view capable of accomplishment. On his last visit to London (in 1920) he attended a meeting of the Wireless Section of the Institution, and addressed the members in characteristic strain, relating that whilst he looked back upon the telephony of the past, the Wireless Section could look forward to an important share in the telephony of the future. It may be recalled, however, that the first wireless telephone was Bell's own photophone, exhibited to the members of the Institution on December 8th, 1880.

It is reported that on Friday evening last the whole of the telephone service throughout Canada and the United States was suspended for one minute as a tribute to the inventor.

Mr. Bernard Godfrey.—We regret to read in *The Times* of the death of Mr. Bernard Godfrey, M.Inst.C.E., M.Inst.Mech.E., M.Inst.E.E., which occurred recently at Hindhead. Mr. Godfrey served his pupilage in engineering with Messrs. Quick & Son. In 1876 and 1877 he was assistant engineer under Messrs. Harding & Co., contractors, in Paris, and he superintended the construction and running of the first steam tramways in that city. From 1878 to 1880 he was engineer and manager in London for the Lontin Electric Light Co., erecting and working some of the first public electric lighting installations in London, at Aldersgate and Moorgate Street Stations, the old Gaiety Theatre, and the Opera House. In 1881 he became a partner in the firm of Messrs. J. & E. Hall, engineers, of London and Dartford, and subsequently managing director of J. & E. Hall, Ltd.

NEW COMPANIES REGISTERED.

Home Radio and Electric Co., Ltd. (183,510).—Private company. Registered August 1st. Capital, £2,000 in £1 shares. To carry on the business of wholesale or retail sellers, installers and suppliers of apparatus for wireless telephony and telegraphy and any other telephonic or electric, magnetic, galvanic, mechanical and other apparatus and appliances, &c. The first directors are: A. F. Wood, "Dagla," Beeston, Notts. (director of Brandt's L.M. Ericsson Manufacturing Co., Ltd.); M. S. Pierce, 233, Wright Avenue, Toronto, Canada; G. L. Crowe, "Beech Hollow," Oatlands Park, Weybridge, Surrey; J. H. Reed, 37, Friern Road, Dulwich, S.E. Registered office: Walter House, 418-422, Strand, W.C.2.

Car Electrical Service, Ltd. (183,501).—Private company. Registered August 1st. Capital, £500 in £1 shares. To carry on the business of manufacturers of and dealers in dynamos, electric motors, batteries, generators of electricity and electric lighting and starting sets and apparatus for motor cars, automobiles, lorries and charabancs, &c. The first directors are: W. D. Oddy, 47, Gledhow Wood Grove, Leeds, R. D. Fairclough, S. Park Road, Dewsbury (both directors of Wilson, Hartnell & Co., Ltd.); S. Hoggart, 22, Dorset Avenue, Harehills, Leeds. Solicitors: J. Hepworth, 14, Buus Court, Albion Street, Leeds. Registered office: 11, New Station Street, Leeds.

Wilson Hartnell (Installations), Ltd. (183,479).—Private company. Registered July 29th. Capital, £100 in 1s. shares. To acquire the installation business carried on by Wilson, Hartnell & Co., Ltd., and to carry on the business of electricians, mechanical and electrical engineers, manufacturers and workers of and dealers in electricity, motive power and light, &c. The first directors are R. D. Fairclough, S. Park Row, Dewsbury, W. D. Oddy, 47, Gledhow Wood Grove, Roundhay, Leeds (both directors of Wilson, Hartnell & Co., Ltd.). Registered office: 11, New Station Street, Leeds.

Northern Auto Electric Services, Ltd. (183,463).—Private company. Registered July 29th. Capital, £5,000 in £1 shares. To carry on the business of motor ignition specialists, manufacturers of insulated wires and cables and all forms of wire and cable casings, electric light and general engineers, &c. The first directors are: C. S. Ramsden, Osborne House, Alderley Edge, Cheshire; E. J. Chambers, Houghton Lane, Worsley Road, Swinton, Lancs.; W. H. Hodgson, 61, Eccles Old Road, Pendleton, Lancs. Qualification: £250. Remuneration as fixed by the company. Secretary: T. Clough, 6, Slater Street, Failsworth.

Dunn & Co., Cheltenham, Ltd. (183,535).—Private company. Registered August 2nd. Capital, £2,000 in £1 shares. To acquire the business of electrical and general engineers carried on by A. E. Dunn at 21, Bath Street, Cheltenham, Glos. The permanent directors are: W. E. Thomson, Chalfont, Cheltenham; A. E. Dunn, Birdlip Place, Bath Road, Cheltenham. Remuneration as fixed by the company. Registered office: 21, Bath Street, Cheltenham, Glos.

Electricians, Ltd. (183,536).—Private company. Registered August 2nd. Capital, £100 in 5s. shares. To carry on the business of electrical engineers in all its branches. The permanent directors are: A. S. Newman, 60, Vine Street, Uxbridge, electrical engineer; A. J. Taylor, Esthy Villas, Otterfield Road, Yiewsley, general engineer; J. R. Buckeldee, Ivy Cottages, Hillingdon, hot water fitter. Registered by C. Doubble, 14, Southampton Inn, E.C.

Midland Wireless Manufacturing and Supply Co., Ltd. (183,482).—Private company. Registered June 31st. Capital, £400 in £1 shares. To [illegible] electrical engineers and manufacturers of [illegible] apparatus of all kinds, &c. The first directors are: A. Barnett, [illegible] Staffs; A. Birkett, Thomas Street, Hanley, Stoke-on-Trent; N. Birkett, Thomas Street, Hanley, Stoke-on-Trent; E. V. Birkett, Thomas Street, Hanley, Stoke-on-Trent. Qualification: 10 ordinary shares. Solicitor: J. W. Moxon, Hanley.

Joclax, Ltd. (183,476).—Private company. Registered [illegible] 4½ per cent. cumulative preference shares of £1 each and [illegible] ordinary shares of £1 each. To acquire and turn to account any invention relating to electrical and other advertising signs and devices, and to carry on the business of electrical, mechanical and other engineers, founders, manufacturers of electric and other signs and devices, implements and machinery, &c. The first directors are: A. J. Barnett, 23, Cumberland Terrace, Regent's Park, N.W.7; S. Jones, Rowland Hotel, Craven Street, Baywater, W. [illegible] is fixed by the company. Registered office: 80, Bishopsgate, E.C.

Motors Machinery and Metals, Ltd. (183,516).—Private company. Registered August 1st. Capital, £5,000 in £1 shares. To take over (1) the business of a general engineer, manufacturer of engineering specialities, [illegible] carried on by H. G. Smith at Chiswick Park Works, Kent Road, and 40, Rothschild Road, Acton Green, and also the rights of the said H. G. Smith in a patent No. 13,186, of 1922, relating to a swivel vice; (2) the rights of Elizabeth F. Cavender and A. E. Thompson in a provisional patent No. 26,424, of 1921, for economising petrol with reference to internal-combustion engines; and (3) the rights of W. H. Cavender and H. G. Smith in a provisional patent No. 17,807, of 1922, being an improvement relating to distribution for electric ignition for internal-combustion engines. The subscribers (each with one share) are: H. G. Smith, 164, Goldhawk Road, W.12, engineer; W. H. Cavender, 48, Wallingford Avenue, North Kensington, W.10, engineer. The company is to appoint the first directors. Qualification: £250. Remuneration as fixed by the company. Registered office: Chiswick Park Works, Kent Road, Acton Green, W.

Astro Electric, Ltd. (183,472).—Private company. Registered July 31st. Capital, £20,000 in 15,000 9 per cent. cumulative participating preference shares of £1 and 100,000 ordinary of 1s each. To carry on the business of manufacturers of and dealers in machinery and plant, agents, electrical engineers, electricians, &c. The permanent directors are: L. M. Colman, Queen Annes Mansions, S.W. (chairman); D. M. Colman, Queen Annes Mansions, S.W.; A. G. France, 153, Clarence Gate Mansions, N.W.1 (managing director) (all directors of Astro Intensifier, Ltd.); H. A. Geaussent, 15, Netherall Gardens, Hampstead, N.W.; R. G. Lock, United Services Club, Pall Mall, S.W.1 (both directors of Overseas Sales, Ltd.). Remuneration: £100 each per annum (chairman and managing director £400 each). Registered office: Carlton House, Lower Regent Street, S.W.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

E. N. Bray, Ltd.—Particulars of £3,000 debentures authorised July 1st, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, whole amount issued.

Cirencester Electric Supply Co., Ltd.—Particulars of £6,000 debentures authorised April 20th, and covered by trust deed dated July 7th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; present issue £2,300. Trustees: Major F. W. B. Cripps, D.S.O., Waterton House, Glos.; and L. C. Wrigley, The Barton, Cirencester, Glos.

Pleno, Ltd.—Mortgage dated July 27th, 1922, to secure £500, charged on freehold land with factory and premises erected thereon in Ankers Street, Nuneaton. Holder: E. H. Guest, The Lindens, Beeches Road, West Bromwich.

Cambrian Electrolytic Zinc Co., Ltd.—Particulars of £6,000 debentures authorised April 21st, 1922, charged on the company's undertaking and property, except uncalled capital; present issue £2,120.

British Illuminated Sign Co., Ltd.—R. Stephens, of 31, Lombard Street, E.C.3, was appointed receiver or manager on July 20th, 1922, under powers contained in debenture dated August 8th, 1921.

British Mica Co., Ltd.—Particulars of £800 debentures authorised July 6th, 1922, charged on the company's property, present and future, including uncalled capital; whole amount issued.

Orbit Electrical Co., Ltd.—Satisfaction in full on July 21st, 1922, of debentures dated July 1st, 1919, securing £6,000.

S. Thompson, of 37, Lime Street, E.C.3, ceased to act as receiver or manager on July 24th, 1922.

F. E. Baker, Ltd.—Debenture dated June 29th, 1922, to secure £110,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: William Beardmore and Co., Ltd., 36, Victoria Street, Westminster, S.W.

Townson & Chadwick, Ltd.—Debenture dated July 15th, 1922, charged on the company's undertaking and property, present and future, to secure all moneys not exceeding £2,300, which J. Brandwood, of "Brandlesholme," Bury, may be called upon to pay under his guarantee to the company's bankers.

McWhitaker, Ltd.—Satisfaction in full on July 26th, 1922, of debenture dated August 5, 1921, securing £400.

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd.

The annual meeting was held on August 1st. Mr. A. H. P. Stoneham, who presided, related the labour troubles which had forced the company to entirely close down the system for three and a-half weeks, resulting in a considerable loss of revenue. In addition to these circumstances there was also a reaction from the great mining activity of the previous year, which further reduced the income. Owing to taxation the net profit was reduced, but a comparison of the operating profits of the two years showed that the position was not so unfavourable. Under the new miners' award wages in the industry were stabilised for three years, and this should result in increased employment, as the companies would be able to consider reorganisation. The present agreement with their own employés expired at the end of June, and although the Australian Tramway Association had fixed rates for a further period, it looked as though negotiations would have to be entered into. In conclusion, Mr. Stoneham said that, so far, the receipts of the current year were an improvement upon those of the same period of last year, but the latter, of course, included the strike period.

Yorkshire Electric Power Co.

The report for the half-year ended June, 1922, states that the sale of electricity largely increased during that period, and the price charged was substantially reduced, due to the lower cost of coal. A clause varying the price with the cost of coal has for some years been included in the company's supply agreements. The profits show a satisfactory increase, and the progress of the undertaking is reflected in the general improvement in the market value of all securities issued by the company. Interim dividends at the rate of 3 per cent. for the half-year will be paid on the ordinary shares and upon the preference shares issued prior to 1922. The issue in February of £558,360 cumulative preference shares was considerably over-subscribed. Negotiations are proceeding between the various authorities concerned in the West Riding (Aire and Calder) Electricity District, which it is hoped will lead to unanimity when the matter again comes before the Electricity Commissioners for final settlement. On May 31st the Yorkshire Electric Power Act, 1922, received Royal Assent. The Act increases the nominal share capital of the company from £2,000,000 to £4,000,000, with an increase in borrowing powers up to one-third, and the £10 ordinary shares and £5 preference shares become respectively converted into ten ordinary and five preference shares of £1 each. Certificates for shares issued prior to this year are now being exchanged. Certificates for the new preference shares will be ready for exchange early next year.

Electrical Distribution of Yorkshire, Ltd.

The directors report that there has been a large increase in the demand for electricity, and the revenue justifies the payment of an interim dividend of 3½ per cent. (free of income tax) for the six months ended June 30th, 1922. In March last an issue of £47,799 in ordinary shares was made, increasing the issued share capital to £150,000. The issue was considerably over-subscribed, and there has been a large increase in the number of shareholders and a satisfactory improvement in the market value of the shares. A special order has been approved by the Electricity Commissioners, amending the Orders obtained in 1915 for Selby and District and Stanley, and in 1917 for Featherstone, Garforth, Horbury, Otley, Penistone and Rawdon, permitting the company to proceed with the necessary works for supply in those districts. A supply of electricity is already being given in Otley, and preparations are being made to supply in the other districts at an early date.

Marconi's Wireless Telegraph Co., Ltd.

In their report for the year ended December 31st, 1921, the directors again draw attention to the many matters which still remain unsettled, with the result that the accounts once more do not reflect the true strength of the company's position. The credit balance of profit and loss account for the year amounted to £275,361, which, added to the balance brought forward, leaves to the credit of profit and loss account £1,093,928, subject to Corporation profits tax and income tax. From this have to be deducted the dividend on the preference shares 7 per cent. paid on January 31st, 1922, £17,500, and that on the ordinary shares (5 per cent.) paid in January, £131,555, leaving available for distribution £944,873. The directors now recommend payment of further dividends on the ordinary shares of 10 per cent. (making 15 per cent. for the year) £265,543, and 5 per cent. on the preference shares (making 12 per cent. for the year) £12,500, leaving to carry forward £666,830. The directors have carefully considered the value at which the shares and debts due by associated and other companies are entered in the balance sheet, and are of the opinion that in the aggregate they are worth not less than that amount. Patents and rights figure in the accounts at £283,691, and the directors are of opinion that their value considerably exceeds that sum. The report reads: "The past year has been one of unprecedented difficulty. The uncertain political conditions, the unstable exchanges, and the financial stringency which have obtained in almost all countries throughout the world, have not only limited the scope of such a business as ours, so largely dependent in the past on governments, but have also rendered every transaction difficult and anxious, calling for unusual caution. A settlement with our own Government in the circumstances would have been welcome, and would have greatly relieved the difficult period through which we have passed. Your directors, however, regret that they have again to inform you that no settlement has been made by any of the Government departments in respect of any of the company's claims arising out of the war or the services rendered during the war, and no sum, therefore, in respect of any of these claims figures in the past year's accounts. Negotiations are continuing, and your directors would welcome the opportunity of adjusting many matters which must be as irksome and costly to the Government as they are to the company. Several of our associated companies, in consequence of the state of trade and labour difficulties which were experienced during the last year, have

required further financial assistance, which has been afforded them by the company, and for which reasonable interest has been charged. Substantial improvement has manifested itself during this year, which has every appearance of being maintained, and lends considerable encouragement to the future. The facilities afforded by the Postmaster-General to 'broadcasting' in this country are warmly welcomed by your directors. They afford for the first time the opportunity to the company to supply on a large scale wireless instruments to the general public, and should represent a new and important source of revenue. The advent of this new industry should also prove of substantial value to all our subsidiary companies."

Meeting: August 15th.

Swiss Companies.

The *Société de l'Industrie Electrique et Chimique*, of Geneva, has decided to pay a dividend at the rate of 10 per cent. for 1921-22, being the same as in the preceding year.

The *Usine Electrique Clees*, of Yverdon, proposes to pay a dividend at the rate of 8 per cent. for 1921-22 out of net profits of 212,000 fr., comparing with 7 per cent. and 205,000 fr. respectively in the previous year.

The directors of *Brown, Boveri & Co.*, of Baden, after writing off 5,470,000 fr. for depreciation in 1921-22, as against 5,400,000 fr., report net profits of 1,080,000 fr., as contrasted with 670,000 fr. in 1920-21. It is not proposed to make any distribution for the year.

The *Motor Company for Applied Electricity*, of Basle, after having written off 776,000 fr. for depreciation in 1921, reports net profits of 242,000 fr. Of this amount 200,000 fr. has been applied to the redemption of the deficiency on foreign currency account and the balance carried forward.

Prospectuses.—*The Elgin Electric Supply Co., Ltd.*—The list of subscriptions in an issue of 15,000 shares of £1 each at par was to close on or before August 10th. With the consent of the Town Council a Special Order is being obtained from the Ministry of Transport for generating and supplying electricity in the City of Elgin. Information received from Edmundson's Electricity Corporation, Ltd., shows that an initial expenditure of £15,000 will be required, and that a "reasonable dividend" may be expected. An agreement has been entered into with Edmundson's as to the terms on which they will carry out the installation of works. The directors have been calling for support from the people of Elgin through the medium of this prospectus. Mr. A. N. Rye, electrical engineer, of London, is a director, as is also Mr. E. J. Williams, M.I.E.E., the Scottish district manager of Edmundson's Corporation.

Melbourne Electric Supply Co., Ltd.—This company has this week advertised in the financial Press particulars of an issue of £300,000 six per cent. redeemable general mortgage debenture stock, not for the purpose of inviting public subscriptions, but to comply with the requirements of the Stock Exchange.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—

British Thomson-Houston.—1,000,000 7 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 1,000,000).

Dealings in the following have been specially allowed by the Committee under Rule 148A:—

Electrical Apparatus Co.—3,134 eight per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 3,134; and 29,214 new eight per cent. cumulative preference shares of £1 each, partly and fully paid, Nos. 3,135 to 32,349.

Yorkshire Electric Power Co.—£117,000 5½ per cent. redeemable debenture stock.

The undermentioned have been ordered to be officially quoted:—

General Electric.—£94,210 6½ per cent. "A" cumulative preference shares of £1 each, fully paid (Nos. 1,705,791 to 1,800,000), and 177,109 7½ per cent. "B" cumulative preference shares of £1 each, fully paid (Nos. 1,622,892 to 1,800,000).

W. T. Henley's Telegraph Works Co., Ltd.—Dividend on the preference shares at the rate of 4½ per cent. per annum, less income tax, for the half-year ended June 30th; interim dividend on the ordinary shares of 1s. per share, less income tax.

The Swedish Radio Company.—The Svenska Radio A.B. reports that the reconstruction works, which were begun in 1919 and 1920, were continued in 1921, and the sale of complete radio stations and of receivers was also commenced. The company has acquired the sole rights for Sweden of the patents of Marconi's Wireless Telegraph Co. During 1921 the company earned net profits of 1,160 kr., which sum has been applied to the reduction of the loss brought forward from 1920.

East Anglian Electricity, Ltd.—The annual meeting was held at Ipswich on August 3rd. Mr. W. R. Bradbrook (chairman), in the course of his speech, said that substantial progress had been made during the year, the profits having increased by £1,100, and still better results were expected from the current year's working. The company was finding it difficult to meet the growing demand, but the Electricity Commissioners had approved a scheme of plant extension which would prove beneficial both to the public and to the company. At a subsequently extraordinary meeting a scheme to issue £30,000 of ordinary shares as 7 per cent. accumulative shares was approved.

Consolidated Electrical Co., Ltd.—According to the *Financial Times* the net profit to March 31st was £3,476, making available, with £1,015 brought forward, £4,491. A dividend of 2 per cent. is to be paid, carrying £1,391 forward.

City of Buenos Aires Tramways Co. (1904).—[illegible] paid per share at the rate of [illegible] per cent. [illegible] tax, for three months ended June 30th.

STOCKS AND SHARES.

[illegible]

The August Bank Holiday week is an appropriate time for reviewing what has happened in the world of electrical stocks and shares since 1921 ended. The main feature, so far as electricity supply shares are concerned, is the manner in which prices have gone steadily higher almost week by week, with scarcely a glance back [illegible] which occurred in the early part of the year were disregarded as a market factor. The dividend declarations for the final half of 1921 were in every case satisfactory. They had the effect of confirming the confidence with which proprietors of these investments looked forward to the future. This confidence has lately been emphasised by the announcement of increased interim dividends by some of the leading companies.

The Westminster Electric Supply Corporation has very fairly stated that the increase in its own interim dividend must not be interpreted as turning into a certainty the hope that the full dividends for 1922 will exceed those of the previous twelve months. It may be that certain of the companies are announcing these improvements in order to bring into greater equality the amounts distributed in each half-year. Nevertheless, prices continue to advance, and, as it has been said here *ad nauseam*, the great difficulty is to obtain supplies of shares. The County of London Company's issue of new ordinary at 22s. 6d. and of new preference at 20s. is welcomed as affording the opportunity for a wider market to be created in the company's issues. The price of the ordinary has risen to 2s. 6d. premium and the preference to 1s. 3d. premium. These prices are sufficient evidence, in themselves, of the readiness of investors to take good stock offered at reasonable figures. It is probable that in the near future there will be other issues of the same kind.

To proceed with our customary tables. We add, and we hope it will be for the last time, the prices of July 27th, 1914, the date immediately preceding the outbreak of war. The figures are interesting enough, and the comparison with values that obtained just eight years ago will stir a good many recollections. However, the Stock Exchange pre-war engagements come up for a final settlement on the first day of next month; and, after that, the decks, again from the Stock Exchange point of view, will be cleared from pre-war entanglements.

HOME ELECTRICITY COMPANIES.

Share.	July 27th, 1914.	Dec. 31st, 1921.	Aug. 8th, 1922.	Rise.
Brompton & Kensington	9½	6⅜	7½	1⅛
Charing Cross ...	5½	4⅜	7½	3⅛
Chelsea	4⅜	3½	6	2½
City of London ...	—	1 7/16	2 1/32	19/32
County of London ...	12	8⅜	1⅜	9s. 9d.
Kensington	7½	5⅜	7⅝	2
London	1 7/16	1	2⅛	1½
Metropolitan	3¼	3½	5½	1⅞
St. James'	9⅜	6½	8½	2
South London	3 1/16	2½	3½	⅝
Westminster	8⅜	5⅜	7½	1⅛

HOME RAILS.

Stock or Share.	July 27th, 1914.	Dec. 31st, 1921.	Aug. 8th, 1922.	Rise.
Central Lon. Ass. Ord.	8⅜	5½	6⅝	1⅛
Metropolitan	37½	26⅜	49½	23
District	21¼	21½	38	16½
Underground Ord. ...	2½	2	2⅜	⅜
ditto "A" ...	7s. 6d.	6s.	6s. 6d.	6d.
ditto Inc. ...	88	75½	82½	7

CABLES, &c.

Stock or Share.	July 27th, 1914.	Dec. 31st, 1921.	Aug. 8th, 1922.	Rise.
Anglo-American Pref.	108½	84½	104	19½
Eastern Extension ...	12½	16¼	18½	2
Eastern Telegraph ...	130½	166½	186½	20
Globe Telegraph Ord.	11½	16½	19½	3
Great Northern ...	32½	26½	29	2½
Indo-European ...	59	27½	36½	9
Marconi	1 27/32	1 11/16	2⅛	⅜
United River Plate ...	6⅜	5⅜	7	1⅝
West India & Panama ...	1½	⅝	⅞	⅛
Western Telegraph ...	13⅜	16½	19	2½

To draw precise comparisons in the cases [illegible] manufacturing companies' shares is rendered [illegible] by

reason of various rearrangements of capital effected in most instances. The above tables are, however, as interesting as they are eminently satisfactory to investors. Rises are shown in every example save one, and the lists were compiled with no attempt to confine the record of movements to stocks and shares that have advanced. We have no space to set out the remarkable manner in which new issues of good stock, offered over the past seven months, have been eagerly subscribed, and how the issue prices are well below current quotations. The investor is to be congratulated upon the way in which his sound securities have increased in capital value.

The Home Railway market is once more in favour, owing to the welcome accorded by rising prices, to the publication of the terms of the North-Eastern Railway "group." Brazilian Tractions dipped to 49, and recovered to 50. Mexicans are still stagnant.

The Marconi dividend of 10 per cent., making 15 per cent. for the year—the same as that of a year ago—came as a pleasant disappointment, and the price rose from 42s. 6d. to 47s. 6d., reverting to 45s. Marconi Marines strengthened to 1 7/16, and the other members of the wireless group went a little better. Cable stocks are unchanged on the week. Bengal Telephone 7 per cent. scrip is harder at 3¼ premium. It is said that there may be more debenture stock of the Melbourne Electric Co. in the market before long. Holders of high interest-bearing debentures and notes should look into what possibilities there may be of having their securities repaid at an earlier date than they, the holders, anticipate. The rubber and armament markets are exceedingly quiet. A boomlet in South Africans is having a strengthening effect upon Victoria Falls ordinary and preference shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Aug 8, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7⅞	—	£8 0 0
Charing Cross Ordinary	8	9	7⅞	—	6 0 0
do. do. do. 4½ Pref.	4½	4½	4	+ ⅛	5 12 6
Chelsea	6	6	6	-	5 0 0
City of London	14	14	2⅛	-	6 18 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1⅜	—	5 16 5
do. do. 6 per cent. Pref.	6	6	1⅛	+ 1/16	5 7 6
Kensington Ordinary	9	10	7⅛		7 0 7
London Electric	2½	4	2¼		5 11 6
do. do. 6 per cent. Pref.	6	6	5	—	6 0 0
Metropolitan	7	7	6⅛	+ ⅛	6 7 6
do. 4½ per cent. Pref.	4½	4½	4	+ ⅛	5 12 6
St. James' and Pall Mall	12	12	8⅞	—	6 17 2
South London	7	7	8½	—	8 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅞	+ ¼	6 13 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104	—1	5 15 5
do. Def.	1½	34/6	23⅜	—	7 7 6
Chile Telephone	6	6	6	— ⅛	5 0 0
Cuba Sub. Ord.	7	7	8⅜	—	8 4 8
Eastern Extension	10	10	18½	—	5 8 1
Eastern Tel. Ord.	10	10	186⅜	—	5 7 3
Globe Tel. and T. Ord.	10	10	19⅜	—	5 4 7
do. do. Pref.	6	6	11½	—	5 6 8
Great Northern Tel.	24	22	29	-	7 11 8
Indo-European	10	10	36½	—	6 17 0
Marconi	25	15	2¼	+ 1/16	6 13 4
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	+	*5 5 3
Home Rails.					
Central London Ord. Assented	4	4	68	—¾	5 17 8
Metropolitan	1½	2¾	49½	+1½	4 11 9
do District	Nil	1	38½	—	2 12 8
Underground Electric Ordinary	Nil	Nil	2⅜	—	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	2	4	82½	—	*4 17 7
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8½	+ ⅛	7 17 2
do. do. 2nd Pref.	Nil	6½	8¼	—	7 2 0
do. do. 5 per cent. Deb.	5	5	82	—	6 2 0
Brazil Tractions	Nil	Nil	50	—	6 0 0
British Columbia Elec. Rly. Pcs.	5	5	76	—	6 10 9
do. do. Preferred	5	9/-	68½	—	*6 15 0
do. do. Deferred	8	124/-	74½	—	*8 5 10
do. do. Deb.	4½	4½	76	—2	5 11 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	72½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	45¼	+2	Nil
Mexican Light Common	Nil	Nil	21¼	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	5	66½	—2	7 10 9
Manufacturing Companies.					
Babcock & Wilcox	15	16	8	—	5 6 8
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2½	— ⅛	7 1 2
Callenders	15	15	2⅛	—	7 1 2
,, 6% Pref.	6⅜	6⅜	1⅛	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/3	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1⅞	—	8 0 0
English Electric	8	5	17/6	—	5 14 8
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6⅜	6⅜	22/-	—	5 18 2
do. Ord.	10	5	18/9	—	5 6 8
Henley	15	15	2½	—	6 13 4
do. 4½ Pref.	4½	4½	48	—	5 2 10
India-Rubber	10	—	1⅛	—	—
Met.-Vickers Pref.	8	8	2⅛	—	6 11 2
Siemens Ord.	15	10	27/-	+9d.	*7 8 2
Telegraph Con.	20	20	26	—	*4 12 2

*. Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	7¾d.	¼d. dec.
a Ammoniac, Sal	per ton	£63	...
a Ammonia, Muriate (large crystal)	,,	£48	£4 dec.
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£30	...
a Copper Sulphate	,,	£26 10s.	10s. dec.
a Potash, Chlorate	per lb.	5d. to 5½d.	...
a ,, Perchlorate	,,	7¾d.	...
a Shellac	per cwt.	£16 16s.	30s. dec.
a Sulphur, Sublimed Flowers	,,	£11 10s.	10s. dec.
a ,, Lump	,,	£11	...
a Soda, Chlorate	per lb.	3¼d.	...
a ,, Crystals	per ton	£6	...
a Sodium Bichromate, casks	per lb.	5d.	¼d. dec.
METALS, &c.			
b Aluminium, Ingots	per ton	£120	...
b ,, Wire	per lb.	1/9 to 2/6	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£150	...
Grade II	,, ,,	£108	...
Grade III	,, ,,	£62	...
c Brass (rolled metal 2" to 12" basis)	per lb.	9¾d.	...
c ,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c ,, Wire, basis	,,	10¼d.	¼d. inc.
c Copper Tubes (solid drawn)	,,	1/1½	...
c ,, Bars (best selected)	per ton	£94	...
c ,, Sheet	,,	£94	...
c ,, Rod	,,	£94	...
d ,, (Electrolytic) Bars	,,	£72	10s. inc.
d ,, Sheets	,,	£145 10s.	...
d ,, Wire Rods	,,	£82	10s. inc.
d ,, H.C. Wire	per lb.	10 7/16d.	...
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	2/6	...
h Gutta-percha, fine	,,	12/6	...
h India-rubber, Para fine	,,	9¾d.	...
l Iron Pig (Cleveland Warrants)	per ton	90/-	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£25	...
g Lead, English Pig	,,	£26 10s.	10s. dec.
g Mercury	per bot.	£11 5s. to £12 10s.	...
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/1	...
p ,, drawn bars and rods	,,	1/3	...
p ,, rolled strip & sheet	,,	1/2½	...
p ,, wire	,,	1/3½	...
o Platinum	per oz.	£19 10s.	...
d Silicium Bronze Wire	per lb.	1/1	...
r Steel, Magnet, in bars	,,	1/-	...
n Tin, Block (English)	per ton	£162	£2 inc.
n ,, Wire, Nos. 1 to 16	,,	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Telephone Removals.—In the telephone business every day is "moving day." During the past year one telephone out of every seven in the American Bell system was moved from one place of residence or business to another at some time during the year. The amount of material and labour and the extent of plant changes involved in "station movement" are indicated by the fact that this item of service cost the Bell system more than $15,000,000 in 1921. To most people the connecting or disconnecting of a telephone seems a simple operation of installing or removing the instrument. As a matter of fact, in every case it necessitates changes in the cables and wires overhead or underground. It also necessitates changes in central office wires and switchboard connections; in subscribers' accounts and directory listings; and frequently requires new "drop" lines from open wires or cables. The problems of "station movement" are among the large problems of the telephone service. Because of the double operation of disconnecting and re-connecting, the work involved is often twice as great as in the case of new subscribers. With 1,820,000 changes a year it is only by the most expert management of plant facilities that Bell service is enabled to follow the subscriber wherever he goes.

"Quick Repairs."—Siam has electricity and the thoughtful electric light people are doing their best. In every room in a Bangkok hotel is posted a notice in various languages. Its English version reads:—

"Sir: For the case that your electric light should fail, we beg to send you enclosed a postcard, which please send us at once when you find your light out. The company will then send you another postcard."—*American Legion Weekly.*

ELECTRIC LIGHTING IN THE NEAR EAST.

By E. J. HAWKINS.

A wide field is open in the Near East to the enterprising man to develop electric power schemes. The prospect of a handsome return on the capital invested is assured.

The Near East is gradually coming into line with the West in schemes for improvement, and among these is a growing demand for electricity. In the small towns in particular efforts are being made by the natives themselves to promote electrical undertakings, but these efforts are often abortive, because of the lack of intelligent methods. An electric lighting system properly undertaken and managed, that would meet the needs of small towns in Palestine, Turkey in Asia, Greece, and the islands of the Mediterranean and Ægian Seas, would specially prove a lucrative undertaking.

Where such schemes have failed, the failure has been due to insufficient capital and the lack of technical ability on the part of the native promoters—who have gone to work with insufficient knowledge. In scarcely one instance has there been a competent electrician in charge. A proper control of running costs and charges has not been set up. The plant is bought cheaply, with little regard for its capacity, and it is erected in the cheapest possible way. It is run by an indifferent staff badly paid. In a word, greed characterises the promoters. Efficient management, an exercise of discipline and supervision would turn failures into successes. A typical case has come under the writer's notice recently. An electric lighting plant in a certain town, financed by a number of Greek merchants and "controlled" by a so-called electrician, also a Greek, comprised a 4-cylinder Diesel (German make) engine direct-coupled to a d.c. generator. After several months' working, a big-end bearing gave out, resulting in the wrecking of the whole engine and damage to the extent of about £3,000. An examination showed that the break was due to lack of supervision and neglect of the oiling system.

The possibilities of well-conceived and properly-conducted schemes are immense. Many of the inhabitants of these small towns are enthusiastic about electric lighting. The opportunity awaits the enterprising man to take advantage of their enthusiasm and put forward an attractive scheme for the supply of electricity. A return of at least 20 per cent. net profit would result.

A scheme on the lines of what is suggested here is based upon the writer's experience in the Near East.

First, encourage the interest of the people in the proposed undertaking. An offer should be made to fix a complete lighting installation, say, up to ten lamps, free of charge in the houses of the first thirty applicants. Others would quickly follow. The average population of these small towns is about 12,000 inhabitants, of whom, perhaps, one-eighth would avail themselves of electric lighting. This would mean installations in about three hundred houses, each house having from ten to fifteen lamps. On an average one could assume 12.5 lamps of 20 watts each to every house, making a total of 250 watts per house, or 75 kilowatts for the whole. In practice, however, not more than 60 per cent. of the total installation for house lighting would be in use at any one time, so that plant capable of an output of less than 75 kilowatts would suffice. Probably house-lighting demands would be reduced to 45 kilowatts. Estimating the street lighting at five miles, with thirty-three 30-watt lamps to the mile, would make 4,950 watts, or a further five kilowatts charge on the plant. Therefore, a plant capable of delivering 50 kilowatts would meet the requirements of such a town.

In selecting an engine for such work, two points must be taken into consideration—climatic conditions and the native temperament; and the class of engine that meets these satisfactorily is the semi-Diesel crude oil engine. This engine can be operated easily by a person of limited intelligence and knowledge without much fear of a breakdown. In some localities water power could be employed. To drive a dynamo of 50 kilowatts output would require an engine of 70 b.h.p., but the most economical working would be obtained with a two-unit plant each unit of 35 b.h.p. and 25 kW running in parallel at times of heavy load. This would ensure the load factor and diversity factor of the station being relatively high.

With a two-unit plant and a steady lighting load a station battery would not be necessary, but this could be installed later should the demand for electricity increase. Normally the plant would be run from sunset to sunrise, but if any consumers could be induced to take energy for power purposes a day load might be arranged.

A number of these small duplicate plants might be erected in different towns—say five towns to one group—and the group put under the charge of a competent electrical engineer. His duty would be to visit the various stations and control and supervise the working of the whole system, the actual running being left to native electricians and mechanics. The Near East can produce some fairly competent craftsmen who, under the supervision of competent engineers, can be made to do good work.

The following figures show the probable expenditure and receipts from such a system:—

Capital Expenditure (for one station only)—	£
Acquisition of freehold of site	200
Two 35-h.p. semi-Diesel engines, direct coupled to two 25-kW d.c. generators at £1,180 each	2,360
Switchboard and switchgear	150
Building	750
Cable for mains (say)	1,500
Poles for above	750
Fittings for street lighting	125
Erecting charges, freight, insurance and incidentals	350
Meters	900
	£7,085

This gives the outlay for five stations—£35,425.

Annual Expenditure (for one station only)	£
Crude oil, say 12,000 galls. per annum, at 9d per gall. (in bulk)	450
Lubricating oil, say 1,000 galls. per annum, at 3s. per gall.	150
Sundries, renewals, &c.	100
Wages—	
1st electrician and mechanic, at £12 per month	144
2nd electrician and mechanic, at £6 per month	72
3rd electrician and mechanic, at £4 per month	48
Clerk, at £7 per month	48
Rates and taxes (say)	10
Stationery, postage, &c.	50
	£1,108

This gives a running expenditure for five stations—£5,540.

Earning Capacity (for one station only)—	£
House lighting consumption might be estimated at 48,000 kWh per annum, at 1¼ shillings per unit	3,200
Street lighting at 18,000 kWh per annum, at 6d. per unit	450
Rent of meters, at 1s. per month	18
	£3,836

This equals £19,150 for five stations.

Assuming that 10 per cent. depreciation is charged

against revenue on the capital outlay, then we should arrive at the following result:—

Trading Account

	£		£
Annual expenditure over five stations ...	5,540	Yearly income from five stations ...	19,150
Salary and travelling expenses of engineer	1,100		
Depreciation ...	3,442		
Profit	9,068		
	£19,150		£19,150

Which shows a return of over 20 per cent. on a capital of, say, £40,000.

MINERAL SULPHIDES AS A SOURCE OF ELECTRIC ENERGY.

According to Mr. G. N. Libby in the *Engineering and Mining Journal*, of April 22nd, 1922, laboratory experiments show that a cell of the Bunsen type can be used with iron pyrite as an anode in an alkaline solution, and the possibility of economy over existing methods of generating power is suggested. The following is a summary of the chief points of the article:—

It has been known for some time that mineral sulphides may function, both as soluble and insoluble electrodes, in electrolytic cells. The fact that they may be a source of electric energy of commercial value is not so well known. The heat of oxidation of carbon and sulphur and some mineral sulphides is given in the following table:

	Calories, per kg.	Electrical Equiv. kWh per kg.
Carbon to carbon dioxide ...	8,000	9.55
Sulphur to sulphur trioxide ...	4,410	5.10
Iron pyrite to ferrous sulphate and sulphuric acid	2,930	3.40
Zinc sulphide to zinc sulphate ...	2,345	2.73
Galena to lead sulphate	815	0.94

It will be noted that weight for weight at maximum oxidation sulphur has about half the heat of carbon, and that the electrical equivalent of this heat is 5.1 kW-hr. per kilo. of sulphur. But sulphur as such is too poor a conductor, and it is only when combined with metals, such as copper, iron, or lead, that it becomes a readily oxidisable substance as an electrode. Amongst these mineral sulphides galena is the best conductor, but its high molecular weight makes the heat of oxidation of an equal mass only equivalent in energy value to one quarter of its weight in pyrite, which, in turn, yields about one-third of that of an equal weight of carbon. Carbon burned under a boiler yields about one-third of its energy as electricity.

If the heat of oxidation of pyrite can be changed directly into electric energy, then it is practically equal to carbon as a source of that energy. While data of the power-house cost of changing the heat energy of coal into electricity are available, no such data exist for the operation of cells of the type and size that the operation of obtaining power from oxidation demands. However, in the cyanide metallurgy of gold extraction on a large scale the cost of agitation, filtration, handling, &c., such as would also be necessary in electrolytic cell operation, is not more than 70 cents. per ton at the Homestake Mine. But it must be remembered that large quantities of copper pyrites are daily oxidised in metallurgical plant, the gaseous products of which are often discharged into the atmosphere, and not infrequently cause material damage. The cost of oxidation, which is usually a roasting operation, credited against any system of producing equivalent results for recovering the copper from the ore must be taken into account.

Comparison with coal is scarcely admissible; in pyrites we have a substance that is practically a waste product, which is mined and delivered, and which must be oxidised by some method as a necessary part of the extraction of the valuable associated metal. In the Butte district of Montana about 4,000 tons of copper pyrite is oxidised daily in the production of copper. The energy capable of being generated by this pyrite, if there were no loss, is equal to

3,490 × 4,000 = 13,960,000 kWh;
13,960,000 ÷ 24 = 580,000 continuous kW.

If compared with the best coal-burning practice, this is worth

580,000 × $2.20 = $1,600,000 per year;
1,600,000 ÷ 365 = $4,400 per day;
$4,400 ÷ 4,000 = $1·10 per ton of copper pyrite.

The proportion of this value that would be realised would depend on cell efficiency, which might be anything from 50 to 90 per cent. Power from cell oxidation of sulphides could not, any more than coal, compete with cheap water power, but the value of water power is, nevertheless, estimated at its cost in competition with coal. The oxidation of mineral sulphides in cells is found to proceed rapidly in alkaline solution, the mineral acting, in fact, similarly to metallic zinc in an alkaline solution, but with a lower e.m.f.

Nitric acid is an efficient depolariser, producing by the cell action NO_2, which is readily oxidised again to HNO_3, so that, theoretically, by proper oxidation and absorption of the gases from a cell of the Bunsen type nearly all the acid could be regenerated for repeated use. A modification of a cell of this type may consist of a tall 300 c.c. beaker in which is placed a smaller 200 c.c. beaker. Into the small inner beaker is poured enough mercury to cover the bottom about a quarter-inch deep. An insulating layer of chloroform of about the same volume is added and a piece of pyrite about one inch cube placed in the beaker, making good contact with the mercury. On this a strong solution of alkali is poured to nearly fill the beaker. Strong nitric acid is put in the outer beaker, enough to make the liquids in the two beakers equal in height, and the two solutions are connected with about 30 quarter-inch asbestos wicks. A platinum wire serves as the acid electrode, but other substances might be used. A copper wire protected by a glass tube and inserted into the mercury gives connection with the pyrite.

This cell, on closing, gives 1.15 volts and 0.3 amp. with no diminution of current until ferric hydrate resulting from the action forms in sufficient quantity to create a resistance. The ability of pyrite to depolarise or oxidise in an alkaline solution can be shown in such a system by sending through a current of 2 amps. with a pyrite anode surface of two square inches, when little or no evolution of oxygen is observed. The current taken from such a cell depends upon the internal resistance, which is due principally to the asbestos wick diaphragm and the electrode coating. Ferric hydrate is soluble in sodium potassium tartrate and other organic substances, and if one of these is added to the anode solution it keeps ferric hydrate from coating the anode. The cell, in principle, is only an adaptation of a well-known form of cell of the Bunsen type, but the use of a mineral sulphide as an oxidising electrode in such a combination is believed to be new. The reaction of the cathode in the nitric acid compartment is fairly well established.

At the anode, however, two reactions occur: first, the oxidation of the sulphide to sulphate, then the reaction between the sulphate and the alkali with the formation of ferric hydrate. Consequently alkali, as well as sulphide, is consumed. To replace, say, caustic soda would be economically impossible, but lime (calcium hydrate) is cheap and abundant. This could be used directly in the cell, which might involve calcium sulphate incrustations, which would produce insulation. In that event an indirect method probably could be developed. The design of the laboratory cell described cannot, of course, be adopted on a large scale. It merely serves to demonstrate the fact that the oxidation of mineral sulphides yields electric energy. But a suitable cell could be devised without great difficulty for large-scale operation. Pyrite has twice the value of an equal weight of zinc, and the energy generated by the oxidation of the sulphur of the sulphide is much more than enough to precipitate its metal from the sulphate formed. It may be possible to oxidise the sulphide in one cell generating electricity, and in another cell to use this energy to electroplate the metal from the solution resulting from the action in the first cell. The reason for this excess energy oxidation over that needed to deposit the metal is evident when it is realised that the complete oxidation of pyrite requires seven atoms of oxygen, whereas reduction of ferrous oxide requires that one atom only of oxygen be taken away.

The conclusions set out above may be summarised briefly as follows:—

(1) Certain mineral sulphides are a possible source of electrical energy.

(2) Pyrite seems particularly promising for this purpose, especially in view of the fact that it is now oxidised metallurgically in enormous quantities with waste of the volatile products.

(3) A simple laboratory cell has been described which demonstrates the possibility of oxidising mineral sulphides with the production of electrical energy.

(4) The new fact demonstrated appears to be that mineral sulphides, such as pyrite, oxidise readily as an anode in an alkaline solution.

Association of Mining Electrical Engineers.—On July 29th members of the Midland Branch of the Association paid a visit to the works of the Brush Electrical Engineering Co., Ltd., Loughborough. The visitors inspected the various processes in the manufacture of Brush-Ljungström turbines and generators, and the transformer and winding departments were also visited. Another department which proved of interest was the rolling-stock works, where cars ordered by numerous authorities in all parts of the world were seen in various stages of construction. Tea was provided by the directors of the firm, who were thanked for their hospitality. The visit concluded with the monthly general meeting of the branch at which the retiring officers were re-elected.

NORWAY'S ELECTRIC POWER PROGRAMME.

From the report on economic conditions in Norway, which has recently been issued by the Department of Overseas Trade, it is apparent that that country has yet to recover further before she can offer many opportunities to the British exporter. The Commercial Secretary at Christiania (Mr. Paus) says, however, that much has been done to clear the ground. Although stocks of goods, which can only be realised at a loss, still remain, large quantities have been disposed of during the past twelve months with corresponding relief to credit. In the demand for certain of Norway's staple export products there are signs of temporary improvement. This tendency will be more marked as business in Great Britain becomes better, but no complete recovery in Norway is considered possible until conditions in Germany and Russia grow more normal. Of more immediate interest are those portions of Mr. Paus's report which deal with electrical progress, particularly in connection with the utilisation of water power. The Commission appointed by the Storting in 1918 to inquire into the question of a scheme for the supply of power over the whole of Norway has now concluded its preparatory work, and proposals have been formulated for satisfying the requirements of practically the whole country in respect of energy for lighting and domestic purposes, and for the use of farmers, craftsmen, and small industries, on the basis of 250 watts per individual. It is estimated that, without including the cost of supplies already available, it will be necessary to expend a further sum of kr. 300,000,000 to this end. It is apparently intended to suggest that the public authorities of each county shall in the main be made responsible for, and shall be given the necessary powers to undertake the provision and distribution of electrical energy within the county in so far as the smaller towns and country municipalities are concerned, while the larger towns will be required to organise their own supply, as, in fact, they have already done.

Overdue Distribution Work.

During and immediately after the war a large number of schemes were initiated by various municipalities with a view to providing electrical energy for domestic and agricultural consumption and for the use of minor industrial concerns, and many waterfalls were harnessed to this end. Arrangements for the distribution of the power which has thus become available are now being made. In view of the prevailing industrial depression and the fact that new supplies of energy are required only for domestic service, it is generally felt that power already harnessed will satisfy the demand for the next few years, unless the electro-chemical and electro-metallurgical industry should receive some at present unforeseen impetus. It has been arranged that the municipalities of Christiania and Drammen shall receive from the Rjukan power station 12,500 kW and 2,500 kW respectively, while the Buskerud county is to receive 4,000 kW from the same source. The scheme for extending the Labro power station with a view to the delivery of an additional 3,600 kW to the Drammen municipality has, therefore, been suspended for the present. The Norwegian Government will undertake the construction of the transmission line from Rjukan to Kongsberg, while the Buskerud county and the municipalities of Christiania and Drammen will undertake the transmission for the remaining distances. The construction of this transmission line was commenced in the spring of 1921, and it is expected that the power will become available in October, 1922.

Operations are being continued in connection with the power scheme at Nore where the tunnel and catchment basin are in process of construction and the site for the pipe line is under preparation. A grant of kr. 4,500,000 has this year been made to the scheme. Work is also proceeding on the railway from Kongsberg to Nore, upon which kr. 4,500,000 has now been expended.

Work upon the Hakavik installation, which is to supply power to the Christiania-Drammen railway, is nearing completion, and it is now hoped that electric traffic will soon commence between Christiania and Sandviken or Asker. It will be necessary, however, to construct a new bridge over the Drammen river before the whole journey can be made by electric train, as the existing bridge is not strong enough to carry the heavy electric locomotives.

At Glomfjord, in the Nordland county, 50,000 h.p. has been installed and the installation of an extra pipe line for 27,000 h.p., together with the necessary electrical equipment, is nearing completion. The State is prepared to consider proposals for the application of this power. A zinc-smelting works controlled by Swedish interests, which has rented 50,000 h.p. from this source, has experienced difficulty in fulfilling its contract, and the State has hitherto received no return for the large capital invested in the power station.

The harnessing of Solbergfos on the River Glommen has been continued and is expected to be completed in 1924. Of the power obtained from this scheme, which has been estimated at 50,000 h.p., one-third will be taken by the municipality of Christiania, and two-thirds by the State.

Municipal Power Schemes.

The harnessing of the Rasmasfos on the River Glommen is nearing completion, and it is expected that the Christiania Municipality will take delivery of 12,000 kW from this source about the end of the present year. The offer of power to Christiania from Tysse has not been accepted.

The Bergen Peninsula Power Co., an amalgamation of the Bergen Municipality and a number of small municipalities in the Bergen district, is considering the construction of a 100,000-h.p. station at Dale with a view to the delivery of energy to the members of the company. The scheme of the Bergen Municipality to procure 6,000 kW from Herlandsfos has, therefore, been suspended.

The harnessing of the Hoge waterfalls, owned by the Aust Adger county, has now been completed.

Work has continued on the following schemes:—

That of Nord Tröndelag county for harnessing the Folla watercourse. It is expected that the delivery of power will commence in about a year's time. The scheme for the harnessing of the Tafjord watercourse in the Romsdal county. The scheme of the town of Kristiansand S. for the harnessing of the Nomeland fall. That of the town of Fredrikshald for power stations on the Brekke and Krappeto waterfalls.

The Troms county has initiated a scheme to procure 2,000 h.p. from the Bardo waterfall.

State Aid.

On February 23rd, 1921, the Norwegian Ministry of Finance concluded with a syndicate of Norwegian banks a loan of kr. 50,000,000 to be devoted to assisting various municipalities in completing power schemes which had been interrupted owing to financial difficulties. From this fund advances have been made of kr. 6,000,000 to the Aust Agder Municipality, kr. 14,000,000 to the Tafjord Power Co., and kr. 9,000,000 to the Nord Tröndelag County in aid of schemes mentioned above. A number of other municipalities have also received assistance.

Export of Hydro-Electrical Power.

The commission consisting of members appointed by the Norwegian, Swedish, and Danish Governments to consider the possibility of transmitting electrical power from Norway to Denmark has continued its deliberations. Norwegian experts are of opinion that the scheme will eventually be realised, although financial and technical difficulties have first to be overcome. It is expected that by the end of 1924, which is considered the earliest date at which the transmission line could be completed, Norway will be in possession of a considerable surplus of power available for export. The question whether the power should be carried overland through Sweden or by a submarine cable direct to Denmark remains unsettled, but the former alternative seems to be regarded with most favour.

German Competition.

The Commercial Secretary does not take a hopeful view of the immediate prospects of selling British electrical goods in Norway. Owing to the depreciation of the mark, he says, German manufacturers dominated the Norwegian market during 1921 for all kinds of electrical machinery and cables. British, American, Swedish, and Swiss firms, therefore, experienced great difficulty in doing business. For the same reason Norwegian factories secured a very small portion of the trade; they were working at only about half their capacity and sold at prices which probably entailed a loss.

Owing to the prevailing general depression and particularly that of the electro-chemical industry, the demand for new supplies for industrial purposes is very small. It is anticipated, however, that 1922 will see a fair demand for small transformers and motors and for cooking and heating apparatus in connection with the realisation of municipal power schemes. It has not hitherto been found that the fall in the price of coal has affected the demand for electrical cooking and heating appliances.

At the present moment German manufacturers are doing a good trade, and it is expected that they will continue to secure the bulk of the business unless the mark recovers in value.

Insulated Wires for Greece.—The U.S. Consul at Saloniki, Greece, in a recent report on Saloniki as a market for rubber goods says that, as a result of the intensive reconstruction of the burned zone of the city, large quantities of rubber insulated wire will be required. High-pressure insulated wire for telephone and telegraph installations is not demanded from the local market, as these services are Government owned and Government supplies are contracted for at Athens. The [illegible] and power plant at Saloniki supplies 220-volt energy for light and 440 and 550-volt energy for power. For the general market Italian and English insulated wire is imported at present. German prices are said to be competitive, but stocks for prompt delivery are not available in Germany.

AUTOMATIC TRAIN CONTROL.

The following is a brief summary of the report of the Automatic Train Control Committee appointed by the Minister of Transport under the chairmanship of Col. J. W. Pringle, C.B.*

The word "control" is construed in its widest sense to include not only cab- and fog-signalling devices, but also more direct methods, such as the automatic application of the continuous brake and the regulation of motive power, speed, &c. The main points for consideration were: (*a*) the technical, climatic, and physical conditions governing railway traffic in this country, which might render special treatment necessary; (*b*) the degree of safety existing and the extent to which additional security was desirable and attainable; (*c*) the methods of automatic control which appeared most suitable; and (*d*) the cost of installation. Evidence was given by responsible traffic and outdoor locomotive officers of the principal railway companies; accident statistics were reviewed and analysed; an inspection was made of a number of existing automatic control systems; and estimates were obtained from railway companies and inventors of the cost of installing various systems of control. A sub-committee examined about 200 inventions, which included mechanical, electrical, and electro-mechanical devices of all known types. All control devices can be classed under two main heads, indirect and direct. The indirect type automatically provides, either on the train or the track, visual and audible indications, supplementary to those given by the wayside signals. In this type reliance is still placed upon the driver. With the other class it is arranged that either the power brake is applied automatically, or that the speed is controlled by means of a brake which can only be released when the speed has fallen to a predetermined limit. Automatic train control can also, generally, be divided into two main types—continuous and localised, or intermittent. A continuous type of control aims at protecting a train constantly throughout its journey, and devices of this kind are essentially electrical, and usually, though not invariably, of the non-contact type so far as the control mechanism is concerned. They are dependent upon complete track-circuiting or its equivalent. There are several arguments against this form of control; for instance, the first cost; the cost and difficulty of supplying electricity to all railways in such a form as to be adaptable to a standard system of control; costly maintenance; it would mean scrapping the highly-developed systems now existing; and risk of failure of electrical supply. In the light of these disadvantages the Committee is of opinion that expenditure to the extent necessary for continuous control is not justifiable upon surface lines in Great Britain. Such control might, however, be provided on an entirely new line. The committee's attention was therefore directed to localised control, which would supplement, rather than supplant, existing signalling and block telegraph systems. Localised control can be either of the "non-contact" or "contact" type. Although the former type avoids physical contact between track and locomotive apparatus, it is more complicated, entails a considerable addition to the maintenance staff, and is more expensive in first cost and upkeep than the contact type. The latter form of control is best known and most developed, and despite the disadvantage of the shock effect, the apparatus has proved reliable after many years' operation. Three indications can readily be provided, *viz.*, "clear," "warning," and "danger," and alternative methods for obtaining brake release can be obtained. In conjunction with local track-circuiting this type of control can be used with automatic and three-position signalling. Moreover, as track-circuiting is extended the control exercised by any localised device, although not strictly continuous in character, will confer nearly all the benefits obtainable from a continuous system. The employment of "speed control" and "time element relay" devices is not considered by the Committee to be advisable. The Committee also thinks that no form of control would tend to lessen the number of buffer-stop collisions. An analysis of 193 typical cases of accidents showed that those due to signalmen's errors amounted to 25.4 per cent., and those mainly caused by failure of enginemen formed 36.8. These might be considerably reduced by track circuiting, electrical control of signals, and some form of automatic train control. The Committee agrees that sufficient provision for safety against preventable train accidents could not be made without recourse to train-control at distant signals also. As a general rule it is considered that this should provide distinctive effects for both "clear" and "warning" positions in order adequately to meet fog-signalling requirements. The Committee has formulated a set of "Requisites" with which control systems should comply. In compiling these due regard was paid to standardisation, future development, and cost. They provide, *inter alia*, that the "danger" effect shall be produced at a two- or three-position stop signal when this indicates, or should indicate "danger," and shall consist of a full application of the power brake. The "warning" effect shall be produced whenever the signals indicate "caution," and shall consist of an unmistakable brake application and audible warning. The "clear" effect shall be produced when the signals correctly give the "clear" indication, and shall consist of a distinctive audible signal. The apparatus shall be so constructed that the correct position of all track and train elements is assured under all conditions, and shall be capable of operating under all conditions which permit of traffic movements. In the event of failure of the mechanism the device shall assume the "danger" or "warning" positions and give the corresponding indications. In the opinion of the Committee the most suitable position for the track element of train control at distant signals is the centre of the four-foot way. Special mention is made in the report of the procedure to be followed in the cases of banking engines, double-headed trains, or two trains coupled together. The effect of the extension of electrification upon the use of a fixed electrified ramp will require special consideration, and special precautions may be necessary to safeguard against false "clear" effects being given as the result of a ramp becoming energised from an extraneous source. In an appendix (III) to the report details of costs are given. It is shown that the first cost would be as follows: Control at stop signals, £1,295,000; control at distant signals, £3,365,000. Annual charges for maintenance and renewals: Stop signals, £105,750; distant signals, £301,250. Full scheme: First cost, £4,660,000; annual charges, £407,000. Against this may be placed an annual saving of £100,000 on account of the displacement of fog-signalling, apart from the saving consequent upon a reduction of accidents. Finally, the Committee recommends a start in the direction of automatic control by the introduction of a system at selected "stop" signals; and also the formation of a committee of experts to determine and standardise track and locomotive apparatus.

*H.M. Stationery Office. Price 9d. net.

MERZ-PRICE 66,000-V PROTECTIVE GEAR WITH BEARD-HUNTER COMPENSATED PILOT.

It is interesting to note the great importance which has been attached to an efficient method of protection for the high-pressure cables which have recently been installed in and around Paris. At the new power station at Gennevilliers (described in our issues of April 14th and July 21st) the current is distributed at 60,000 volts to the surrounding sub-stations, several kilometres distant. The cables are run in duplicate, and in view of their importance with respect to continuity of supply the protective apparatus must be sensitive to small fault currents, absolutely discriminative, and must possess maximum stability.

These factors have been realised by the engineers who have designed this large power scheme in France, and Messrs. A. Reyrolle & Co. have recently completed the Merz-Price protective apparatus for the high-pressure cables. The problem of design presented greater difficulties than in previous cases,

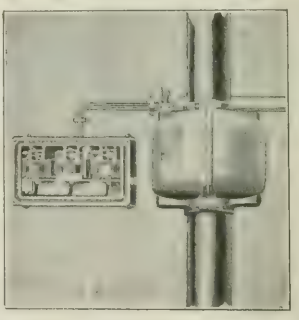


Fig. 1.—56,000-V Merz-Price Transformer and Relay.

since more sensitive operation was required than had hitherto been necessary; at the same time, the apparatus was required to be perfectly stable when heavy "through" currents were passing. These requirements have been made simpler by the use of the compensated pilot, in which the capacity current in the pilot is rendered ineffective. Improvements also in the manufacture of the balancing transformers have assisted in obtaining the necessary stability. The transformers are of such dimensions that efficient protection can be given for feeders of 50 miles or more in length, and tests were made at the makers' works for balance between the transformers with a current greatly in excess of that likely to be met with under short-circuit conditions.

The photographs show the Merz-Price transformer and relay (fig. 1), and the installation in the switch-house at the Gennevilliers power station (fig. 2). The sensitive relay controls the large circuit breakers near by. It will be noted that the

transformers are enclosed in metal cases, and they are constructed in a thorough and robust manner.

Experience has already been obtained with this apparatus under fault conditions, and in each case the damage has been negligible consisting of a small burn through the insulation

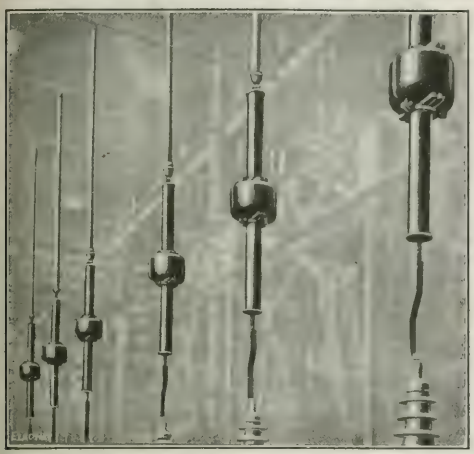


Fig. 2.—Cable Protective Apparatus in the Gennevilliers Station.

of the cable. The damage was very easily and quickly repaired, and the feeder recommissioned within a few hours of the breakdown.

THE MANUFACTURE OF ELECTROLYTIC IRON.

In *Chemical and Metallurgical Engineering*, of April 5th, 1922, Mr. G. F. Macmahon gives details of a process for the manufacture of electrolytic iron. The essential points of the article are given below :—

Electrolytic iron deposited from an ammonium sulphate-chloride-ferrous sulphate solution is suitable as a substitute for certain grades of sheet iron and iron wire in various types of electrical equipment. Until recently the high cost of electrolytic iron prevented its use commercially, but the process operated at Grenoble, in France, by which boiler tubes are made by the employment of a ferrous chloride electrolyte and the Eustis process, also a chloride one, seem both likely to prove commercially sound. These processes aim at the production of a ductile and malleable product, but the process now to be described is directed to the production of a brittle deposit, which can be readily pulverised.

The principles of an electrolytic refining unit are the same for iron as in a copper, zinc, or lead refinery, the tanks being connected electrically in series-parallel. Unlined wooden tanks 3 ft. wide, 10 ft. long, and 4 ft. deep are built and assembled on piers well above the basement floor. A neutral, or nearly neutral, electrolyte is employed, and lead piping for the conveyance of the liquors gives the best service. The electrolyte requires frequent filtering to prevent the impurities accumulating. The rate of flow through the tanks is about three gallons per minute, and the overflow is taken to a tank, mixed with diatomaceous earth, and filtered before being returned to the depositing tanks. The purpose of the addition of siliceous material is to facilitate the formation of porous filter cakes. The electrodes are lifted from the tanks by an overhead crane with a lifting capacity of 4 tons. Current is supplied from a generator, 3,300 amps., at about 36 volts. For a high-grade product the anodes must be fairly pure, and Bessemer, or open-hearth, steel is usually the material. The anodes are cast 3 ft. 8 in. x 3 ft. 5 in. x 2 in. over all; lugs are approximately 1 in. thick. Sixteen anodes per tank is the usual number, and these are spaced at 7.5 in. centres. Closer spacing is not satisfactory, as it tends to produce "treeing."

Cathode starting sheets are of ⅜ in. x 2 ft. 6 in. x 3 ft. 8 in. cold-rolled steel, and are riveted to hard-drawn copper bars ¾ in. x 1 in. x 41 in. long. To key the deposit to the steel blanks ¾-in. holes are drilled about 6 in. apart near the solution line. The deposited metal practically fills these holes and holds the deposit to the blank sheet. Fifteen cathodes are used per tank. The sheets are pickled before use in dilute sulphuric acid, washed with hot water, and coated with kerosene. After about 12 or 13 days the deposit of electrolytic iron has reached a thickness of about a quarter of an inch, and is withdrawn from the tank and stripped off. The approximate composition in percentages is as follows :—

Carbon	0.014	Sulphur	0.005
Phosphorus	0.015	Manganese	0.025
Silicon	0.028		

"Treeing" on the cathodes depends upon the composition of the electrolyte, but the addition of a trace of glue to the bath is a good preventive of treeing. The electrolyte which has been found to be most satisfactory has the following composition :—

Iron	60 grammes to the litre.
Chlorine	25 grammes to the litre.
Ammonia	25 grammes to the litre.

The successful deposition of iron depends upon this composition being maintained practically constant. At first the electrolyte has a slight acid reaction, but after being in use a short time it develops alkalinity, which must be corrected by careful additions of acid. The desired condition of the electrolyte is either absolute neutrality, or the slightest alkalinity, as the iron product is, under such conditions, the most satisfactory. The conductivity of the electrolyte is increased by warming it to about 45 deg. C., at which temperature, or near it, the electrolyte remains so long as the current is passing.

The loss of electrolyte constituents is practically nil other than the unavoidable small waste in working. Iron tends to concentrate in the solution, due to the additions of acid, and this must be corrected by dilution from time to time. The consumption of acid in the counteraction of alkalinity is quite small, and adds but little to the operating costs. A current density of between 12 and 15 amps. per sq. ft. of immersed cathode produces good results, and the yield of deposited iron is about 90 per cent. of the theoretical; 3,300 amps. is used for each tank at 1.3 volts, and the average output per kilowatt hour is about 1.5 lb. of refined iron.

The essential points to observe to obtain satisfactory results are : (1) the use of a small amount of glue in the electrolyte; (2) efficient circulation of the electrolyte to avoid stratification and re-solution; (3) proper ammonia concentration; (4) avoiding high ferrous sulphate concentration, which produces a tendency to "treeing"; (5) a fairly high, but not too great, chlorine concentration; (6) a suitable temperature, which influences the hardness and permeability of the deposit.

Iron deposited at 59 deg. C., or over, is softer and less brittle than that deposited at 25 deg., other conditions being the same.

If electrolytic iron be deposited at different temperatures under the same conditions with respect to current density and composition of the electrolyte, its magnetic permeability is almost directly proportional to the temperature of the electrolyte between the limits of 25 and 50 deg. C. This variation in the permeability of freshly prepared electrolytic iron has been known for some time, but the cause of such variation from an electro-deposition point of view, had not been ascertained. It now seems that the rate of annealing and the permeability obtained are dependent upon the electrolytic baths and the changes occurring therein.

WIRELESS TELEPHONY.

Radio Research Board's Report

It will be remembered that in October, 1921, the Radio Research Board of the Department of Scientific and Industrial Research appointed Sub-Committee E (radio telephony), consisting of Admiral of the Fleet Sir H. B. Jackson (chairman), Prof. C. L. Fortescue, Prof. G. W. O. Howe, Major A. G. Lee,* and Mr. O. F. Brown (secretary), as the result of a resolution that was passed by the Imperial Conference, to examine the present position of wireless telephony in this country, and in doing so the Committee had the assistance of witnesses representing the three fighting services, Marconi's Wireless Telegraph Co., Ltd., and the Radio Communication Co., Ltd.

In its report, which was issued last week,† it states that for the transmission of a specific message over any distance—long or short—the radio telephone is greatly inferior to the radio telegraph in accuracy, speed, and cost; and is likely to remain so. The articulation of the best radio telephone installations compares favourably with that over a trunk land line, but it is necessary to repeat or spell unusual words or proper names and repeat figures. The skilled personnel necessary to work a large radio telephone installation

* Major A. G. Lee (G.P.O.) had to go to India in connection with the Imperial Wireless Chain during a part of the time that the Committee was sitting, and his place was taken during his absence by Mr. E. H. Shaughnessy, the P.O. representative on the Radio Research Board.

† H.M. Stationery Office, Cornwall House, Stamford Street, S.E.1; Cmd. 1707. Price 3d. net.

or a number of small ones is approximately that necessary to maintain similar radio telegraph stations. The spheres of utility of the two systems are as separate and clearly defined as those of land line telephony and telegraphy.

Considerations of mutual interference—quite irrespective of the greater convenience of land lines—rule out the radio telephone for local communications. Therefore, the most important applications of the radio telephone on a commercial scale are as a connecting link between ordinary land-line telephone systems either at great distances (*e.g.*, between Europe and America), or at medium or short distances as a means of communication with isolated posts where the laying of a telephone cable would be expensive or impracticable; or again, broadcasting intelligence and music for the general benefit of the community is a further example of its commercial utility. There are occasions, also, usually in the case of very short distances, when personal communication between principals is essential and secrecy is unimportant. In these cases the use of a radio telephone, even independent of land line systems, may be very convenient. The fighting services have directed their development of radio telephony almost entirely to meet such demands, and have developed efficient non-secret installations suitable for their special requirements; for example, the Air Force makes use of radio telephony daily in the navigation and landing of aircraft; and it has been developed to a certain extent in the Navy for communication between particular officers of ships in close company. The need for similar communication may also arise commercially; for example, when a ship is approaching harbour, direct communication between the master and the port authorities with regard to berthing and other matters might effect a considerable saving of time in getting alongside.

The requirements of any system of telephony for commercial success may be summarised as follows:—

(*a*) The articulation must be reasonably good.

(*b*) It must be possible for subscribers to be connected—either during the whole day or specified periods—without excessive delay.

(*c*) The running and maintenance costs must be such that without excessive charges the Service can pay its way.

(*d*) Some degree of secrecy must be provided.

The interference of atmospherics is very variable both in respect of locality and season, and in certain localities communication may be interrupted from this cause for hours or days, even when very high transmitting powers are used. As regards (*d*) a service might be considered commercially possible if the interception of a conversation required costly and elaborate apparatus needing skilled adjustment, thereby making interception a matter of great difficulty and impossible with ordinary radio telegraph receiving instruments. Furthermore, where the radio telephone is a link between land line systems it must provide for direct connection so that two subscribers may be able to communicate from the telephone installations in their own homes or offices without having to travel to special radio stations to carry on their conversation.

With regard to long distances (3,000 miles and over) it appears that, under those favourable conditions which are experienced for a few hours daily in most places, it is technically possible for speech to be transmitted through the ether to any range up to the distances which are now judged feasible for reasonable radio telegraph communication, provided expense is no object and secrecy is immaterial. Demonstrations have been given of the transfer of speech by non-secret methods over distances up to 2,000 miles or more. However, no organised experimental work with a view to providing a reasonably secret commercial service over such distances is contemplated in this country. The possibility of establishing satisfactory radio telephone communication on a commercial basis over a distance of 3,000 miles or more is remote. The reasons for this conclusion may be stated as follows:—

(*a*) The wave lengths most suitable for long-distance radio telegraphy are unsuitable with the methods at present in use for radio telephony, and telephonic communication would, therefore, have to take place on wave-lengths which are known to be inefficient for long ranges.

(*b*) The power required for radio telegraphic communication for a 24-hour service daily is already very large, and in spite of the improvement in receiving apparatus modern practice favours the use of higher powers for long distance communication than were considered adequate a few years ago.

The powers for radio telephone services are estimated to be from 3 to 20 times greater than those at present considered necessary for similar radio telegraph services over the same ranges. The necessary charge for a conversation would accordingly reach an impracticable figure.

(*c*) No appreciable secrecy can at present be obtained for a conversation taking place at such a range.

(*d*) The interference with other radio communication would be greater than that due to two radio telegraph stations communicating over the same distance on the continuous-wave system, owing largely to the increased power.

(*e*) Radio telephone communication would be exposed to atmospheric interference, and the interference of other radio stations, to a greater extent than radio telegraph communication over the same distance. With a long distance radio telegraphic service it is possible in the event of temporary adverse conditions to hold back traffic without serious results, but with long-distance radio telephony, a delay through any disturbance would be most detrimental to the service.

For medium ranges, say, 1,000 miles, the difficulties as regards a commercial service are practically the same as those for longer distances, except for the fact that unless considerations of mutual interference prevailed, the waves which could be used for radio telephony would be the same as those which are efficiently used for radio telegraphy. However, in remote localities where the danger of mutual interference between radio stations is small and the risk of interception of the conversations by unauthorised persons is slight a radio telephone service employing waves of the length used by medium power radio telegraph stations would be possible; provided always that the cost of the necessary additional power was not prohibitive.

The position as regards short-distance communication, 200 miles and under, is, however, more hopeful. The Marconi Co. in this country is experimenting with semi-secret systems with the expectation of placing radio telephony on a commercial basis in the near future for distances up to about 200 miles over sea. The representatives of the Marconi Co. have furnished the Committee with a complete description of the installations intended for such a service between this country and the Continent, using short wave lengths of the order of 100 metres and a power of 5 kW. This company has informed the Committee also of the very promising results of experiments at a range of 90 miles over land using wave lengths of the order of 20 metres. Although this later line of development appears promising, it must be recognised that the system proposed is only in the experimental stage. Neither of the systems has yet been tested in an actual commercial service.

The conditions requisite for a commercial service as enumerated above, can be met at the present time in the case of a service over a short range to the following extent:—

(*a*) The articulation is approximately as good as on land lines of similar length.

(*b*) It seems probable that a full 24-hour service could be maintained in most localities.

(*c*) Atmospheric disturbances and, under present conditions, interference by and with other stations are very much less troublesome on the short waves used, so that delays of traffic through these causes are less probable, and the power required is not excessive.

(*d*) Unauthorised reception is made more difficult by the use of short waves, but the conversations can be picked up by special apparatus. In the case of very short waves, instruments of very special design are required and, moreover, transmission can be made to some extent directive, *i.e.*, the waves can be made stronger at points on the line joining the transmitter and receiver than at points off that line, thus reducing the area over which interception is possible. In any system, irrespective of distance, the use of different wave lengths for transmission and reception at a given station makes it more difficult for one person to overhear the whole of a conversation.

(*e*) There are no insuperable difficulties in the system being worked satisfactorily in connection with the ordinary trunk lines, and, as far as subscribers are concerned, the conversation can take place exactly as with the land line system, *i.e.*, the subscriber has not to install in his office any special apparatus or to manipulate any switches during a conversation.

The solution of the practical difficulties of the commercial application of radio telephony outlined above depends largely on the use of short waves. The system is thus limited to comparatively short ranges, and the achievements of this line of development cannot be extended to radio telephonic communication at longer distances without resorting to longer wave lengths with the consequent elimination of the slight degree of secrecy the use of short waves at present gives. The absence of interference with short waves is mainly due to the fact that these wave lengths are not greatly used at present for radio communication. The increased use of such wave lengths would probably cause mutual interference to nearly the same extent as is now experienced with longer wave lengths.

The Committee cannot recommend the use of radio telephony as a substitute for any other means of telegraphic communication except in those cases where the special requirements can be met in no other economic way; for example, the broadcasting of intelligence of general information where one costly transmitting station supplies a great number of simple, inexpensive, receiving stations, seems a practical commercial problem, especially in localities ill-equipped with land lines.

As regards future work, the Sub-Committee states that it can, if desired, examine more fully the position of radio

telephony abroad. However, from the general study which it has made of the information published in the technical Press, it hardly expects that the development of radio telephony in foreign countries has been carried much, if any, further than in this country. The Committee intimates that it can, if desired, recommend to the Radio Research Board a programme of investigation which could be undertaken with a view to the improvement and development of this means of communication.

REVIEWS.

Radiations From Slow Radium. By J. B. Kramer. With a note on their therapeutic value, by John Hall-Edwards, L.R.C.P., &c. Pp. 105; figs. 53. London: Ballière Tindall & Cox. Price 12s. 6d. net.

This book deals with the advantages of replacing in therapeutical work the very expensive radium salts by the less expensive uranium and thorium salts, the emanations of which, whilst relatively weak, are capable of much more control, and so offer advantages and less risk of radium "burns."

To such mixtures of uranium and thorium which may possibly contain an infinitesimal quantity of radium, the author has given the name "Slow Radium," but as the presence of radium is not essential a more accurate and true name would be "Uranium and Thorium Emanations."

In his preface, the author mentions that "the study of radium and its radiations has been rendered rather difficult for the medical man, owing to the fact that most books published on this subject contain intricate mathematical problems and highly abstract technicalities."

This being the case, and the use of radium having potentialities for good and evil, it is questionable whether any medical man has the moral right to employ a therapeutic agent with whose properties he is not thoroughly conversant, as far as present day knowledge permits, particularly when the mathematics necessary for radio-active theory are of a far more elementary standard than the mathematics required by a first-class electrical engineer dealing with general electrical technology.

Granting this, however, it is questionable whether such a medical man will have a very clear idea of the ratio e/m introduced on page 8.

The book consists of seven chapters, namely: Introduction; What Radio-Activity Means; The Products of Radio-Activity; How to Trace Radio-Activity; Penetrative Powers of Radium Radiations; Effects of Penetrations from Slow Radium; Summary and Conclusion; and Slow Radium as a Therapeutic Agent.

One may say that the first five chapters give a description of radio-activity of the "popular" type, such as may be obtained from any good "popular science" book or magazine.

Chapter VI gives various photographs comparing the penetrative powers of pure and slow radium, and is, therefore, of interest to those who may use "slow" radium.

In Chapter VII. we appear to reach the nucleus of the book, since this chapter deals with the "Standard Kramer Applicators" and shows various photographs of their application to nœvus of face, dermatitis of scapula region, lupus of forearm, neoplasm of breast, neuritis of shoulder, keloid of leg, lumbago of back, arthritis of ankle, and papillomatous growth of plantar aspect of foot. The varieties of disease to which slow radium is applicable leaves one with the impression that "slow" radium is the present-day elixir *vita*.

The book concludes with a general statement by Dr. Hall-Edwards, on the possible applications of "slow" radium, who states that his interest is purely scientific, but urges the trial of the applicators by dermatologists for chronic and intractable skin disease.

The book is only just over 100 pages of large type, and is very artistically got up, in fact, more artistically than usual with a book of this type, and its price being high, one is left with the impression that its chief use will be for propaganda purposes in connection with "Standard Applicators."

B. J. L.

Directive Wireless Telegraphy: Direction and Position Finding, &c. By L. H. Walter, M.A., A.M.I.E.E. Pp. xii+124; figs. 57. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

The various methods of directive working, and especially of directive reception, have in the last year or two assumed a very prominent place in the practice of wireless telegraphy. Of hardly more than theoretical interest before 1914, they were developed under the stress of war requirements into valuable aids to both the naval and military forces, and the methods so developed are now finding a great and a growing field of usefulness under peace conditions. The seaman and the aviator find directive wireless of great assistance in taking bearings and so finding their position when the ordinary navigation marks are invisible owing to fog. The network of long-distance lines of communication with which before long the world will be covered could not be developed to anything like the extent now proposed without the aid of methods of directional working. By these methods the transmitted signals can be confined more or less to the desired direction, and so the wasteful and harmful radiation of energy in other directions avoided, while at receiving stations interference from adjacent transmitting stations can be cut out. By this means not only is jamming reduced, but duplex working is made possible.

Directional working is, therefore, a subject with which anyone whose business brings him into contact with wireless matters should have some acquaintance. Unfortunately, it is a branch of wireless telegraphy which has not hitherto received very detailed treatment in the ordinary text-books. The literature of the subject exists mainly in the form of papers published in the proceedings of various scientific societies, and it is not everyone who has the time or the opportunity to consult these papers. In the volume under review the author, who is an expert in this particular branch of wireless telegraphy, has given a comprehensive survey of the work which has been done in the subject up to the present, and for the average wireless man little more is needed. For the benefit of any reader who wishes to go more deeply into the matter a list of references to more detailed sources of information is given at the end.

The book is divided into six chapters. In the first the general question of directive working is discussed. In the second chapter the various methods of directional transmission and reception are described. Elaborate theory is avoided, but the author does not make the mistake, so common with the authors of primers, of avoiding all theoretical discussion. Enough theory is given to enable the reader to see for himself why the various results described are produced, instead of being left to take statements on trust. In this chapter also is given a useful summary of the various formulæ connected with transmission and reception with loop antennæ, and a short note is added on the method of designing such antennæ.

The following chapter is devoted to a description of the various methods by which directive wireless telegraphy is applied to the navigation of ships and air-craft, together with a discussion of the different errors which are met with in practice.

In the fourth chapter the various types of direction-finding apparatus in actual use to-day are described. The fifth chapter is devoted to a brief description of the direction-finding stations now in operation, while in the final chapter are described some miscellanous applications of directive working, the most important of which are those designed to eliminate atmospherics.

The book is very clearly written, the illustrations are numerous and clear, and we can recommend it to anyone who is in any way interested in the subject.

Fuel and Lubricating Oils for Diesel Engines. By W. Schenker. Pp. xii+114; figs. 26. London: Constable and Co. Price 10s. net.

The presentation of a chemical subject by an engineer is perhaps a little novel, but as the book is written for engineers it has the advantage of being viewed from the engineer's standpoint. The book is intended for owners and engineers in charge of Diesel engines. It deals with liquid fuels in general, their origin, composition, and preparation for use. Special attention has been devoted to Diesel fuel oils proper, and it has been thought useful to give specifications of qualities, also directions for carrying out simple tests. The lubricating oils are so nearly related to the fuel oils that the book would have had to be considered incomplete if they had not been included.

The author being the chief engineer to the Diesel engine department of Messrs. Sulzer Frères must possess an intimate association with the subject about which he has written, but one ventures to suggest that the value of the book would have been considerably enhanced had he confined himself to some of the problems which beset many engineers, instead of dealing with some of the side-tracks of petroleum technology.

It is obvious that there are many types of fuel which can be used in Diesel engines, but there are no doubt some merits or demerits attached to at least some of them, but the author gives no guidance in this direction, neither does he give any pronouncement upon the special characteristics of the lubricating oils to be used. It is quite insufficient merely to state the viscosity and flash point of the oil, for it is generally acknowledged that such a brief specification gives but little guarantee of the suitability of the oil for the purpose. No result of oil tests in the several types of engines are given. The best oil for one engine may not be the best for another, especially is this the case with the lubricating oil. The influence of the design of the flame plate upon the burning of the fuel, and the interpretation of the indicator cards obtained would have been welcomed.

The significance of the special gravity of oils is over-estimated, in fact one is led to suppose that this physical constant is of primary importance, but the author cannot have meant this, because on page 86 he reveals the fact

that the correlation between specific gravity and calorific value only exists between oils of the same origin, *e.g.*, the crude oil from a Pennsylvanian well would give rise to various fractions ranging in specific gravity from about 0.7 to 0.92, and each fraction would show a certain continuity in its physical constants, likewise, the fractions of a Californian oil would show a similar continuity, but it is highly improbable that two fractions from dissimilar crude oils would possess the same physical constants even if their specific gravities were the same.

The popular topic of the sulphur content is dismissed in about two lines. When one engineer has trouble with an oil containing a few per cent. of sulphur and another experiences no trouble with an oil with a 40 per cent. sulphur content, engineers would like to know the reason for it.

On page 22 the term "liquidity" could well be changed to "fluidity" and on page 27 the words "cracking naphtha might be revised.

Except for the typical analysis on page 44, there are not any specifications for fuel oils given, although in the preface they are stated to be included. Certain properties are described, but not a word about the asphalt content is given.

The lubricating oils described on page 60 may be suitable on the Sulzer engines, but they do not apply to other makes of Diesel engines. Surely it would be erroneous to lubricate a large Burmeister & Wain Diesel engine with a superheated steam cylinder oil.

It is hoped that these helpful criticisms will not minimise the comforting forecast of the supplies of oil in the future, which is very admirably estimated, nor the valuable graphs and tables which have been inserted. The art of evading chemical nomenclature is amply manifested in this chemical book written by an engineer and should, therefore, be heartily welcomed by engineers.

The Mechanical Handling of Goods. By C. H. Woodfield, M.I.Mech.E. Pp. xi+116; 73 illustrations. London: Sir Isaac Pitman & Sons. Price 2s. 6d. net.

The problem of transport within factories and works is one that received great attention during the recent war period, when the supply of manual labour was so very limited. With the continual demands for increased production being accompanied by the withdrawal from industry of large quantities of general labour, it became more and more important that all the manual labour available should be employed to the very best advantage, necessitating that man-handling should be replaced, wherever possible, by the use of mechanical devices. The extent to which such appliances have been developed is well indicated in the above little book, which gives much interesting information concerning the methods and equipment employed.

After a brief discussion of the general scope of goods-handling machinery, and of the extent to which capital outlay thereon is justifiable, the book devotes three chapters to the description of various forms of lifting gears, such as rope, chain, and worm-geared pulley blocks, crab winches and derricks, and friction hoists. The four succeeding chapters describe overhead runways, travelling cranes, electric mono-rail hoists, self-landing and delivery hoists, cantilever and transporter cranes. A separate chapter is occupied by a brief but excellent description of electric storage battery trucks, which are now so frequently seen in use at large railway termini. Continuous conveying apparatus and useful adjuncts thereto are described in Chapters 10 to 12, including gravity roller runways, sack and spiral shoots, "humpers" and "pushers," stacking machines (including a type devised by the author), band, bucket, worm and tray conveyors, machines for raising and lowering sacks, coke and ash handling plant. The last chapter is devoted to portable jib cranes and runway accessories, and would be in a more logical position if it followed Chapter 8.

With the small space available the book cannot possibly be comprehensive, neither can the various items be treated with much detail. The scope is fairly wide, however, and the descriptions are good, while the many illustrations are excellent, and the book gives an interesting survey of appliances to which little more than casual notice is usually given. Much useful information is given as to the capacities and speeds, &c., of the various machines described, and of the extent to which labour charges may be reduced by their employment.

The object of the book being frankly descriptive, the few calculations included (which deal mainly with lifting gears) are of secondary importance, but certain points are open to criticism, such as the use of the words "power" and "power ratio" to mean "effort" and "velocity ratio" respectively, on pp. 10 and 16, and the neglect of the effect of friction on the formulæ on pp. 16-17. The worked example in the middle of page 17 is peculiar—a winch problem is worked using a ¾-in. steel rope on a 5-in. diameter barrel, but a footnote is added stating that this size of barrel is only suitable for manila rope, and that steel rope would require a much larger barrel. There appears to be no reason why practical conditions should not have assumed in the first instance.

Typographical errors appear to be remarkably few, only one having been noticed so far, viz., the spelling of "overlowering" in line 3, page 54.

COMPARATIVE TESTS ON TRAMCARS.

Roller *versus* Plain Bearings.

At the recent annual convention of the Tramways and Light Railways Association, during the discussion on a paper that dealt with the subject of modern improvements in rolling stock, several speakers referred to the advantages of using roller and ball bearings on tramcars in place of the ordinary plain pattern of bearing.

It is, therefore, appropriate to draw attention to the comparative tests for electric power consumption, tractive resistance, &c., on tramway cars that are mentioned in the director's annual report on the work of the National Physical Laboratory during 1921.

A series of tests was carried out by the Engineering Department of the N.P.L. for the Hoffmann Manufacturing Co., Ltd., Chelmsford, on two double-deck tramcars, one of which had the main axle and the motor bearings fitted with Hoffmann roller bearings, the other car being fitted with plain bearings of the ordinary pattern. The cars selected for the tests were made by the English Electric Co., Ltd., Preston, and were fitted with "Brill" pattern trucks of standard type. The cars were the property of the Wigan Corporation, and the tests were made in Wigan and the vicinity.

The apparatus used for the test consisted of a recording Elliott voltmeter and a recording ammeter specially fitted with electro-magnetic time pens, the draw-bar dynamometer designed at the Laboratory, and specially fitted with apparatus for measuring and recording pulls down to 10 lb., and a sprung distance recording wheel, which was attached to the rear buffer beam of the car under test.

The electrical instruments were arranged with a paper speed of from 6 to 9 in. per minute in order that an open diagram could be obtained, and both were fitted on the end panel of the car under test so that the recording pens moved in a direction at right angles to the direction of motion of the car. For measurements of tractive resistance the pressure unit of the dynamometer was connected between the car to be tested and a hauling car, and the record paper was driven by a small electromotor operated by means of a storage battery.

The distance wheel was provided with three commutators with one, four, and eight contacts respectively, and a single slip ring. The commutators and slip ring were connected through a battery and selector switch to a magnetic pen which enabled indications to be made on the record paper every one eighth, one quarter, or every whole revolution of the wheel, corresponding to 1/8,000, 1/4,000 and 1/1,000, respectively, of a mile travelled. Time indications were made every half-second or every five seconds, as desired.

The same clock was used to indicate the time on both the dynamometer and the electrical instruments, and from the records obtained the time, distance run, speed, acceleration or retardation, voltage, current, and draw-bar pull were determined. For comparative tests on service runs the cars were loaded with sand bags and run separately, over a route having variable gradients, to a terminus some two and a half miles distant. The following results were obtained:—

	Test No.	Car.	Consumption, units per car-mile.	Reduction % in favour of Hoffmann car.
Unloaded cars ...	1	Hoffmann	1·69	30·5
	2	Ordinary	2·43	
Loaded cars ...	3	Hoffmann	1·82	22·2
	4	Ordinary	2·34	
Loaded cars with frequent stops	5	Hoffmann	1·16	22·1
	6	Ordinary	1·49	

With regard to the weather conditions when the above test results were obtained, it should be pointed out that during test No. 1 there was rain at intervals and the rails were wet, while when test No. 2 was made there was heavy rain and the rails were flooded. Fine weather prevailed whilst tests Nos. 3 and 4 were being carried out, but the former was made on dry rails and the latter on wet ones. The weather was also fine when test No. 5 was made on dry rails, but during test No. 6 rain fell and the rails were flooded.

The tractive resistance tests gave the results recorded below:—

(1) Loaded cars—				
Speed, m.p.h.	4	6	8	
Reduction in tractive resistance in favour of Hoffmann car, %	20·5	22·7	21·1	
(2) Unloaded cars—				
Speed, m.p.h.	4	6	8	10
Reduction in tractive resistance in favour of Hoffmann car, %	24·0	22·3	21·6	21·0

The static friction tests were made at various loads and the results obtained showed that the starting effort required for the Hoffmann car was 1/20 that of the ordinary car.

Retardation tests were made and the retardation determined from speeds up to 20 miles per hour. It was found that the Hoffmann car would run 57 per cent. further than the ordinary car after the supply of power was shut off at the same speed.

LEGAL.

C. B. Carpenter v. C. A. Carpenter, Ltd.

In the Mayor's and City of London Court, on August 1st, George Bertram Carpenter, electrical engineer, claimed £36 15s. against C. A. Carpenter, Ltd., electrical engineers, 9, Coleman Street, E.C., for 10 per cent. commission on business introduced whilst he was in the company's employment. Mr. Eddy appeared for the plaintiff and Mr. Powell for the defendants.

Mr. Eddy said that prior to March of last year plaintiff's brother, Charles Augustus Carpenter, was carrying on business on his own account as an electrician. In March of last year the defendant company was formed to take over the business of C. A. Carpenter, he and his wife being permanent directors. The defendant company specialised in a burglar alarm, and from February until June plaintiff acted as the representative of the defendant company, and he was to be paid 10 per cent. commission on the turnover. In February defendants were doing scarcely any business, but as a result of plaintiff's work the turnover became £130 a week. Plaintiff introduced the burglar alarm to Lloyd's, insurance companies, and others. Plaintiff had advanced more than £1,000 to his brother. Plaintiff had received part of the commission due to him, leaving the balance sued for due. A counter-claim of £21 had been raised for electrical work done at the plaintiff's house at Hendon. That was to have been set off against the interest due to plaintiff for his loans to C. A. Carpenter.

Mr. Powell said he admitted owing plaintiff £18, and the plaintiff owed the company £21.

After consultation judgment was entered, by consent, for the plaintiff for £20 on the claim and on the counter-claim the Judge observing that that was the sum he should have suggested, and he was very glad the case had been settled.

Boden v. Davis.

In the Mayor's and City of London Court, on August 1st, before Judge Jackson, Mr. Leslie J. Boden, 840, Winchester House, London Wall, E.C., sued Mr. H. E. Davis, electrical engineer, 11, Sun Street, for £44 balance of account for office accommodation supplied, and clerical and accountancy work done by him at £1 a week in connection with "Delcoblast," a chemical material for obscuring glass. Mr. Beasley appeared for the plaintiff and Mr. James Duncan for the defendant.

Mr. Beasley stated that towards the latter part of 1919 the defendant approached one Kirby to do the business work in connection with the manufacture of "Delcoblast" at South Street, where he carried it on. For some months Kirby did it for nothing. He then became too busy and defendant asked Kirby to find some one to do the work. In May, 1920, Kirby brought plaintiff to the defendant's office. Kirby and Boden were partners, and it was arranged that the plaintiff should carry on the work of keeping the books and generally looking after the business of the defendant. Plaintiff was to be paid £1 a week. Defendant's name and "Delcoblast" were put up at the plaintiff's office. Plaintiff did the work and kept the various accounts. From time to time he was paid £31 on account, and the balance claimed was due. Plaintiff drew the necessary cheques, all of which were signed by the defendant. The business did not pay and the office work was moved to the defendant's premises.

Plaintiff said that Davis, the defendant, and one Cahan each put up £100 to carry on the business of "Delcoblast." There was no arrangement that Kirby was to get 20 per cent. of the profits, Cahan 40 per cent., and the defendant 40 per cent.

Defendant said he never agreed to pay the plaintiff £1 a week or any sum. He looked upon the plaintiff as Kirby's clerk, and Kirby was to have had 20 per cent. of the profits of the sale of "Delcoblast." The business was unsuccessful and the £200 capital was lost. He signed the cheques without having any explanation as to what they were for. More than half were signed in blank.

Judge Jackson thought it extraordinary that the defendant should have signed the cheques in blank. The books were all against the defendant. Judgment was given for the plaintiff, with costs.

Electrician Sentenced for Fraud.

An electrician named Frank Sinclair Ormonde (52) appeared at the Liverpool Sessions on August 3rd on a charge of obtaining £600 by false pretences from John Alfred Scallon in October last. For the prosecution, it was stated that Mr. Scallon came into contact with prisoner through an advertisement inserted by a partnership agency. Ormonde described himself as an electrical installation contractor, carrying on business at 125, Islington, and said he wanted a partner to pay £250 for the goodwill, and to invest £350 in the business. They were each to draw a salary and equally share the profits. When Mr. Scallon visited the works he asked for a balance sheet. He received one, and on October 8th he received another balance sheet from the auditor, and on the strength of that and other documents he was satisfied that it was worth his while to put his money into the business. In the balance sheet, under the assets, were sundry debtors representing £772, and [illegible] connection with this item that the present charges were brought. Mr. Scallon handed over £250, and later £350, and started work with the company. He noticed that some small jobs were dealt with, but nothing of any importance, and he examined the books. In the day book he noticed three items of £26, £22, and £180 outstanding against two firms, and after making inquiries complained to the prisoner. When prisoner was arrested and charged he replied "My partner is to blame. He kept my books." The accountant said that he had taken the balance sheet from the books, which were shown to him by the prisoner. He was not responsible for the care of the books. With regard to the item of £180 shown as due, it seemed to him a large amount for the business, and he asked the prisoner about it; he replied that it was a good debt. The books were loosely kept. Prisoner was sentenced to six months' imprisonment in the second division.

Marconi's Wireless Telegraph Co. v. Mullard Radio Valve Co.

Mr. Justice P. O. Lawrence, in the Chancery Division last week, continued the hearing of this action, brought by the plaintiffs for an injunction to restrain the defendants from infringing their Letters Patent Nos. 28,412, of 1913, and 126,658, the first granted to the company and Mr. Henry Joseph Round for an alleged invention of "improvements in receivers for use in wireless telegraphy," and the other relating to a patent granted to Michel Peri and Jacques Biguet for "improvements in or relating to vacuum tubes."

The defence was a denial of infringement (*vide* Electrical Review, July 28th, p. 121).

Dr. W. H. Eccles, called for the defendants, said he was adviser to the Admiralty on matters connected with wireless telegraphy. He understood that Round's patent related to a particular construction of the De Forest three-electrode vacuum tube with cylindrical grid and cylindrical anode characteristically by themselves, that the grid entirely separated the filament space from the anode space, and that the cylinder separated the filament from the glass. Witness thought that what the defendants had done did not constitute infringement. Cross-examined, he did not say that Round's patent was devoid of merit. He thought that it possessed the merit of keeping the electrons off the glass in a soft valve, and yet retaining Lebins's improvements upon De Forest.

Counsel for the respective parties having addressed the Court, his Lordship said he would deliver his judgment next term.

Judgment was accordingly reserved.

Telegraph Concessions in Brazil.—Decrees signed on April 7th and 8th by the President of Brazil approve the following telegraph and cable developments, says the *Financier*.—(1) Plans of the All-America Cables Incs for overhead telegraph lines and cable stations in Sao Paulo and Santos; (2) similar plans in the same cities submitted by the Western Telegraph Co.; (3) petition of Enrico Sehoch for permission to organise a company for the construction and operation of cables from Rio to Rome and from Rio to Monte Video. The authority granted Enrico Sehoch specifies that the proposed company shall enjoy no special privileges, monopoly or subvention in Brazil, states a report published by the U.S. Department of Commerce. The new company is a further development of the plan for a cable from Italy to Brazil, the Italian concession having been obtained last September. This last concession gives the Compagnia Italiana dei Cavi Telegrafici Sottomarini the right to lay and operate, for a period of 50 years, cables to Greece, Spain, the Canary Islands, the Cape Verde Island, Brazil, Uruguay, and Argentina, and specifies that during that period the Italian Government will not grant cable rights to any other company, Italian or foreign, without first notifying the Compagnia Italiana dei Cavi and giving it the opportunity to furnish the service proposed.

There is no obstacle to the granting of cable concessions in Uruguay, and recent developments in Argentina make it probable that the Italian company will encounter little difficulty there. The date set for the completion of the cable from Italy to South America is January 27th, 1925. The Western Telegraph Co., on April 21st, opened to the public its new cable giving direct service between Rio and Maceió. Several months ago the Brazilian Government granted to the All-America Cables a new concession for a cable from Rio to Buenos Ayres. The previous concessions to that company covered cables from Buenos Ayres to Monte Video and from Rio and Santos to Monte Video, but no authority had been granted for a direct cable from Brazil to Argentina. It will be possible for the company to make the direct connection from Rio to Buenos Ayres by cutting the Monte Video-Rio cable in the River Plate and diverting it to Buenos Ayres, but if this is done a new coastal cable between Santos and Rio will probably be necessary. With these rearrangements a flexible system for communication between the three republics will be produced, and the service to the West Coast and to North America will be improved.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,158. "Method of exploding bombs discharged from aircraft by wireless telegraphic waves." C. R. Jarman. July 24th.
20,161. "Electric transmission systems." A. M. Taylor. July 24th.
20,170. "Conducting wires for electrical apparatus." W. Picard. July 24th.
20,173. "Wireless telegraphic, &c., receivers." D. S. F. Adams. July 24th.
20,181. "Automatic, &c., telephone switching systems." W. Aitken. July 24th.
20,209. "Electric heating units." British Thomson-Houston Co., Ltd. (General Electric Co.). July 24th.
20,243. "Glareless lamps." A. V. Cassels, J. A. Paton, H. Richards, and O. A. Townsend. July 24th. (Australia, September 13th, 1921.)
20,252. "Spark plugs." A. de Claremont. July 24th.
20,258. "Wireless aerials, &c." H. M. Lucy. July 25th.
20,304. "Antenna for underwater wireless telegraphy, &c." L. S. Palmer and L. G. Preston. July 25th
20,336. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. July 25th. (United States, April 18th.)
20,337. "Wireless telegraphy and telephony." G. A. Irving, L. G. Preston and G. Shearing. July 25th.
20,348. "Anti dazzle devices for vehicle lamps." R. G. Newhall. July 25th.
20,350. "Electrodes and method of manufacturing same." J. P. Scott. July 26th.
20,351. "Electrodes and method of manufacturing same." J. P. Scott. July 25th.
20,352. "Electrolytic cells." J. P. Scott. July 25th.
20,361. "Means for interconnecting electrical lines in telephone plants, &c." Relay Automatic Telephone Co., Ltd. July 25th. (Sweden, October 18th, 1921.)
20,365. "Jewel bearings for rotary elements of electric meters." G. A. Cheetham, Metropolitan-Vickers Electrical Co., Ltd., and W. Smethurst. July 25th.
20,393. "Synchronous electromotors for charging accumulators by alternating current." J. Bregi. July 26th.
20,410. "Electric motors, dynamos, &c." C. F. Davies, J. H. Taylor, and W. E. Taylor. July 26th.
20,421. "System for distant control of direct-current electric motor." F.I.A.T. Soc. Anon. July 26th. (Italy, August 9th, 1921.)
20,423. "Drive of electric power producing machines." D. H. Savage and J. A. Savage. July 26th.
20,443. "Insulation of electric cables." C. J. Beaver (Executor of E. A. Claremont), A. W. Claremont (Executor of E. A. Claremont), E. A. Claremont, L. B. Claremont (Executor of E. A. Claremont), and W. T. Glover and Co., Ltd. July 26th.
20,452. "Dynamos for train lighting, &c., installations." A. H. Darker and J. Stone & Co., Ltd. July 26th.
20,458. "Arrangement for suspending overhead wires on electric railways, &c." Sir P. Dawson and F. W. Fawdry. July 26th.
20,459. "Device for supporting overhead wires for electric railways, &c." Sir P. Dawson and F. W. Fawdry. July 26th.
20,460. "Electro responsive devices." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. July 26th.
20,467. "Electric arc welding apparatus." British Thomson-Houston Co., Ltd. July 26th. (United States, July 26th, 1921.)
20,462. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.) July 26th.
20,471. "Reducing devices for high intensity arc lamps." H. L. M. J. Renard. July 26th.
20,476. "Electric circuit controllers." F. R. McBerty. July 26th. (United States, August 10th, 1921.)
20,478. "Circuit controllers." R. C. Arter. July 26th. (United States, September 8th, 1921.)
20,479. "Ringing control systems." A. W. Clement. July 26th. (United States, August 10th, 1921.)
20,483. "Device for transmission of electric currents between relatively movable solid conductors." R. Erban and A. Madle. July 26th. (Austria, July 26th, 1921.)
20,485. "Manufacture of plates of electric storage batteries, &c." O. Reynard, F. F. Tapping and F. C. Thornley. July 26th.
20,493. "Device for locking electric lamp globes in holders." A. Wilkinson. July 27th.
20,499. "Electro mechanical typewriter." E. P. Hall. July 27th.
20,526. "Telephone, &c., head instruments." Dictograph Products Corporation and E. W. Pattison. July 27th.
20,528. "Machines for winding electric coils." Dictograph Products Corporation and E. W. Pattison. July 27th.
20,529. "Telephone receivers." Dictograph Products Corporation and E. W. Pattison. July 27th.
20,546. "Removable shutters for electric alarm systems." G. B. Carpenter. July 27th.
20,555. "Impulse sending devices for automatic telephone systems, &c." W. Stott, Telephone Manufacturing Co., Ltd., and A. F. Wood. July 27th.
20,563. "Protective arrangements for alternating electric current circuits." R. W. Biles and A. Reyrolle & Co., Ltd. July 27th.
20,568. "Electric circuit systems for wireless telegraphic, &c., receiving apparatus." W. J. Rickets. July 27th.
20,571. "Electric induction coils." N. E. Dobbin, S. L. Forbes, and J. W. Fothergill. July 27th.
20,572. "Loud speakers for wireless installations." N. E. Dobbin, S. L. Forbes, and J. W. Fothergill. July 27th.
20,574. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. July 27th. (United States, July 27th, 1921.)
20,576. "Radio receiving devices." Capitol Phonolier Corporation. July 27th. (United States, June 2nd.)
20,579. "Electric controller." Ward Leonard Electric Co. July 27th (United States, July 29th, 1921.)
20,582. "Controlling device operating by the aid of a relay." Aktiebolaget Vaporackumulator. July 27th. (Sweden, July 29th, 1921.)
20,580. "Resistance devices." Ward Leonard Electric Co. July 27th (United States, March 27th.)
20,581. "Resistance devices." Ward Leonard Electric Co. July 27th (United States, March 28th.)
20,599. "Combined packing crates and stands for electric storage batteries." Fuller's United Electric Works, Ltd., and J. P. Mansfield. July 27th.
20,600. "Publicity sign telegraphs." H. K. Harris. July 27th.
20,601. "Telephone exchange systems." G. Deakin and Western Electric Co., Ltd. July 27th.
20,624. "Artificial illumination." P. Beeston and J. A. Lambert. July 27th.
20,632. "Electric microphones." B. A. Pilkington. July 28th.
20,633. "Electric device for indication of vacant seats in kinemas, &c." G. B. Banks. July 28th.
20,639. "Distribution of electricity." T. Cooper. July 28th.
20,673. "Electro-magnetic apparatus for steering vehicles." J. G. Gray. July 28th.
20,685. "Wireless tuning coils." J. Lipousky. July 28th.
20,691. "Induction motors." H. C. E. Houtard. July 28th. (Germany, July 29th, 1921.)
20,705. "Systems of electric distribution." British Thomson-Houston Co., Ltd. (General Electric Co.). July 28th.
20,737. "Burglar alarm systems." G. B. Carpenter. July 28th.
20,751. "Glands for junction boxes." Macintosh Cable Co., Ltd., and D. D. Watson. July 28th.
20,753. "Electric switches." W. C. Davey and D. White. July 28th.
20,767. "Adjustable electrical rheostats, inductances, &c." W. A. Brooke. July 29th.
20,771. "Mast for aerial wires used in wireless telegraphy." F. H. Armstrong. July 29th.
20,810. "Alternate-current electricity." A. E. Salisbury and M. J. E. Tilney. July 29th.
20,811. "Apparatus for testing and improving high-tension spark circuit of internal-combustion engines." A. Hewlett. July 29th.
20,813. "Wireless receiving apparatus." C. S. Agate. July 29th.
20,818. "Treatment of magnetic materials." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 29th.
20,819. "Loaded electric conductors." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 29th.
20,825. "Electric switches." O. Lucas. July 29th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

30,775. "Electrical heating and cooking apparatus." G. Pate and J. R. Laird. July 30th, 1921. (182,822.)

1921.

1,156. "Electric motors." Traun's Forschungslaboratorium Ges. H.O. January 10th, 1921. (157,262.)
1,157. "Process and apparatus for converting static atmospheric electrical energy into dynamic electrical energy of any suitable high periodicity." Traun's Forschungslaboratorium Ges. H.O. January 10th, 1921. (157,263.)
1,317. "Automatic electric switches." H. Bollinger. August 19th, 1913. (157,396.)
1,329. "Means for modulating the periodicity and potential of alternating current supply." Ges. für Drahtlose Telegraphie. December 24th, 1919. (157,408.)
2,688. "Sound-recording or sound-reproducing machines." Plantation Rubber Manufacturing Co., Ltd., and M. M. Dessau. January 20th, 1921. (182,836.)
2,782. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). January 21st, 1921. (182,839.)
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9,501. "Means for detecting faults or breaks in submarine electric cables." F. B. Young and B. S. Smith. March 30th, 1921. (182,870.)
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10,433. "Dynamo electric machinery." H. F. Joel, Sen., and H. F. Joel, Jun. April 9th, 1921. (Cognate application 19,830/21.) (182,896.)
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10,478. "Electric voltage regulators." E. C. Wilkins. April 9th, 1921. (182,899.)
10,702. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. (General Electric Co.). April 12th, 1921. (182,923.)
10,770. "Illuminated signs." Studien ges für Elektrische Beleuchtung, Dr. F. Skaupy, and A. Fehse. April 13th, 1921. (182,926.)
10,803. "Telautography." H. G. Bartholomew. April 13th, 1921. (182,928.)
10,822. "Retarding devices for electric relays." W. H. Petersen and Allmanna Svenska Elektriska Aktiebolaget. April 13th, 1921. (182,932.)
11,070. "Electric switch." A. H. Hunt. April 15th, 1921. (182,940.)
11,152. "Electric switches." Butlers, Ltd., and A. Reeves. April 18th, 1921. (182,951.)
11,427. "Telephone hand sets." Western Electric Co., Ltd., and G. Deakin. April 20th, 1921. (182,956.)
11,560. "Electro-magnetic switches or contactors." Metropolitan-Vickers Electrical Co., Ltd. April 23rd, 1920. (162,251.)
11,943. "Electric burglar alarms." G. Kirk. April 26th, 1921. (Addition to 181,171.) (182,965.)
12,181. "Electric welding and appartus therefor." W. Langdon Davies and A. Soames. April 28th, 1921. (Cognate application 34,224/21.) (182,970.)
12,386. "Electric switches." Bristol Tramways and Carriage Co., Ltd., and B. A. Payne. April 29th, 1921. (182,977.)
13,671. "Automatic reversing switch or pole-changing mechanism for dynamo electric machines." J. Stone & Co., Ltd., and A. H. Darker. May 13th, 1921. (182,996.)
14,571. "Secondary electric batteries or accumulators." B. Heap and Chloride Electrical Storage Co., Ltd. May 25th, 1921. (183,012.)
15,075. "Alternating-current electrical instruments." G. F. Shotter and E. W. Hill. May 31st, 1921. (Addition to 168,339.) (183,017.)
15,256. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 18th, 1920. (165,030.)
16,010. "Electric terminals." P. B. Handley. June 10th, 1921. (183,022.)
17,073. "Fireproof holders for half-watt electric lamps and the like." H. C. Tudor. June 22nd, 1921. (183,027.)
18,955. "Apparatus for controlling the relative speeds of motors, or other driven devices." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). July 13th, 1921. (183,036.)
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19,940. "Electric protective systems." Akt. Ges. Brown, Boveri et Cie. July 31st, 1920. (167,170.)

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8,372. "Alternating-current rectifying apparatus." H. Andre. March 26th, 1921. (177,531.)
14,820. "Electric lighting and starting installations for motor vehicles." R. Bosch Akt. Ges. May 30th, 1921. (180,687.)
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BRITISH ENGINEERS UNDER FOREIGN LAWS.

ALMOST all over the world and extending back for many, many years, British engineering firms and contractors for public and private works of various kinds have carried out undertakings in different countries which have earned for them a reputation that is unsurpassed, if indeed equalled, by that of any of their competitors of any other nationality who at a much later date embarked upon similar enterprises. In the course of this work a large amount of experience has been gained of the commercial laws of the foreign countries concerned in so far as they were applicable to the works which were executed, and the information thus obtained has naturally been carefully safeguarded by the parties concerned in the interests of possible developments in the same parts of the world in the future. Private enterprise, in fact, and almost invariably without any assistance from the State, has always been the basis of the success of British engineers all over the globe.

The preceding reflections have been evoked by the announcement that an American inquiry is now being officially made into the legal requirements of American engineers and contractors in the matter of operations carried out in other countries. Some time ago a Division of Commercial Laws was created within the United States Department of Commerce for the express purpose of compiling and distributing information on the working of foreign laws abroad as affecting the conduct of business in other countries by American firms domiciled in the United States. At the outset the Department of Commerce intended that the Division should make an investigation into those legal problems which are encountered by the representatives of American firms who betake themselves to a foreign country for a limited period to execute an engineering contract of one kind or another. As is quite obvious, immediately on arrival the supervising or erecting engineer finds himself in contact with foreign laws. His position is very different from that of the resident manager of the branch of a commercial firm; yet his contact with local laws is more direct and more fruitful of possibilities of difficulties. With a view to throwing light on the situation of the American engineer abroad, and at the suggestion of an American company, the Division decided to make an inquiry on the question, and for this purpose a questionnaire was prepared, which was sent last April to the "field men" of the Department of Commerce and also to American Consular officials in a number of selected countries.

The principal points embodied in the questionnaire were:—

1. Is it advisable for engineering companies which undertake temporary contracts in your territory for official or private interests to obtain domestication or to register their company?

2. How is this effected?

3. Will it suffice for the engineer in charge, with power of attorney, to register as an individual?

4. What taxes must the company pay? (In answering that question bear in mind that the company undertakes the work at a fixed price payable in part before the work is started and the balance after the work is completed. Profits cannot be determined until the work is finished.)

5. Describe the liability for injury to labourers under the laws of your territory. Can insurance be obtained for this liability? Can contractors' insurance be secured?

It appears that down to the beginning of June replies to the questionnaire had been received from the American acting commercial attaché at Havana in relation to Cuba and from the American Consul in Mexico City with regard to Mexico, while other replies are being awaited by the Division of Commercial Laws.

Apparently the investigation only covers the situation of the legal obligations of the contracting company and its supervising engineer, and it does not include the position of the travelling representative who is sent out to work up business in the direction of a contract for State, municipal, or private account. Yet it seems necessary for the travelling engineering representative to familiarise himself, apart from the language of the country, with such legal conditions as apply to himself in the matters of temporary permits, trading licences, &c., and in order to enable him, as far as possible, to make sure that any contracts entered into are also legally binding upon the other parties concerned. While much may be learned from Consular or other commercial officials, there are other ways in which information respecting the responsibilities and liabilities of representatives and of their companies should be procurable. In the first place, there are the foreign Consuls and other foreign commercial organisations in London; secondly, there are foreign attorneys in London who understand the commercial laws of their respective countries; and in the third place there are the large banking institutions whose wealth of information concerning the trading conditions and the legal obligations of traders and contractors, which apply to the overseas countries where the banks have maintained branches for many years past, is no doubt available to clients or others who seek development in transmarine countries.

On the other hand, the travelling engineer or the supervising engineer on reaching a foreign country is able to apply, as already mentioned, to the British Consulates, Legations or Embassies; the firm he represents no doubt possesses commercial relations with overseas firms from which much useful knowledge may be obtained; the English managers of the local branches of English banks also come into consideration for procuring information; and it is open for the representative to consult an approved native attorney in the country where he intends to stay for a temporary period.

That the sources above mentioned have been utilised by British engineers in the past is highly probable; we merely recall them in order to show that certain paths are already open for the purpose in view. But it would appear to be impossible in every case to draw up a set of rules and information for the safe guidance of engineers and contractors or their representatives in different countries, so as to apply in general to the whole of one country concerned, as, for instance, Mexico and Brazil, on account of the existence of local or State laws. Thus in Brazil, besides the laws of the Federal Government, there are those of the different States, each of which is able to raise a loan on its own account, but the Federal Government assumes no responsibility for the payment of the interest or the redemption of the debt.

The most prudent course for engineers to follow, after having exhausted all sources available in England, would appear to be to take advantage of the overseas facilities already mentioned. In some cases it may cost money, but such expenditure is generally a profitable investment, as the resident Germans representing German industrial works in South America found out long ago, when they began the practice of making contributions of single sums of from £50 to £100 occasionally to local charities or public institutions, which they notified to headquarters, being credited with the amounts thus disbursed. Certainly those who are well equipped with the requisite information under consideration should be better able to transact business and execute contracts than those who are not so endowed, and it therefore devolves upon firms and companies which are interested to see to it that their representatives are fully armed with the necessary powers and the required information in order to ensure the success of their efforts in the acquisition of business and the fulfilment of contracts with the greatest facility and with the prospect of the minimum amount of friction with foreign authorities or private interests.

Baltimore Oil Switch Tests.

The high degree of reliability and continuity of service that users of electricity generally expect in this country makes it imperative to insist upon every section of the plant that supplies and distributes electricity maintaining a high standard of performance. It is realised that the astonishing growth of electric power systems, by necessitating a corresponding increase in the size of their components, *i.e.*, generators, transformers, cables, and other station equipment, has considerably augmented the burden that the switchgear has to carry. Moreover, the tendency to interconnect the older systems still further increases the duty that switching apparatus is called upon to undertake.

In view of these facts, it is not surprising that grave doubts exist as to the adequacy of the older types of oil circuit breakers at present in service for the heavy duty they may have to assume, whilst considerable uncertainty is felt concerning the actual rating of many of the more modern types of breaker. Even when a breaker does function properly it generally requires repairs or adjustments of some kind before it can be relied upon to clear a second fault, and this limitation of the number of times a circuit-breaker will satisfactorily interrupt heavy currents is indeed a serious drawback. The lack of exact knowledge as to the individual performance and rating of switchgear places the selection of the proper type and size of new equipment on an uncertain basis—a most undesirable condition when the size of, and investment involved in, modern undertakings are considered.

That this situation exists may be said to be largely due to the fact that manufacturers of switchgear are handicapped so far as the making of adequate tests is concerned. Tests are, of course, made, but they are generally few in number, or involve relatively small capacity. Manufacturers are naturally unable to reproduce the short-circuit conditions under which their products are required to function in practice.

Under the circumstances the elaborate series of oil circuit-breaker tests that have been carried out at Baltimore are of particular significance. Elsewhere in this issue it will be learned that a total of some 200 three-phase metallic short circuits were made directly on the Baltimore 13,200-volt, 25-cycle, power system, which the switchgear under test was called on to clear. The maximum generating capacity behind the short circuits was 170,000 kW, and the currents interrupted during the tests varied from 750 to 23,700 r.m.s. amperes.

The most interesting feature of the experiment is the fact that it has been proved to be possible to conduct such tests directly on a modern power supply system without damaging its equipment and without seriously interfer-

ing with its normal operation—a result which is undoubtedly due to the short duration of the short circuits, never more than 0.5 second, and to the fact that the system is equipped with a carefully designed and adjusted selective relay system.

The individual performances of the circuit breakers are said to indicate that it is possible to design and build switchgear which can be relied upon satisfactorily to interrupt large currents on large-capacity systems many times in succession without damage to the breaker, without oil throw, and without a change of oil or other adjustments being necessary.

Transatlantic Cable Communication.

The importance of accurate, prompt, and rapid communication by telegraphic means in times of peace and war, whether it be for business purposes or for naval or military operations, is universally recognised. The situation which arose last week as the result of the interruption of the cable and wireless telegraphic communication between Ireland and America should therefore be a significant warning.

Three weeks ago the large wireless station at Clifden, Co. Galway, was destroyed; last week the ten British submarine cables which connect British North America directly to the west coast of Ireland, in the neighbourhood of Valentia, were cut by Irish "Republican Irregulars" and the transmitting and receiving instruments either damaged or destroyed—the result being that this country is left with only three direct cables to America, which terminate at Penzance, Cornwall.

The reason which led the Irregulars to this action is not clear; the indignation of the American business world is no less than that of the general public whose widespread disapproval is summed up in the remarks that: "Mr. de Valera's mad Irish are making an international nuisance of themselves. They will, if possible, be more unpopular and more thoroughly discredited on this side of the Atlantic than they have ever been. If they persist, they will stir up a hornets' nest that will give them more trouble in a minute than Free State men can give them in a week." At a time when they are counting on American sympathy and support, the rebels' latest action seems to be singularly ill-advised; its only effects have been seriously to embarrass communication and to throw a number of their fellow-countrymen out of employment.

When the cables were landed on the west coast of Ireland, that country was an integral part of the United Kingdom and there was no serious risk of interference with them. With the constitution of the Irish Free State Provisional Government, however, the situation has radically changed, and the only way of freeing this country of what threatens to prove a serious handicap, would seem to be to transfer all vital arteries of communication with the Western Hemisphere direct to British soil and so place them out of reach of malicious damage. Happily, the situation has improved, and a considerably better service is available now, as compared with what was possible last week.

The German Electrical Industry.

The Rhenish electrical engineering group recently held a general meeting, when the secretary presented a report on the existing situation. The report stated that according to the guiding lines laid down by the Central Union of the Electrical Industry, the industry still calculates orders at the prices fixed on the date of the placing of the contracts in so far as the orders are executed within two months, which system is contrary to the practice of other industries. In the case of orders, the execution of which requires a period of longer than two months, the Central Union stipulates that these prices are to be calculated according to the arithmetical system of the percentage additions fixed every month to meet the increased costs of production. The Rhenish group contends that at a time when the depreciation of the currency proceeds in leaps and bounds and raw materials, such as castings, bars, sheets, textiles, copper, &c., have to be purchased at the ruling prices of the day, the following of the lines of the Central Union must lead to considerable losses. It is therefore suggested that this system should be abandoned as speedily as possible, that it should be replaced by invoicing at the prices prevailing on the day of delivery, and that the method of granting credits must be discontinued under any circumstances if the electrical industry is to continue to possess vitality.

The Glasgow Electricity Undertaking.

One of the largest electricity supply businesses in the United Kingdom, that of Glasgow, has just emerged from the most successful year of its history. The past year's working showed a net profit of £42,578, the whole of which has been transferred to reserve—a very wise policy. The most striking feature in the annual report is the enormous reduction in generating costs. Although the production of energy decreased, the decrease does not account for the very low figure recorded. As mentioned in our review of the report, the fuel cost was practically halved. No doubt the increased efficiency gained by the working of the up-to-date Dalmarnock station has a great deal to do with the result, but there is nothing in the report to show the fuel expenditure per kWh produced. In all probability the efficient method of coal handling and checking in use at Dalmarnock, aided by Mr. R. H. Parson's system of blotting a monthly boiler-house comparative efficiency diagram, has helped to attain this satisfactory result. It is significant also that a testing engineer, who is provided with complete testing equipment, is employed solely for the purpose of investigating problems connected with the economical operation of the station. The cost of coal must have been considerably lower, but it is to be noted that notwithstanding increased efficiency the cost of fuel per kWh sold remained at double the 1914-15 figure. Wages underwent a substantial reduction, and the decreases which occurred in other items appear amply to justify the institution of a scale of reduced charges by the Electricity Committee. The Glasgow supply is certainly "abundant," and compared with the majority of undertakings is very "cheap." We congratulate Glasgow on the result, and hope for an even better outcome from the current year.

The Proposed Visit to Gennevilliers.

As intimated in our last issue, the visit to the Gennevilliers station cannot take place before the end of the first week in October. We are now endeavouring to complete arrangements for an extended visit to the reconstructed areas of the North (particularly in the Lens district), which already contain magnificent new power stations and an astonishing network of extra-high-pressure overhead lines, together with a vast amount of new work of general engineering interest. We have spent some days recently in personally surveying the area referred to, and are satisfied that all that has been said regarding the work carried out during and since the war by our French allies falls short of the truth; not only as a matter of personal interest, but still more on the ground of technical progress, it is of the first importance that British engineers should make themselves acquainted with the methods and material employed in the reconstruction of the generating stations and transmission lines, and in the development of entirely new undertakings for the supply of electricity over large areas at the lowest cost compatible with reliability and efficiency. The number of engineers who have intimated their intention of becoming members of the party has already reached practically the limit which can be readily handled on a Continental visit. If there are any others who have not yet communicated their intention to join the party, their names should be sent in at once, as it will now be necessary for us to complete all arrangements and to advise the French companies of the numbers attending.

D

ALUMINIUM OVERHEAD TRANSMISSION LINES.

[Communicated.]

Aluminium as an electrical conductor has been in use to well over 20 years, and its special characteristics as a material for overhead transmission lines are generally well known. The development of aluminium cables having a core of steel, however, has of recent years drawn special attention to this alternative to copper, especially as a very large proportion of the most important modern transmission lines employ this form of cable, and an examination of the reasons which have led to the choice of steel-cored aluminium cables in these cases becomes of particular interest in view of the possibility of extensive developments of overhead transmission in this country that will probably follow the revision, now under consideration, of the existing overhead line regulations.



Fig. 1.—Section of the 45,000 volt French State Lines, Carrying Two Circuits of Steel-cored Aluminium Cable on Narrow Base, Lattice Steel Supports.

Before describing the particular advantages of steel-cored aluminium it is desirable briefly to refer to the chief characteristics of plain aluminium cables, in order to show in what way they are influenced by the presence of the steel core.

The chief claim for aluminium as an alternative to copper is that of economy. Although aluminium has a higher specific resistance than copper and, for the same conductance, the section must be about 64 per cent. greater, the specific gravity of aluminium is less than one-third that for copper and, in consequence, the weight of an aluminium cable is almost exactly one-half that of a copper cable of the same resistance and length. If, therefore, the cost of aluminium cable per ton is less than *twice* the cost per ton of copper cable, the aluminium one will be cheaper. The actual extent of the economy depends on various factors, but it is usually substantial, and may be as high as 25 per cent.

On the other hand, the tensile strengths of aluminium and copper cables of the same resistance are in the proportion of 82 to 100 and, in addition, the wind pressure will be greater on the aluminium cable owing to its larger diameter. The result is that the sag of an aluminium line will, in general, be greater than that of a copper line, so that the supports required may be both higher and stronger, and the saving on the conductors may be reduced, to some extent, by some extra cost of the supports. The difference between the costs of the supports to carry copper and aluminium cables decreases as the size of the conductor increases, and as the span length increases. Plain aluminium cables, therefore, have their greatest field of usefulness in schemes involving fairly large sizes of conductor and span lengths not exceeding two or three hundred feet.

For long-distance transmission, modern practice is to use span lengths of 500 ft. and over, not only because that figure gives the most economical construction, but also because the reduction in the number of supports and insulators reduces the number of points of possible breakdown. Moreover, the perfection of high-pressure switchgear, and the big strides which have been made in the development of insulators, have made available working pressures up to 220,000 volts, and the tendency is, therefore, to reduce the size of the conductors required to carry the power. If follows that long-distance transmission involves the very conditions under which aluminium cables show the least advantage—namely, long span lengths and small conductors, but even under these conditions aluminium is worth while, and there are several long-distance transmission lines of plain aluminium cables in America, Japan, New Zealand, and elsewhere.

For most modern long-distance schemes, however, the most suitable type of conductor is an aluminium stranded cable in which the central strands are of high-grade steel. Such a composite cable shows to the best advantage with long spans and with small sizes of conductors.

The steel strands are not regarded as contributing towards the current-carrying capacity of the cable, and the resistance is taken as the resistance of the aluminium strands alone. Hence, a steel-cored aluminium cable is of even larger diameter than the equivalent plain aluminium cable, and the supports must withstand an even larger wind pressure. Further, the addition of a core of steel obviously increases the cost and reduces the economy over copper. Why, then, with these apparent disadvantages, are steel-cored aluminium cables adopted



Fig. 2.—Ferro-concrete Supports with Steel-cored Aluminium Conductors, as Used in Northern France.

on the longest transmission lines and the largest high-pressure networks in the world!

The answer to that question is the fact that steel-cored aluminium conductors are from 55 to 65 per cent. stronger than copper cables of the same resistance and, at the same time, are from 16 to 26 per cent. lighter. The sum effect is that the sag with any particular factor of safety and loading conditions will be very considerably less than that of the equivalent copper conductors erected on the same span length, and hence the most economical span length with steel-cored aluminium cables is far larger. Thus, although the increased diameter necessitates an increase in the strength of the supports, the number of supports required per mile is reduced, and, taking both effects into consideration, it is found that the use of steel-cored aluminium cables enables a very considerable economy to be obtained in the total cost of supports and insulators and also in the costs of erection. In addition, although the steel must be paid for out of the saving on the aluminium part of the conductor, there is nevertheless an appreciable economy on the conductors themselves in comparison with copper, and the composite cable therefore scores as regards economy on all the chief items of the line.

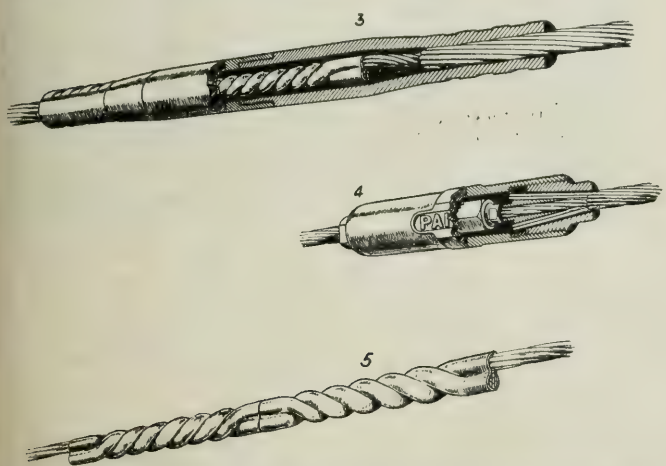


Fig. 3.—Two-piece Compression Joint for Large Steel-cored Aluminium Cables.
Fig. 4.—"Pairard" Cone-type Connector for Steel-cored Aluminium Cables.
Fig. 5.—Double McIntyre Sleeve Joint for Steel-cored Aluminium Cables.

It is interesting to note that in the transmission line now being erected in Australia in connection with the Morwell brown coal scheme, the adoption of steel-cored aluminium conductors has enabled the span length to be fixed at 1,054 ft., which is at present the longest average span length in the world. It is not suggested that in this country such span lengths will be possible even for the long-distance transmission lines which would be associated with any schemes for the utilisation of the water-power resources of Wales or Scotland. The crossing of cultivated land will necessarily restrict the space available for tower foundations, and long-distance transmission schemes in this country will probably be carried out on narrow base supports, such as those shown in fig. 1, or possibly on ferro-concrete supports as illustrated in fig. 2. The same principles will apply, however; and while with copper conductors it may be necessary to place a support in the centre of a large ploughed field, or to divert the line round the field, with steel-cored aluminium cables, in most cases, there will be no difficulty in crossing in a direct line with supports at the hedges.

The fact that the diameter of a steel-cored aluminium cable is greater than that of the equivalent copper conductor, gives the composite cable two special advantages which are sometimes of great importance. First, the corona voltage will be increased, and, secondly, the reactance of the line will be decreased. The corona voltage is nowadays quite frequently the most important factor in fixing the conductor size. For example, a copper conductor of 0.05 sq. in. section cannot be used without corona discharges taking place, even in fine weather, at line pressures over about 70,000 volts; whereas under the same conditions corona discharges will not occur with the equivalent steel-cored aluminium conductor unless the line pressure exceeds 94,000 volts. Thus, with a line voltage of 60,000, the copper conductor would be dangerously near the corona limit, and corona discharges are certain to occur in periods of bad weather, whilst with the aluminium-steel cable the factor of safety against corona loss is much higher.

The inductance of a steel-cored aluminium cable is the same as that of a homogeneous conductor of the same overall diameter, and the presence of the steel core, which carries no appreciable part of the current, has little greater effect on the total reactance than would a core of hemp. The fact that the overall diameter is larger, and that the smaller sag often permits the conductors to be spaced nearer together, results in the total reactive drop in steel-cored aluminium cables being smaller than that in copper cables of the same resistance.

It now remains to explain how the combination of the two different materials into one cable affects the physical characteristics of the cable. It should first be appreciated that under no practical circumstances can there be any relative movement between the steel core and the outer aluminium strands. It is the practice at joints, dead-ends, and anchor points to secure the steel and aluminium separately, so that at these points the two are rigidly fastened together; but, quite apart from this, it is well known that when a stranded cable is under tension the tendency for the outer strands to straighten out causes them to grip the centre strand, or strands, very tightly. In a steel-cored aluminium cable, therefore, the elastic stretch under load must of necessity be the same for both the steel and the aluminium, and it follows that the load will automatically be distributed between the steel and the aluminium in such a way that the stresses are proportional to their moduli of elasticity. The stress in the aluminium will, therefore, be about one third the stress in the steel, and since in a 7-strand cable there will be six aluminium strands to one steel strand, the total load taken by the aluminium will be twice the total load taken by the steel.

Now, supposing the temperature rises, the aluminium will tend to expand more than the steel, but because of the strong gripping action between the aluminium and the steel the actual expansion which occurs will be limited by the fact that it must be accompanied by an extra elastic stretching of the steel. In effect, the result is that the stress in the steel is increased and the load in the aluminium correspondingly reduced. It is desirable to explain that this transfer of load cannot, under practical conditions, continue to such an extent that the steel core is dangerously overloaded, nor can any trouble be experienced with "bird-caging" due to a complete removal of all stress from the aluminium.

The stress distribution between the aluminium and the steel strands is continually changing, but this need cause the designer no concern, because the total tension in the cable, however it may be distributed between the two materials, varies with changes in loading and temperature strictly in accordance with the usual catenary

formulæ. Calculations of sags and tensions under any particular weather conditions can, therefore, be made with the same accuracy as for homogeneous copper or aluminium cables, provided that use is made of certain "virtual" physical constants that are derived from the different physical constants of the two component metals.

No trouble has yet been recorded due to corrosion. The steel core is heavily galvanised, but it is probable that the immunity from corrosion also depends very much upon the fact that the aluminium strands bed so tightly round the core, when under load, that moisture penetration is impossible. The outer aluminium strands are not themselves subject to corrosion unless in alkaline atmospheres. Very many examples are known of thoroughly satisfactory operation of aluminium cables on the sea coast, in the neighbourhood of blast furnaces and other localities where copper is subject to attack. Such troubles as have occurred with aluminium cables can nearly always be traced to the use of copper binding wire, alloy clamps, or some other form of bi-metallic contact exposed to moisture. Bi-metallic contacts are always subject to corrosion in such circumstances, and this point should always be borne in mind.

The jointing of steel-cored aluminium cables requires no very special consideration, except for fairly large sizes. For all sizes up to about ½ in. diameter the standard joint is the McIntyre sleeve as used with plain aluminium cables and sometimes with copper cables, but owing to the much greater strength of steel-cored cables it is usual to use two sleeves twisted in opposite directions, as shown in fig. 5. For larger sizes several methods are available.

That favoured in America is shown in fig. 3. In this case the steel core is first joined by a steel McIntyre sleeve, which is enclosed in an outer cast sleeve of aluminium made in two halves and screwed together. This outer sleeve is bored at the ends to fit closely the aluminium strands, and when the steel joint is made and the outer sleeve screwed up, intimate contact between the aluminium strands and the sleeve is made by squeezing the ends of the latter between the dies of a portable hydraulic press.

In France the "Pairard" joint, illustrated in fig. 4, is greatly used. It has the advantage that no hydraulic press is required, and the joint is shorter and neater in appearance. In this case the aluminium strands are gripped between two wedging cones at the ends of a cast aluminium body. The steel strands are also gripped in a similar way by means of a small cone-type connector which is itself enclosed within the outer aluminium body.

Both the two-piece compression joint and the "Pairard" joint are capable of taking the full tension of the line.

In conclusion, it should be pointed out that steel-cored aluminium cables are not in all circumstances the most economical. Their chief advantage lies in the small sag which is permissible, which makes possible the use of long spans and a reduction in the number of supports. In many cases, such, for example, as distribution systems in towns, the span length is restricted by local conditions, and though in such cases steel-cored aluminium would be cheaper than copper conductors, an even greater economy could be obtained by the use of plain aluminium cables.

In the same way, for heavy low-pressure feeders the extra strength afforded by the presence of a steel core is not necessary. The tension allowable, and hence the sag, is limited by the maximum tension which clamps and insulators can withstand, and in this case also the use of plain aluminium conductors gives the greatest economy.

Briefly, steel-cored aluminium cables are chiefly of value for long-distance transmission, while plain aluminium ones can compete when span lengths are limited by considerations other than economy.

75,000 H.P. NATURAL GAS-FIRED POWER PLANT.

By FRED. A. TALBOT.

Although the State of California is richly endowed with hydraulic resources which are being extensively exploited for the bulk generation of electric energy, the completion of the essential development work occupies considerable time, especially when the hydraulic field lies in a somewhat inaccessible spot rendering rapid survey impracticable, and the establishment of communication facilities, as a preliminary for the haulage of material and labour indispensable. This has been especially noticeable in connection with the San Joaquin Valley. During the past few years the cultivation of raisins and other agricultural produce has advanced at a phenomenally rapid rate, and the necessity to resort to irrigation during the summer season has imposed a difficult task upon those responsible for the provision of cheap power.

Electricity is the pre-eminent form of power for inexpensive irrigation, and the realisation of this fact by the farming industry of California has created a somewhat remarkable situation, which is especially noticeable in the valley of which Fresno is the commercial centre. At the present moment there are approximately 1,500,000 acres of cultivated land in the State dependent upon irrigation by pumping, and as 297 kWh per acre per annum are required, more than 500,000 h.p. is utilised for this purpose during the summer season. The convenience and low figure at which electricity is available has induced the cultivation of the semi-arid land within easy reach of the coast which previously had been ignored, and some idea of the load likely to be imposed in this connection may be gathered from the statement that there are over 3,000,000 acres within easy reach of the seaboard which can be reclaimed for agriculture if only adequate electric energy be available. On the basis now ruling this should offer scope for the consumption of a further 1,000,000 h.p. per year. The hydro-electric corporations appreciate the situation and the significance of the agricultural load, but find it difficult to keep pace with development, for the simple reason that the farmers, cognisant of the possibilities of electric energy, are developing the land in anticipation of the supply being forthcoming, and once the land is taken over the corporations are faced with the necessity to supply energy with all speed to save the crops.

In 1920 the situation in the San Joaquin Valley became critical. The San Joaquin Light and Power Corporation, which is established in this territory, commands an area more than 200 miles in length by 200 miles in width at its broadest point. The total acreage served by the system is 16,584,930, of which 7,916,050 acres are adaptable to agriculture. The total value of all products from the territory served, inclusive of oil, farm produce, live stock, manufactures, lumber, minerals, &c., is in excess of £64,000,000 per annum, with a population of less than 310,000, while the gross revenue of the power corporation mentioned exceeds £850,000 a year. Electricity was introduced to this territory in 1896 by a small company which was the first to transmit the energy over a distance of 36 miles. Reorganisation, combination, and amalgamation have had to be persistently embraced, culminating in the present enterprise, which, up to July 1st, 1921, had spent over £5,250,000 on stations having an aggregate generating capacity of 168,251 h.p. and distribution systems. Yet, notwithstanding the energy displayed, the corporation was faced with a waiting list of 2,000 customers at the termination of the war, which number grew to 4,500 in the course of a few weeks.

To meet the situation the corporation was compelled to hurry forward a hydro-electric plant of 55,000 h.p.,

which was completed within 15 months, and to embark upon a more ambitious scheme which ultimately will yield 407,000 h.p. But owing to the time which the latter undertaking will require to carry through, the corporation was forced to embark upon a comprehensive steam-power plant construction programme. So far as the latter was concerned, the fuel issue did not assume such formidable proportions as is generally the case with such undertakings in California, because the Bakersfield oil fields are in the territory served, and one of the by-products of the oil industry is the natural gas which



Fig. 1.—Bakersfield 37,500 h.p. Generating Station, California.

is drawn off in enormous quantities. Accordingly the corporation laid down a new 17,500-h.p. steam unit at its Bakersfield station, bringing the output of the latter up to 35,600 h.p., produced by three units, the natural gas for firing the boilers of which is pumped from a point on the oilfields 46 miles distant.

The completion of the new hydro-electric and steam extension provided a further contribution of 72,000 h.p. in the autumn of 1920, and forthwith an extensive "drive" was inaugurated during November of that year to connect up the 4,500 priority customers, the object being to deliver power before the following irrigation season. In the course of six months more than 1,000 miles of transmission and distribution lines were completed, connecting up 50,000 h.p., and the waiting list, then unfilled, demanded an aggregate load exceeding the balance of 22,000 h.p. in hand.

To avoid a power shortage the corporation thereupon assumed the construction of another huge steam-power generating station, the first unit of which was brought into service within eight months of the ground being broken; it would have been available earlier but for the inability to secure delivery of some of the electrical plant. This station, for which 120 acres of land were secured, is at Midway, Buttonwillow, 28 miles from Bakersfield. The power-house, the first part of which measures 140 ft. in length by 128 ft. deep, is of the steel-framed type, housing a battery of eight 622-h.p. water-tube boilers, disposed in batteries of two, designed to generate steam at 250-lb. pressure, superheated to 600 degrees. The first turbine unit of 15,000 h.p. is coupled direct to an Allis Chalmers 12,500-kW generator, and the current, delivered at 11,000 volts, is stepped up to be fed into the new 110,000-volt transmission line extending from Bakersfield to Merced to the north, which is tapped at strategical points *en route*.

The boilers are gas-fired, the fuel being drawn from the Elk Hills oil-fields. The gas is pumped for a distance of nine miles through an 8-in. main at a pressure varying from 450 to 500 lb. per sq. in., which is reduced to about eight ounces at the plant for delivery to the boilers. The consumption of gas averages about 7,000,000 cu. ft. per day. The water supply promised to prove a difficult problem, but this was satisfactorily met by six wells sunk to depths ranging from 350 to 585 ft. The wells are lined with a 12-in. casing and have a total delivery of 4,000 gallons (American) per minute. Tests proved the water to be of great purity and suitable for boiler-feed purposes, so that a treating plant has not been found necessary.

The boilers have a total evaporating capacity of about 180,000 lb. or 22,500 gallons per minute, and practically the whole of the water evaporated into steam, after passage through the turbines, is led through condensers for return to the boilers. Steam from the main turbine is condensed by a surface condenser having 30,000 sq. ft. of cooling surface. It comprises 6,000 1-in. brass tubes, 20 ft. long, through which the condensing water is circulated. A supply of 24,000 gallons of water per minute is required for circulation purposes, and this is furnished through a 30-in. centrifugal pump driven by a 150-h.p. steam turbine.

The water enters the condenser at about 80 degrees and leaves at 90 to 95 degrees. It is cooled in a spray pond measuring 300 by 200 ft. and 4 ft. in depth, being projected 6 to 8 ft. into the air through 360 brass nozzles, and in this manner has its temperature

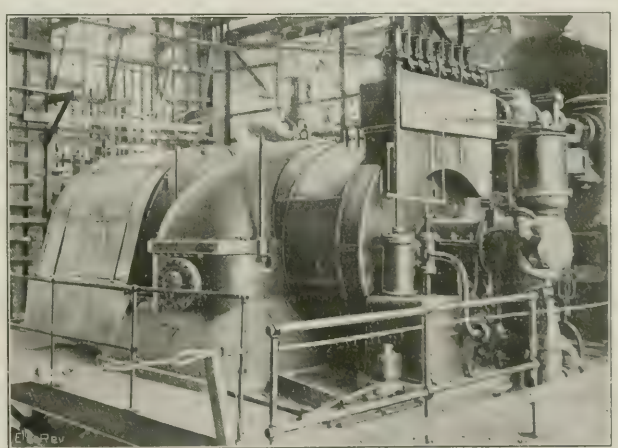


Fig. 2.—A 12,500 kW Turbo-Generator at Midway Station, Buttonwillow.

reduced to from 5 to 10 degrees below that of the atmosphere. This spray pond is also designed to serve as a water supply reservoir in case of fire. Water for domestic use by the employes is supplied from a separate tank of 20,000 gallons elevated 50 ft.

When the Midway station is completed it will house four units similar to that already installed, the de-

signed rated capacity being 75,000 h.p. The station has a frontage on two main streets, and on the site there has also been erected fourteen five roomed permanent



Fig. 3.—Spray Cooling Pond at Midway Station.

cottages for the employés. These houses are equipped with all modern domestic conveniences, including natural gas heating appliances and electric lighting. The completion of the initial part of this plant, costing £500,000, permitted the pressing demand for power to be relieved, but the crisis was not effectively avoided until two months later by the completion of the Kern River hydro electric station, which increased the aggregate available energy to 181,900 h.p. The larger scheme on the Kings River, 50 miles east of Fresno, which will furnish 407,000 h.p. through nine power-houses ranging in capacity from 4,270 to 162,615 h.p., and working under effective heads of 122 to 2,385 ft., is now in hand. The realisation of this scheme will take some years, since it involves heavy development work, impounding the water in four large lakes giving an available storage capacity of 269,400 acre-feet, and the driving of 34 miles of tunnels ranging from 6 x 6 to 14 x 14 ft. in section. The longest tunnel, 12 ft. square in section, will be 7½ miles in length. In addition, six miles of open ditch, two miles of woodstave pipe, and ½-mile of steel siphon have to be built and laid. To meet this commitment the corporation is allocating £400,000 per annum until completion. Extensions to the Midway steam plant can be carried out somewhat more leisurely, inasmuch as the relative rapidity with which the additional units can be installed will enable the corporation to anticipate safely any sudden demand that may be likely to arise.

STEAMPIPE ARRANGEMENTS.

By EDWARD INGHAM, A.M.I.Mech.E.

In designing a steam plant, the arrangement of the pipes conveying the steam from boilers to engines is a matter of vital importance, particularly where the pipe ranges are of great length. Nevertheless, this question is commonly regarded more or less indifferently, and to this attitude must be attributed a large proportion of the steam pipe failures which occur from time to time.

In designing a range of steam pipes, it is well to bear in mind that pipe explosions are brought about in three principal ways: (1) By water hammer action; (2) by expansive and contractive movements; and (3) by vibration.

Water Hammer.—Water hammer is the action which takes place when volumes of water are propelled violently along the pipes until they meet an obstructing metal wall, as, for example, the bend of a pipe, which is more or less strained by the force of the impact, and in severe cases, fractured.

Since the formation of water cannot be avoided, the object should be to arrange the pipes, as far as practicable, so that no water can settle at any part. The ideal arrangement would be that in which there were no parts in which water could collect, *i.e.*, one straight length of piping almost horizontal, except for a very slight fall from boilers to engines. With such an arrangement, all water would drain naturally towards the engines, where it could be collected in a suitable separator or drop leg, and run off from time to time.

Under such circumstances, water hammer would be impossible, so far as the steam pipes are concerned. Unfortunately, this ideal arrangement is not possible in practice, because there must of necessity be at least one vertical rise or fall in the piping, which means in most cases that "collecting lengths" or pockets are found in the range. Nevertheless, in a great many instances there are more of these pockets than need be, and it seems obvious that many pipe designers have paid no attention to the question of avoiding them.

A case in point is frequently seen on the boiler itself, where the steam, after passing through the junction valve, is made to rise up a short vertical length to the main steam pipe. Clearly, when the junction valve is shut, water of condensation will gradually collect in the vertical length above the valve. This objection is easily obviated by placing the junction valve on the top of a short stand pipe, so that it is level with the main range, instead of direct on the mounting block on the boiler.

With the object of preventing danger from water hammer in all cases where water chambers cannot be avoided, two precautions should be taken—one by the designer of the pipes, and the other by the person in charge of the steam plant. The first is to provide efficient drains at every point where there is any possibility of water accumulating; the second is to make certain that all the drains are opened and the water run off before the steam is turned into the pipes. It is most important that the drains should be of ample area, and that they should not be allowed to get choked or partially choked with deposit.

It is advisable to connect up all the drains to a good automatic steam trap. An attendant is always liable to forget to open the drains before turning on the steam, and should any considerable quantity of water have collected, risk of water hammer is incurred. A steam trap, provide it be maintained in reliable working order, will drain off all water of condensation as fast as it is formed.

When there is no steam trap, the engineer-in-charge should not attempt to drain off any water under pressure. Under certain conditions, to do this is really dangerous.

Suppose, for example, a vertical length of piping is connected with a horizontal length below, and that water has filled the latter and part of the former length. Now if the drain tap be opened, the water level in the vertical pipe will fall steadily, and no serious consequences are as yet liable to ensue. When, however, the level falls to that of the horizontal length, a long surface of water is exposed to the steam. Since the water is at a lower temperature than the steam, heat flows from the steam to the water, in consequence of which, some of the steam condenses, and a partial vacuum is formed. The action now would appear to be as follows:—The steam rushing into the horizontal length agitates the water contained therein, giving to it a wave motion. The water is driven forward with great violence, and

although the pipes may be strong enough to resist many times the normal working pressure, they may be much too weak to resist the excessive stresses set up when the water meets the first obstructing metal surface. It is in this way that fracture and explosion of steam pipes may occur.

In a recent explosion, the engineer-in-charge opened the drain cock to run off water from a vertical length before opening the junction valve. The drain, however, was partially choked, and the junction valve was opened before all the water had been run off.

All that happened for a time was a little crackling in the pipes whilst the vertical length was being drained, but when the water level had fallen to that of a long horizontal pipe connected with the vertical pipe, water hammer action was set up, and the pipes exploded. This accident shows the importance of arranging, as far as possible, that the outlets of the drain cocks should be visible.

As a further precaution against water hammer, steam should always be turned on very gradually. It stands to reason that if the conditions for water hammer exist, there is far more risk of danger if a full body of steam is admitted suddenly into the pipes, than if the flow is made very gradual.

Expansive Movements.—Next in importance to water hammer as a cause of explosion of steam pipes is the question of expansive movements of the pipes. The forces set up during expansion are practically irresistible, and unless this fact is recognised by the designer, fracture will be likely to result.

There are several ways of allowing for expansion of steam pipes. If the range is not a long one, the expansion of a certain length of piping can be suitably taken up by another length running at right angles to the first. If those concerned in the design of steam pipes would take a little trouble in sketching out two or three arrangements instead of adopting the first which presents itself to their minds, rigid pipe arrangements would be much less common than they actually are.

When considerable expansion is to be allowed for, it becomes necessary to provide special spring bends, expansion cushions or joints of some form.

The most scientific arrangement from the theoretical point of view is undoubtedly what is known as the gland expansion joint, in which the end of one pipe is supposed to slide freely into the end of another as expansion takes place, a gland and packing being provided to prevent leakage of steam. But expansion gland joints are frequently found defective, and as they often give trouble from leakage of steam, and are expensive to make, most pipe designers prefer other means of taking up the expansion.

Expansion bends are of various forms, but most of them approximate to the form of a horse-shoe or a complete loop. When made with a large sweep, they are capable of taking up considerable expansive movements without undue straining. They are mostly made of mild steel.

As far as possible, expansion bends should be arranged so that they do not form chambers in which water of condensation can collect. Otherwise, they must be provided with suitable draining facilities.

Other devices for taking up expansive movements are somewhat loosely classified as expansion diaphragms, cushions and bellows joints.

All these essentially consist of copper or steel plates of curved or dome form, fixed between two flanges, and the whole piece is inserted between the flanges of the two pipes adjoining each other. The expansion is taken up by the yielding of the curved plates, the action being very similar to that which takes place in a concertina or a bellows.

Whatever sort of expansion device is adopted, particular care must be taken to fix the device in the right place. In general, the expansion piece should be arranged centrally, and the ends of the pipe length whose expansion is to be accommodated should be anchored. Only in this way can it be ensured that each device will satisfactorily fulfil the purpose for which it is intended.

Vibration.—Vibration of steam pipes can scarcely be regarded as a common trouble, but it is occasionally experienced, and under certain conditions proves to be a most serious and even dangerous annoyance. The general effect of vibration in steam pipes is to cause more or less severe stresses in the pipe material, and in course of time these stresses, oft repeated, cause fatigue and weakening of the material, which is then liable to fail under the steam pressure.

With regard to vibrations caused by pulsations of the steam, it has to be remembered that the flow of steam along the pipes is not steady, but is in the nature of a series of waves, due to the fact that a piston engine does not take the steam continuously, but only periodically, when the admission valves open.

These pulsations of the steam are, of course, transmitted to the pipes, which are made to vibrate in consequence. In the majority of cases, the vibration is so slight as to be inappreciable, but occasionally it becomes annoying. The trouble is most liable to occur if the pipes are of small diameter; when they are amply large, the flow of steam is comparatively slow, and there is not the same tendency for the trouble to be set up.

When the vibration is due to pulsations of the engine, the trouble is likely to be more pronounced than in the other case. In general, two conditions must be fulfilled before an engine can set the steam pipes vibrating. The first condition is that the engine is not properly balanced, and the second that the natural period of vibration of the pipes just synchronises with the period of vibration of the engine.

Obviously, when the trouble in question occurs, a slight alteration of the speed of the engine will often entirely prevent the trouble. Even when the vibration is due to steam pulsations, an alteration of speed of the required amount may for similar reasons be expected to relieve the trouble.

The supports used for carrying the piping will have an influence on the natural period of vibration of the pipes, and hence, by altering or replacing the supports so that the natural period no longer coincides with the period of pulsation, the trouble may be overcome.

Pipe Material.—It will be obvious from what has been said that steam pipes have to resist stresses in addition to those due to the steam pressure, some of which may be very severe, and for this reason the question of material is an important one. To reduce the risk of failure to a minimum, the material used should possess the qualities of tenacity and ductility in a high degree.

Mild steel ought to be used in almost every case, in preference to any other material. There can be no question that if it were universally adopted, steam-pipe explosions would become much less frequent than they are at the present time.

A New Traffic Light.—Various systems of traffic or signal lights have been installed in the U.S.A. during recent years in order to care for the ever-increasing traffic on city streets at night. They have consisted of elevated beacons which are also used to control the traffic; iron, wooden and concrete posts equipped with illuminated globes at their tops, illuminated signs, &c. A recent development in a traffic signal that is discernible by day and by night is the Mushroom light first used in Milwaukee, and since in many other cities, including Chicago, Cleveland, Minneapolis, Indianapolis, Detroit, St. Louis, Kansas City and many smaller cities. This new light consists of an 18-in. heavy ruby glass hemisphere covered with a ribbed steel grating rising 8 in. above the pavement. Its hemispherical shape causes the wheels of passing vehicles accidentally striking it to slide off easily without injury either to the light or to the vehicle. In this type of unit there is no part to be broken off by impact; two 75-watt lamps are used. This light is designed primarily for use in the centre of street intersections, especially at intersections where traffic is heavy, but where a policeman is not [illegible] stationed. Its presence in the street ahead immediately [illegible] to the motorist a busy corner. By dividing the [illegible] and keeping motorists on the proper side of the [illegible] the possibility of accidents is greatly reduced. *Electrical Journal.*

LEAVES FROM AN INSPECTOR'S NOTEBOOK.

By "ANODE."

A point to which sufficient importance is not paid by users of electrical machinery is that of duplication, and if this were more often considered when installing additional machines, or replacing old ones, a deal of trouble and manufacturing losses would be saved.

In the course of my travels I have dropped across numerous cases where it would have been possible by a slight additional expenditure to duplicate an important or key machine, yet the opportunity had been neglected, with the result that on a breakdown of the key machine, the whole of the works had perforce to stop, whereas, had a duplicate been available, it could have been installed in the place of the faulty machine, and the probable result would have been that the output of the works would not have been seriously affected.

An instance of this occurred some years ago, in a small foundry, where the key machine was a 30-h.p. motor driving the blower. No other motor in the place was of anything like the power, and the firm did not feel like going to the expense of buying a duplicate, which probably would have remained idle for a lengthy period.

I urged upon the owners the advisability of making some arrangement to ensure that in the event of a breakdown they could carry on, but without avail, until one day, when I was making my customary inspection, they asked my advice as to purchasing a motor for an extension of their works.

The maximum horse-power required would be 20, and that very seldom, and their idea was to install a 15 or 16-h.p. motor conservatively rated, and rely upon its overload capacity for the exceptional instances when the 20 h.p. would be required.

The opportunity was too good to be missed, and I put forward the suggestion that it would be advisable to duplicate the blower motor; even though it would cost more than the 16-h.p. machine, it would consume very little more energy, and in the event of a breakdown of the blower, they would not have to close their works for any lengthy period, as two hours would suffice to change-over the machines.

After a lot of discussion they decided to do this, and having gained my point, I went a step further and suggested that they should also duplicate the starting switch, which was arranged for speeds above and below normal. This was also agreed to, and the necessary particulars, together with the order, were duly dispatched to the motor manufacturers. The firm was then in the position that in the event of a breakdown of either the motor or the starter, it could get going again immediately, and further that the motor working in the new extension would be running on an easy load, and capable of dealing with the occasional 25 per cent. extra load without difficulty, and still leave a reserve of power available if any extra were required.

A few months later, at a time when they were exceptionally busy, the blower motor completely burnt out, necessitating rewinding of both armature and fields, and the change-over to the duplicate was made; it was found that the total loss of output was 15 per cent., whereas had this duplicate not been available, it would have taken as long to obtain another machine as to rewind the burnt-out one, and for that period the whole of the output would have been lost. This afforded a striking example of the value of even a partial duplication, and there are many instances where something on similar lines could be arranged.

It is not always the case that the largest machine in a works requires duplicating, as the following instance will show:—

A large works had an electrical installation second to none in the kingdom; all the machines were standardised and so arranged that practically any motor could be replaced at once, and in addition they had at least 50 per cent. of the armatures duplicated, so that it appeared impossible for any breakdown to cause more than a very brief stoppage.

On going round these works I was greatly impressed with the admirable arrangements of the whole installation, yet there was a cockroach in the jam.

The generating plant consisted of two large high-speed sets, one of which worked at a time, and of ample capacity for the whole requirements of the works, yet only one condenser pump motor was installed for both sets, and this was the only motor that was not duplicated, no motor of the same size and speed being available in the works.

In the event of this motor breaking down, the position would have been very awkward, and on my pointing this out to the managing director he was greatly surprised, and immediately put a spare machine on order.

It would certainly have been possible to work the sets non-condensing, but the loss would have far outweighed the cost of the small motor.

It is not always so easy to advise clients as in the two instances related, as in some cases where firms adopt a penny-wise policy, one finds an installation of perhaps 60 motors representing a dozen different makers and all of different powers and speeds.

One happy-go-lucky firm of this sort on one occasion had a breakdown to a 25-h.p. machine, and was forced to substitute a 15-h.p. motor, this being the only one available near the speed required, and to work on half the plant for a week or two, a serious matter during the war, and still more serious from the point of view of munition supplies.

This taught the owners a lesson, and when they extended their works, the electrical portion received very careful attention, the new plant being so arranged that not only was it standardised, but it duplicated a fair portion of the older plant as well.

It is not only the motor that requires duplicating; it should always be possible to replace a defective starter, and it is common knowledge that there are some thousands of these to be found all over the country.

I suppose the history of the motor-starting switch is something like this: When the first man made a motor he found that it was not lucky to start it by closing the main switch, especially when the motor was of any size, so he made a graduated resistance which went in series with the motor, and gradually evolved something on the lines of a multiple switch, which took the place of the old main switch as the starting device.

This went on till one day the generating station broke down and the motor stopped, the resistance, of course, being cut out. The generating station got going, and the poor motor got the lot suddenly, with disastrous results.

Then the brainy man designed a no-volt release, which acted sometimes, and more often did not.

The next thing was that the motor got overloaded, so he set to work and designed the overload release, that beastly little thing made out of hairpins and odd brass strip, which acted, or was supposed to act, by short-circuiting the no-volt coil.

After thirty years we find the same device stuck in the south-west corner of the starter, and still as profanity-provoking as it was in the beginning.

Then the cheap-jack took a hand in the deal, and cut down everything to the finest limits, and turned them out by the thousand, and at such a price that when you bought a motor, a starter was thrown in like overweight margarine, and 75 per cent. of the motors running to-day are controlled (?) by these rotten cheap starters, with the result that 50 per cent. of the motor breakdowns are directly caused by them.

It is to the credit of a few firms that this state of affairs is being altered, and they have succeeded in turning out absolutely reliable control gear, and I find that the leading engineers are paying great attention to this question of control, in many cases the control gear costing more than the motors it works in conjunction with.

THE EFFECT OF HEAT ON THE ELECTRIC STRENGTH OF SOME COMMERCIAL INSULATING MATERIALS.*

By W. S. FLIGHT, A.M.I.E.E.

It is chiefly to the insulating materials used that we shall have to look for future improvements in electrical machinery, and in this connection a knowledge of the effect of heat upon the electrical and mechanical characteristics of insulating materials is of the greatest practical importance.

Following upon his "Tests on Insulating Materials,"† and his experiments on the "Dielectric Strength of Solid Insulating Materials,"‡ the author conducted an investigation in the Research Laboratories of the Metropolitan-Vickers Electrical Co., Ltd., to ascertain the variation in electric strength between temperatures of 30 and 100 deg. C. of many of the solid insulating materials at present employed in the manufacture of electrical machinery and apparatus.

The most important factors to be considered to enable the test conditions to be standardised so that the effect of variation of temperature can be studied, are explained in the original paper, throughout which the "electric strength" is expressed as volts per mil. By that term is implied the voltage required to break down unit thickness of the material.

Temperature voltage curves were obtained for each material, dry and humidified specimens being tested in dry and damp air and in oil.

Papers.—It would appear that the following facts can be deduced:—

(*a*) When damp papers are tested in air the electric strength at 100 deg. C. may be higher than that when tested cold, due to evaporation of some of the moisture, which takes place even when the paper is surrounded by damp air.

(*b*) When damp papers are tested in oil the electric strength at 100 deg. C. may be higher or lower than that when tested cold. This depends on whether the voltage is raised sufficiently slowly to permit of the moisture being driven out through the oil. Under the conditions in which the insulation is placed in, say, an oil-immersed transformer, and when the voltage is raised at the usual rate for the high-pressure test, it would appear that the electric strength of damp paper when hot would certainly be lower than that of the same material when tested cold.

(*c*) When dry papers are tested in air or in oil the electric strength at 100 deg. C. would appear always to be lower than when cold, particularly in the case of tests in oil.

Micarta.—All the results on this substance were obtained on materials composed solely of paper and varnish, and as it is largely employed for the insulation of oil-immersed apparatus, the majority of the tests were conducted in oil. The decrease in breakdown voltage with increase in temperature is very rapid. Speaking generally, it would appear that the synthetic bonds have a higher electric strength than the natural-gum bonds at 100 deg. C., probably partly due to the fact that at this temperature the synthetic-gum micartas retain most of their initial mechanical strength, whilst the natural gum micartas were all found to be extremely soft and flexible.

The average of all the tests on all bonds and papers investigated clearly shows that whilst the addition of the bond to the paper makes the electric strength of micarta at 30 deg. C. higher than that of the same thickness of unvarnished paper, the reverse is the case when the materials are tested at 100 deg. C. At first sight this is very surprising, but both natural and synthetic gums are extremely complex chemical mixtures; when either of these types of gums is heated destructive distillation takes place. Some of the constituents given off consist of organic acids, and water is also often one of the distillates. Even at 80 deg. C. certain gums give off small quantities of highly acid distillates, whilst at 100 deg. C. practically all the gums which have been employed for the manufacture of micarta produce acid distillates. Even if the quantity produced is extremely small its acid nature and the fact that it is evolved inside the insulation may conceivably result in a very appreciable decrease in electric strength. To those acid distillates is attributed the rapid decrease in electric strength.

The materials and process for the manufacture of micarta offer a most profitable field for further research, and even with the bonds at present employed much can be done by suitable heat treatment to remove the acid distillates and so raise the electric strength at 100 deg. C.

Fullerboard.—By this term is meant a good quality paper board known as fullerboard, pressboard, or press-spahn.

The electric strength of a material of the nature of fullerboard may vary over a very wide range, depending on the treatment it has received and the condition of the sample at the time of test. Thus, when untreated, fullerboard of a thickness of 1/16 in., which had previously been exposed to a damp atmosphere, was tested in oil, the electric strength at 30 deg. C. was of the order of 110 volts per mil only. If the same material is dried and impregnated with a mineral oil, the electric strength at 30 deg. C. when tested under the same conditions may be as high as 1,000 volts per mil. The corresponding values when the samples are tested in oil at 100 C. are 48 and 610 respectively. These facts are of the utmost importance in the manufacture of electrical machinery, particularly when the thickness of the insulation used is such as to impose, during the high-voltage pressure-test, stresses near the breakdown voltage of the dielectric. It is quite conceivable that apparatus which, with correct treatment, might have had an ample factor of safety on the test voltage, may not, as the result of incorrect treatment, be able to withstand the test voltage.

When using a material of the nature of fullerboard, the electric strength depends even more on the thoroughness of the treatment than upon the initial electric strength of the material previous to treatment. On the whole, fullerboard would appear to be a more suitable material for high temperatures than micarta, and it has approximately the same electric strength at 100 deg. C. as thin papers. At lower temperatures the effect of the treatment given to fullerboard is more pronounced, resulting at 30 deg. C. in the electric strength being about the same as that of micarta and higher than that of untreated papers.

Varnished Cloth.—When this material is tested cold it compares very favourably with the others already considered, but when tested at 100 deg. C. it is no better electrically than paper of fullerboard, though superior to micarta.

Mica Products.—Nine materials were investigated: *i.e.*, mica cambric (untreated cambric, overlapping mica splittings, and Japanese paper); flexible mica paper (untreated paper, overlapping mica splittings, and Japanese paper); mica varnished cloth (yellow varnished cloth, overlapping mica splittings, and Japanese paper); micafolium plate (overlapping mica splittings, shellac varnish, and paper); mica silk (silk, overlapping mica splittings, and Japanese paper); hard mica paper (mica splittings, shellac, and paper); mica Japanese paper (overlapping mica splittings, Japanese paper, and flexible sticking varnish); flexible micanite (overlapping mica splittings and flexible sticking varnish); and hard micanite plate (overlapping mica splittings and shellac varnish, steam heated and pressed).

In all the mica products there is less decrease in the elec-

AVERAGE BREAKDOWN VOLTAGE OF $\frac{1}{16}$-IN. THICKNESS OF INSULATING MATERIALS.

Material.	Average of air tests, B.D.V.			Average of oil tests, B.D.V.			Average of all tests, B.D.V.		
	At 30° C.	At 100° C.	Increase or Decrease.	At 30° C.	At 100 C.	Decrease.	At 30° C.	At 100° C.	Decrease.
	kV.	kV.	Per cent.	kV.	kV.	Per cent.	kV.	kV.	Per cent.
Papers	12·0	13·7	+ 14	32·2	23·5	— 27	22·2	18·5	— 16·5
Micarta	27·9	7·7	— 75	28·8	11·8	— 61	26·2	10·8	— 59
Fullerboard	18·0	16·8	— 6·7	27	17·5	— 35	26·7	18·6	— 30
Varnished cloth...	27·8	16·2	— 41·6	30·7	23·1	— 24·6	28·1	17·1	— 39
Mica products	29·3	31·0	+ 5·8	35	30	— 14·4	32·3	30·5	— 5·6
Varnished paper	24·8	17·2	— 30·6	38·5	17·7	— 54	31·7	17·4	— 45·5
Varnished asbestos paper ...	7·3 (H)	1·2 (H)	— 84	15·0 (D)	8·4 (D)	— 44	11·2	4·8	— 57
Fibre	7·5 (H)	1·5 (H)	— 80	25 (D)	7·5 (D)	— 70	16·0	4·5	— 72
Treated wood	—	—	—	17 (oil)	11·3 (oil)	— 33·5	17 (oil)	11·3 (oil)	— 33·5 (oil)
Moulded composition, No. 1 ...	5·0	2·6	— 48	9·0	2·0	— 78	7·0	2·3	— 67

D = dried; H = humidified.

*I.E.E. *Journal*, Feb., 1922; p. 218 (abstract).
†Elec. Rev., Dec. 9th, 1921; p. 771.
‡Elec. Rev., Jan. 13th, 1922; p. 39.

tric strength at high temperatures than in the case of fibrous materials. With some of the materials, however, there is still an appreciable decrease, particularly when tested in oil (when they could not readily get rid of any moisture or varnish compounds which they contained). In this connection it should be remarked that very few of the above-named mica products are actually employed for the manufacture of oil-immersed apparatus. When tested in air the small samples evaporated some of the volatile constituents contained in the backing materials or the bonds. When the above-named mica insulations are employed in electrical machines they are usually wrapped layer upon layer and so confined that they cannot readily evaporate any volatile matter; consequently, the tests in oil afford a truer indication of the behaviour of the materials in service than do tests in air. This opinion was confirmed by test on high-voltage stator bars insulated with micafolium. As the percentage decrease in this case is considerably more than even that found in the oil tests on micafolium, it tends to show that in the case of very heavily insulated bars the volatile matter driven off from the shellac may very appreciably lower the breakdown voltage of the bars. Fortunately, as is the case with micarta, it is possible by suitable heat treatment during the manufacture of the coils to remove a large percentage of the volatile constituents and thus to appreciably increase the hot breakdown voltage of machines insulated with mica products.

Miscellaneous Materials.—In the case of varnished paper, varnished asbestos paper, fibre, treated wood, and moulded compositions, results were obtained up to a temperature of 140 deg. C.; they thus give a little information with regard to the hitherto unexplored region beyond 100 deg. C.

Deductions.—In order that the large mass of information contained in the paper may be more easily reviewed, the average figures for each class of material tested have been collected together in the accompanying table, and the percentage decrease in breakdown voltages for a rise of temperature of from 30 to 100 deg. C. has been calculated on the breakdown voltage at 30 deg. C. Although in a few cases of tests in air a small increase is obtained when breakdowns occur at 100 deg. C., in the majority of cases there is a very decided drop in the breakdown voltages, the values of which may be reduced to 50 per cent. of those obtained at 30 deg. C. Mica products suffer the least loss of electric strength, whilst with micarta, varnished asbestos paper, fibre, and certain moulded compositions the decrease is the greatest.

This investigation has clearly shown that the electric strength of most of the solid insulating materials at present in use decreases with increase in temperature up to 100 deg. C. As in modern machines hot-spot temperatures as high as, or even higher than, this may occur at periods of overloads, it is of the utmost importance that the electric strength of the insulating materials should be determined at 100 deg. C. and not at the temperature of the air, as has usually been done in the past. There is a very great need for systematic research work with a view to increasing still further our knowledge of the electrical characteristics of commercial insulating materials at temperatures likely to be attained in electrical machinery, and to developing new materials which will be more capable of withstanding these temperatures than the materials now employed.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Sand-Cooled Starters for Three-Phase Motors.

During and since the war it has been difficult to obtain oil in Germany for electrical apparatus, and various attempts have, therefore, been made to employ substitutes for cooling purposes. Water has been used with some success for cooling three-phase motor starters, a layer of oil preventing evaporation. The permissible loading of the resistance elements is, however, strictly limited when water is employed. This and other disadvantages are avoided by the use of sand as a cooling medium. Sand is, of course, inapplicable to transformers, switches, and other gear in which the cooling medium must serve also as insulation; neither is it applicable where there are submerged moving contacts. As a means of cooling the resistances of motor starters, however, it offers the advantage that the starter can be dispatched by the maker ready for immediate service.

The sand-filled rotor starter shown in the accompanying illustration (fig. 1) is made by Brown, Boveri & Co., for use with three-phase motors. The construction is simple and inexpensive, and the device is quite suitable for use by unskilled persons. The elimination of fire risk is an important consideration, and starters of this type are applicable in many cases where air-cooled starters have hitherto been used. The resistance spirals R are carried by insulating ferrules A in the plates B C, and connected to contacts F in the plate D. The star contact arm G is operated by the lever L, the switch contacts and arm being enclosed by a casing H as a protection against dirt and accidental contact. The sand-filling reaches, as shown, to the under-side of the contact plate, and cables K

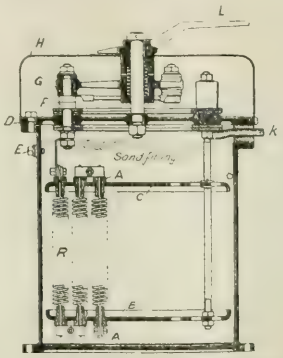


Fig. 1.—A Sand-cooled Motor Starter.

are fitted permanently, for connection to the rotor terminal board. No "off" contact is provided, hence the rotor circuit cannot be opened. Slow-motion operating gear is easily fitted if required.—*E.T.Z.*

The "Wefco" Gas-proof Hand Lamp.

A patent gas-proof safety electric hand lamp has recently been placed on the market by Messrs. Watts, Fincham and Co., Ltd., 22, Billiter Street, E.C.3. This, known as the "Wefco" lamp, is illustrated in fig. 2. The outer case is of

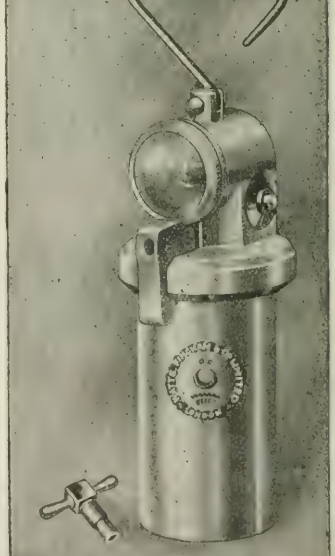


Fig. 2.—The "Wefco" Gas-Proof Hand Lamp.

an aluminium alloy, and is fitted with a patent locking device operated by a triangular key, without which the lamp cannot be opened. The accumulator is of the alkaline type, and is "unspillable." The switch and contacts are self-contained, the former being operated by "on" and "off" push buttons. The total weight of the lamp is 5¼ lb. The lamp is dismantled by unscrewing the lock to the full extent of the locking screw by means of the key. The base is removed by unscrewing it from the top. The switch and contacts are removed by unscrewing the lamp bulb, and taking out a rubber joint ring, when the part will slip out as a whole. The lamp will give a continuous light for ten hours, and has been approved by the Mines Department, the Board of Trade, Lloyd's, and leading petroleum companies for use on tank steamers.

LEGAL.

British Thomson-Houston Co., Ltd., *v.* N.L.O. Co.

In the Vacation Court on August 9th, the Lord Chief Justice had before him two motions by the plaintiffs against the N.L.O. Co., for injunctions restraining infringements of letters patent.

Mr. Whitehead, for the plaintiff company, in moving the first motion stated that a certificate of validity of the patent had been granted. The defendants had posted back to the plaintiffs the writ and notice of motion served upon them, and had not entered an appearance.

His Lordship granted the injunction asked for.

Mr. Whitehead said that the second motion dealt with a different patent.

Here again there was no appearance on behalf of the defendants, and an injunction in this case was also granted.

Electricity in Mines.—Coal-Cutting Machine Accident.

Sheriff Principal A. O. M. MacKenzie, Glasgow, has reversed the decision of his substitute in a test action arising out of a fatal explosion at Auchengeich Colliery, Chryston, when two men who were operating a coal-cutting machine were killed and four brushers severely injured. Actions were raised in the case of the deceased and injured men against the colliery owners, Messrs. James Nimmo & Co., Ltd., but five of these have been sisted pending a final decision in the present case (George Connell *v.* Nimmo & Co.). The Sheriff Substitute, in the first instance, assoilzied the company from all the conclusions of the action. The Sheriff Principal, on the other hand, finds the defenders liable to the pursuer in damages under the Employers' Liability Act, but not at common law, and assesses the damage at £325, with expenses. His Lordship finds that the explosion was caused by the ignition of gas caused by a spark from an electric coal-cutting machine fitted with a switch box cover which the men operating the machine had negligently failed to screw down properly. He also finds that the fireman employed by the defenders to inspect the section on the pursuer's shift negligently and without sufficient excuse failed to inspect the section as required by the Coal Mines Act within five hours of the previous inspection.

CORRESPONDENCE.

Letters received by us* after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Breach of Confidence.

The Dundee Corporation has long since earned the reputation of not being "quite the thing," and that it seems determined to live up to their odious repuation will be apparent to everyone who learns of its bad faith in connection with the applications for the post of city electrical engineer.

Its latest achievement is to publish broadcast in the Scottish Press a full and complete list of all applicants, their addresses, ages, and qualifications.

Their disreputable measure has caused consternation amongst many who had made application in confidence, and there have been many unpleasant sequels resulting from this gross breach of faith.

To those candidates who were hopeful of getting the appointment this exhibition of bad faith should serve as an unpleasant reminder of the kind of body they would have to serve under.

Such conduct gives honourable men a feeling of nausea.

John Ogilvie.

Dunfermline, *August 15th*, 1922.

[The action of the Corporation was, in our opinion, most regrettable.—Eds. Elec. Rev.]

Electrical Supplies in South America.

In your issue of June 9th, page 819, there appears an article on "Electrical Supplies in South America," by Mr. Percy F. Martin, which I read with a good deal of interest.

I should like, however, to correct the remarks which concern the city of Rosario de Santa Fé (Argentine).

The Sociedad de Electricidad de Rosario is a Belgian concern and one of the many controlled by the Société Financière de Transports et d'Entreprises Industrielles, Brussels. The power house has 28,000 kW of plant installed, and last year generated over 35,000,000 kWh. There are roughly 2,100 motors installed, with an aggregate h.p. of 17,500; they range from 250 h.p. down to the smallest used for such purposes as coffee grinding, &c.

The centre part of the city is fed with direct current at 2 x 220 volts, all motors over 5 h.p. being connected across the outers. The other parts of the town are supplied by 3-phase alternating current, 220 volts, 50 periods. There is no 110-volt supply in Rosario.

The tariff, according to the municipal concession, is as follows:—

Private Houses.—First 30 kWh per month per kW installed $0.15 gold; rest at $0.095 gold.

Business Houses.—$0.17 gold per kWh.

Motive Power.—First 30 kWh per month per h.p. $0.08 gold. Rest up to 1,000 kWh $0.06 gold. All above at $0.045 gold.

In the case of power users, special tariffs are given depending upon load factor, consumption, &c. A large number of our power consumers are supplied on the maximum demand principle, a fixed charge being made per kW year in addition to a low-priced energy charge. Large consumers' agreements usually contain a combustible clause, the price per kWh rising and falling in proportion to the price of fuel.

Motors are hired or sold on the hire-purchase system.

The Sociedad de Electricidad de Rosario, in addition to being the sole supplier of electrical energy in Rosario, also supplies energy to the municipality for public lighting, and to the Compañia General de Tranvias Elétricos de Rosario, a Belgian concern.

The principal fuel used is petroleum (fuel oil) a large portion of which is obtained from the Argentine fields of Comodoro Rivadavia.

In conclusion, I would say that the British Chamber of Commerce, Buenos Aires, has a permanent Electrical Committee, and I am sure would be pleased to give the fullest information possible regarding the electrical market in the Argentine.

Sociedad de Electricidad de Rosario,
L. W. Migotti,
Technical Director.

Rosario, *July 14th*, 1922.

Small Private Generating Stations.

The letter from the Secretary of the Electricity Commission on the above subject in your issue of the 11th inst., is but another instance of the usefulness (*sic*) of bureaucracy. The article "Small Generating Stations" would surely be deemed under ordinary conditions to be a useful reminder or suggestion to the trade of a way to lessen unemployment and boost up trade. But no, our bureaucrats step in and so our unemployed must still draw the dole. But need they?

No, sir, and I say it with good reason; let the contractor carry on, the Commissioners will not stop him. They may inform the contractor he is not allowed to do so, *but who is to stop him?*

C. Culmer Hodges,
A.M.I.E.E., A.M.I.Mech.E.

Dawlish, *August 14th*, 1922.

The Sale of Wireless Apparatus.

Your correspondent "Electrical Contractor" seems to have omitted to take the only practical step he can to secure the redress of his grievances. Alone he is powerless to affect the trend of any particular trade current in so large an industry, but as a member of the E.C.A. he would be actively supporting the only organisation working in the interests of the electrical contractor.

So far from taking this common-sense step he appears to scoff at the Association's efforts. He says the Association "cannot assure its members of preferential treatment from wholesale houses." This is exactly what it does, although truly it has not covered the whole ground yet. Every month, almost every day, sees something accomplished in this direction.

He says the Association "cannot discriminate between the electrical sanitary engineer and the genuine electrical engineer." No, the E.C.A. does not attempt this, but it does discriminate between the genuine electrical engineer and the sham. It does not trouble about what other business a man may have, but for membership he must be a qualified electrical contractor.

He claims that "the remedy is as yet beyond the reach of the E.C.A." If he be old enough he should look back at the conditions existing in the trade before the E.C.A. got seriously to work and realise that he owes it at least gratitude.

The remedy your correspondent calls for is being accomplished, and the accomplishment will be complete when "Electrical Contractor" and the rest of his kind—if eligible—take up their membership and share the work.

I shall be very pleased to provide him with an application form and particulars.

Electrical Contractors' Association (Inc.).
Leonard G. Tate,
General Secretary.

London, W.C.1, *August 10th*, 1922.

It would be interesting to know if there is any firm or firms which make a business of installing wireless telephonic receiving sets in private houses." I presume all sets so installed be provided with lightning arresters as damage from this cause is not uncommon."

D. R. Broadbent.

London, S.W.1.
August 12th, 1922.

Removal of Static Charge.

Replying to "F.W.F.," I would suggest employing a number of discharge points, effectively earthed, to the tank or otherwise. These may be obtained by securing a series of needles to a metal base supported upon a portable stand. When the discharging part of the rinsing process is about to begin, so place the stand that the needles are pointing downwards towards the liquid. The distance between the points and the liquid need not be less than the distance of the points at which the spark occurs. Another way of obtaining the points is to secure some asbestos or mica wool and bind it to a portable base by means of twisted strands of wires, all common to earth. The asbestos or mica forms the necessary points. This method will be found very effective, and a careful application of it will meet with success. The action is as follows:—The charge on the surface of the liquid induces an opposite charge on the points. This opposite charge is so intense upon the points that the molecules of air about them are broken up into positive and negative parts, and portions which are unlike in sign to those on the points are attracted towards them, portions of like sign being repelled, thus neutralising the charge upon the surface of the liquid.

Wilfred Pinkerton.

Manchester. *August 11th*, 1922.

The Registration of Contractors.

Why does or did the heading of your interesting leader of the 11th inst. terminate with "Contractors?" I submit that "Installation Undertakings" would be more in keeping with the subject matter. An abbreviated letter by myself, which you kindly published in your issue of the 4th inst. had some bearing on this, to my mind, all-important subject. Unquestionably, the supply authorities are those most intimately concerned, and should, I consider, subject to the Electricity Commissioners' approval, be the referees in all matters relating to the industry, and study the interests of the actual consumer. The supply authorities are the only parties which are sincerely anxious to avoid "The Fusing of Electric Wires." With the exception of quite a small minority the country is saturated with so-called contrators, whose sole desire it is to get so much v.i.r. cable, lampholders, &c., into an establishment, to get it paid for, and to wish the payee a very rude good-bye. You refer to the formation of a registration authority as tending to make installation work a "closed" industry. Surely this would be all to the good from all points of view if by so doing the standard of installation work were raised. At present the industry is handicapped by a multiplicity of ambiguous rules and regulations, which indirectly are interpreted and looked after by members of that excellent association generally known as the E.P.E.A. Broadly speaking, I submit that until supply authorities have real powers to insist on good work, including the condemning of old-fashioned and dilapidated installations, little can be done to ensure safety and continuity of operation. Local advisory committees are bound to meet with adverse criticism and friction. Unless there is an absolute leak on an installation, a supply authority can do absolutely nothing in the direction of improving matters.

Walter E. Rogers, A.M.I.E.E.

London, W.12,
August 13th, 1922.

Do you not think that your leader of August 11th, on the proposed scheme of registration of electrical contractors, is a little unfair to the interests concerned? You suggest that the parties forming the licensing authority will be responsible for seeing that the contractor does his duty, but a study of the scheme will show that this is not so. Supply authorities as members of the Licensing Committee will have a say as to who shall be registered and who shall not, but it has not been suggested that any supply authority shall have more power or responsibility than at present with regard to installation work.

True, if any complaint is made regarding any particular registered contractor, and the supply engineer in the district is upon the local advisory committee he might be called upon to make a report, but he would not do so in his capacity as supply engineer, and would not have power even to examine the installation except at request, or by grace of the owner.

Contractors would not tolerate any additional powers to supply authorities as part of the scheme nor could they support anything in the nature of fresh regulations. As contractors foresee the working of the scheme it will require of its registered members observance of a certain minimum standard extracted from the Institution Wiring Rules, certainly not the creation of new rules or the enforcement of the whole of the existing rules.

Examination of the scheme will show that it is in no way an E.C.A. matter and leaves the door wide open for any man capable of carrying out contracting work to register, and to hold his registration so long as he maintains a minimum standard of workmanship.

Electrical Contractors' Association (Inc.),
H. Marryat,
London, W.C.1., *President.*
August 14th, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—J. E. Rollinson, electrical engineer and contractor, 5, Tavistock Chambers, Beastmarket Hill, Nottingham.—First meeting August 21st, at the Official Receiver's offices, Nottingham; public examination October 5th, at the County Court House, Nottingham.

A. E. Blower (Blower & Cooper, electrical engineers and merchants), late of 1 & 3, Pauls Bakehouse Court, Godliman Street, E.C.—Last day for proofs for dividends August 29th. Trustee: Mr. W. P. Bowyer, Senior Official Receiver, Carey Street, W.C.

G. F. Coupe, electrical engineer, 2, Spring Gardens, Stockport.—Last day for proofs for dividend August 26th. Trustee: Mr. J. G. Gibson, Official Receiver, Byron Street, Manchester.

Frank Rawcliffe, electrical engineer, trading as Frank Rawcliffe & Co., 8, Nun Street, Newcastle-on-Tyne.—The adjourned public examination of this debtor was held recently at the County Court, Westgate Road, Newcastle-on-Tyne. Debtor was questioned with reference to the sale of a business to a former partner, and it was stated that he had furnished accounts of his transactions with this partner. He stated that he had made out the accounts from his late partner's books. With regard to transactions with another company debtor said he intended becoming a partner, but the arrangement fell through. After further questions the examination was again adjourned.

The *London Gazette* contains a notice to debtor "in lieu of personal service of bankruptcy notice and petition and of application to commit for contempt of Court" in the following: E. Durden & Co., 13, Queen Street, Liverpool, electrical engineers; Liverpool Court. Substituted service of bankruptcy notice directed August 1st. Bankruptcy notice served by Messrs. Downes & Davies, electrical fittings factors, 1, Stanley Street, Liverpool.

Frank Porter, electrical engineer, 17, Goldhawk Road, Shepherd's Bush, and 23, Cromwell Avenue, Hammersmith, W.—The first meeting of creditors under this failure was held on August 14th before Mr. Vyvyan, Official Receiver, at the London Bankruptcy Court, when accounts were submitted showing unsecured liabilities £696, and preferential claims £69, against assets valued at £226, and consisting of cash, £32; stock, £30; furniture, £100; and book debts, £64. The chairman reported that the debtor filed his own petition on July 28th. He commenced business in August, 1921, with a partner, under the style of "Porter & Simpson," at 23, Cornwell Avenue, Hammersmith, and they traded as electrical engineers until the following October, when Mr. Simpson withdrew and the debtor continued the business alone. He had stated that, owing to lack of working capital, the business was not a success, his failure being further due to insufficient business knowledge and slackness of trade. The case was left in the hands of the Official Receiver to be wound up in bankruptcy. The creditors include:—

	£		£
Colley & Co.	62	Huddleston & Co., P.	51
Electro Generator Co.	33	Hedberg, Trevor	15
General Electric Co., Ltd. ...	47	Kent, Frank	40

F. A. Watkins, electrical engineer, 57, High Street, Hythe—Receiving order made August 10th on debtor's own petition. First meeting, August 24th, at the Official Receiver's office, Canterbury; public examination, September 23rd, at the Guildhall, Canterbury.

R. V. Mayner, electrical engineer, 62, Harris Street, Peterborough.—First and final dividend of 1s. 5d. in the £, payable August 22nd, at the Official Receiver's office, 5, Petty-cury, Cambridge.

Company Liquidations.—The Horton Manufacturing Co., Ltd. Liquidator appointed May 10th.

Rendle, Blanchard & Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. Barnes, Balfour House, Finsbury Pavement, E.C. Meeting of creditors is called for August 24th at Balfour House. Particulars of claims to the liquidator by September 21st.

Dissolutions of Partnership.—Bland & Lewin, electrical motor engineers and garage proprietors, South Knighton Garage, Knighton Church Road, and Goldhill Road, Leicester.—Mr. E. Bland and Mr. J. Lewin have dissolved partnership. Mr. Bland will attend to debts.

H. Cleminson & Co., electrical and mechanical engineers, 315a, Stretford Road, Hulme, Manchester.—Messrs. J. H. Fleming and H. Cleminson have dissolved partnership. Debts will be attended to by Mr. Fleming, who will continue the business.

Receiver Appointed.—British Scientific Industries, Ltd., St. John's Works, Headingley, Leeds.—In July Mr. Alfred Dobson, of 10, Park Row, Leeds, was appointed receiver for the debenture holder.

Trade Announcements.—The British Engineering Products Co., of 26, Westminster Palace Gardens, Victoria Street, London, S.W.1, has taken over the commercial engineering section of Sir J. F. Payne Gallwey, Brown and Co., Ltd., 58, Victoria Street, S.W.1.

Messrs. H. T. Boothroyd, Ltd., dynamo and motor manufacturers, ask that all communications should be addressed to them at their works at Bootle, Liverpool, for the present, as they have discontinued their agency agreement with Sir J. F. Payne Gallwey, Brown & Co., Ltd.

Messrs. Paterson & Service, of 38, Bath Street, Glasgow, state that the Electric Lamp Manufacturers' Association of Great Britain, Ltd., has appointed them wholesale distributing factors for all E.L.M.A. lamps.

The Eddystone Lamp Co., electrical appliance manufacturers, has opened a branch establishment in Mincing Lane, Blackburn.

Messrs. Poulden Bros. have taken a five-floor building in Great Eastern Street, E.C., suitable for showrooms, part of which will be allocated to wholesale business in wireless apparatus.

Catalogues Required.—The Allied Electric Manufacturers, of 3, Paradise Square, Sheffield, ask for catalogues and lists.

Catalogues and Lists.—Electric Control, Ltd., Hastings House, Norfolk Street, Strand, W.C.2.—An illustrated descriptive booklet dealing with "Empire" automatic control gear for various purposes.

Messrs. Leslie McMichael, Ltd., Providence Place, West End Lane, Kilburn, N.W.6.—An illustrated and priced catalogue of wireless apparatus.

Messrs. Richson & Co., 114, New Oxford Street, W.C.1.—A beautifully-produced catalogue, containing illustrations of selected glassware for lighting purposes. The publication includes chandeliers, bowls, coloured glass, and a number of novelties.

Messrs. F. & A. Parkinson, Ltd., Guiseley, Leeds.—An illustrated brochure written in a non-technical style for prospective users of a.c. motors.

Messrs. Landis & Gyr, Ltd., Elgee Works, Hampton Hill. An illustrated pamphlet giving particulars of time switches and limiters.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 367, dealing with "English Electric" turbo-blowers; and Publication No. 370, describing the electrical driving in Scottish woollen mills.

The Key Engineering Co., Ltd., Mansion House Buildings, 4, Queen Victoria Street, E.C.4.—An illustrated pamphlet dealing with socket and spigot joint conduit and troughing, and sleeve-joint conduit.

Messrs. Gyer, Hill & Gyer, 661-3, Harrow Road, Willesden, N.W.10.—A comprehensive catalogue of surplus Government stores, including machines, tools, boilers, hose, &c.

London Electric Stores, 23a, Oxendon Street, Haymarket, S.W.1.—An illustrated leaflet dealing with receiver headgear for wireless telephony.

Berry's Electric, Ltd., 85-86, Newman Street, W.1.—List No. 2,271, a catalogue and price list of "fool-proof" switchgear and switchboards.

Messrs. Wates Bros., 13-14, Great Queen Street, Kingsway, W.C.2.—A well-illustrated price list of wireless sets and component parts, dealing especially with primary and secondary batteries.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—An illustrated pamphlet describing the "Universal" electric boiler scaler.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A well-illustrated brochure describing the "Relay" system.

Unemployment.—The latest Ministry of Labour returns show that the total number of unemployed persons on August 7th was 1,328,000. This was a reduction of 23,831 on the week and 495,133 fewer than in the first week in January last. Short-time workers numbered 69,100—a reduction of 1,500—comparing with a total of 934,786 in July, 1921.

Patent Restoration.—An order has been made restoring Patent No. 18,278 of 1908, granted to Johann Kremenezky for "improvements in the process of sealing the [illegible] carrier into the bulb of electric incandescent lamps."

Copper and Lead Prices.—Messrs. F. Smith & Co. report: (August 15th):—Copper (Electrolytic): Bars, £71, £1 decrease; ditto ditto sheets, no change; ditto ditto wire rods, £81, £1 decrease; ditto ditto H.C. wire, 10¾d., 1/16d. decrease.

Messrs. James & Shakespeare report, August 16th:—Copper bars (best selected), sheet and rod, no change. English pig lead, £26, 10s. decrease.

E.D.A. Activities.—The most recent pamphlets issued by the British Electrical Development Association deal with many phases of the use of electricity. A useful suggestion is contained in a pamphlet entitled "Give Your Consumer a Unit a Year" (E.D.A. 293). The idea is to expend upon publicity which will benefit the consumer a sum equivalent to the price of a unit for every consumer, and the way, or several ways, in which this can be carried out with the aid of the E.D.A. are set forth. Two interesting publications deal with electric cooking in a practical manner, one of them (E.D.A. 289) relating to cooking on a large scale, as in restaurants, and the other (E.D.A. 295) to domestic service. Lighting is represented by a reprinted lecture given recently by Mr. C. H. Yeaman (Stoke-on-Trent) (E.D.A. 268), and by E.D.A. 265, advocating the use of electric lighting in shop windows during the evening hours. Another pamphlet (E.D.A. 290) details some of the many uses to which automatic electric welding may be put. A general electrical advertising device is a well-coloured postcard (E.D.A. 292).

B.T.H. Magnetos.—The British Thomson-Houston Co., Ltd., informs us that further successes were attained in the "Aerial Derby" of August 7th by machines fitted with B.T.H. magnetos, this being the fourth occasion of the kind in which the first and second prize-winners have had these magnetos on their machines.

Chinese Notes.—The Chang Ming Electric Co., of Changhing, Chekiang, has completed its preparations. Work will soon be started.

The Lingping Electric Co., of Lingping, Chekiang, has applied to the Chekiang Board of Industry for registration.

German Trade with Australia.—According to Reuter, the first consignments of goods from Germany which have arrived at Melbourne consist of small parcels, the German merchants apparently being anxious to feel their way at present.

For Sale.—By direction of the Disposal Board, Messrs. Bowler & Blake will sell by auction, on August 22nd and following days, at H.M. Dockyard, Portsmouth, H.M. Gunboat Yard, Haslar, R.A.O.C. Depôt, Hilsea, and the Seaplane Training School, R.A.F., Lee-on-the-Solent, machinery and electrical equipment. (See our advertisement pages to-day.)

New French Companies.—With a capital of 2,700,000 fr., all subscribed in currency, the Société l'Electricité at Villars (Vosges), has been formed for the erection and working of electric distribution networks.

The Société rurale de Distribution d'Electricité has been constituted at Lencloitre (Vienne) for the distribution of energy in the region named. The capital of the concern is 150,000 fr.

Under the style of Société Commerciale de Lampes et d'Appareillage Electriques, a company has been formed at Paris (97, Rue de Lille) to take over the assets of the Société Commerciale d'Appareillage et de Lampes Electriques Marque d'Or (now in liquidation). The capital of the company is 100,000 fr.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries. Notices of objection to any of the applications can be entered within one month of the dates mentioned below:—

M.V. & M.V.E.C. (lettering and design). Nos. 426,319 426,320, 425,321, 426,322, and 426,323. All goods in Classes 5, 14, 15, 16, and 40. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. August 2nd, 1922.

South African Electricity Undertakings.—The Association of Municipal Electrical Engineers (Union of South Africa) has sent us some useful information which is supplementary to the Official South African Municipal Year Book. The matter consists of a number of tables containing exhaustive details of the municipal electricity supply undertakings of the Union. The information includes particulars of generating plant, prime movers, supply voltages, &c., as well as a mass of financial statistics. One list gives details of tariffs which make an interesting comparison with British charges.

Licensing Electrical Contractors in New South Wales.—A deputation from the Electrical Employers' Association of New South Wales waited upon the Minister for Mines recently asking that a Bill be introduced providing for the issue of licences to electrical contractors.

Mr. A. Waddell, chairman of the Association, said it had been felt for years that there should be at least as much control over the installation of electrical equipment as there was over plumbing. The workmen themselves also wanted licences, but the Association objected to that on the ground that it would only give the employés an additonal lever to go before the Court and ask for higher wages. He pointed out that the City Council and municipalities had power to bring in a scheme for the issue of licences, and in certain municipalities schemes had been started. The Association was afraid that unless something comprehensive were done quickly there would be numerous schemes of a varied character in operation throughout the State, whereas a uniform scheme was required to deal effectively with the question. At the present time an individual without any qualifications could carry out electrical installations. The suggestion was that a board of control, with power to issue licences for the whole of New South Wales, should be appointed. A licence fee could be charged, and the scheme could be introduced without cost to the Government.

Mr. Fitzpatrick said he was thoroughly in sympathy with the project. There seemed no justification for leaving the electrical contractor out of the registration scheme. He undertook to give instructions for a Bill along the lines suggested to be prepared, and to submit it for possible alterations to the Association before placing it before Parliament. He saw no necessity for the licensing of the employés, as the contracting firms should take the responsibility. By the operation of the Act when it was passed it would be possible to squeeze out the firms which were incompetent and those which were dishonest. He could not give an assurance that the passage of the Bill would be secured this session, but he would try to have it put through.—*Industrial Australian and Mining Standard.*

New Belgian Company.—There has been formed at Genappe the Société Anonyme Genappe Electrique II., with a capital of 287,400 fr., with the object of working generating installations, distributing motive power, and the sale and erection of electric meters, motors, &c.

Book Notices.—The *Journal* of the South African Institution of Engineers. Vol. XX, No. 12, July, 1922. Johannesburg: The Institution. Price 2s.—In this number is presented the annual report (1921-22) and the balance sheet. It also includes the result of the ballot for officers and the valedictory address of Mr. R. C. Atkinson, the retiring president, and a statement presented to the Select Committee dealing with the South African Electricity Bill.

The *Transactions* of the South African Institution of Electrical Engineers, Vol. XIII. Part 4. June, 1922. Johannesburg: The Institution. Price 2s.—This part contains a paper on "Direct-current Lifts," by Mr. H. M. Missing; and a discussion on the South African Electricity Bill, embodying a statement by Mr. B. Sankey, the municipal electrical engineer of Johannesburg.

"Some Things that Matter," by Lord Riddell (187 pp.). London: Hodder & Stoughton, Ltd. Price 7s. 6d. net.—This work, which consists mainly of articles reprinted from a weekly periodical, contains much that is useful and much that may be classed as "counsels of perfection." The main theme is mental discipline, but this is not considered in the abstract merely, nor is the treatment highly psychological; the distinguished author endeavours to implant principles which will be of use when applied to everyday and special occasions. Among the subjects so dealt with are the correct methods of reading; the art of public speaking; the intelligent use of facts in forming conclusions; and the development of the powers of observation. In common with other authorities Lord Riddell considers the study of law to be the best medium of mental training, and, therefore, legal matters occupy a large part of his book. The laws of evidence are succinctly set forth, legal maxims are explained, and many other matters are dealt with in an interesting manner, quite characteristic of the author himself. It is probable that Lord Riddell will succeed in interesting and assisting many who are frightened or the phrase employed by most writers on the subject of mind training.

"The Brown, Boveri Review," July, 1922 (16 pp.). London: Brown, Boveri & Co., Ltd.—The illustrated articles appearing in this number are "Brown, Boveri Marine Turbines" and "Improved Short-circuiting Devices for Induction Motors." The latter article describes several forms of centrifugal short-circuiting arrangements.

"Technical Electricity," by H. T. Davidge and R. W. Hutchinson. Fourth edition. Pp. xii.+511, 403 figs. London: University Tutorial Press. Price 10s. 6d.

"Cable Spans," by E. Parry, B.Sc., M.Inst.C.E. (17 pp.). London: The English Electric Co., Ltd. (Publication No. 3685).—This work embodies practical formulæ and constants relating to suspended wires of different materials, and was originally produced for the use of the New Zealand Government Public Works Department.

"Filtration," by T. R. Wollaston. Pp. x+102; 30 figs. London: Sir Isaac Pitman & Sons. Price 2s 6d. net.

British Manufacturers' Representatives in South Africa.—We have received a copy of the half-yearly report of the British Manufacturers' Representatives' Association of South Africa (Inc.) (President Mr. H. Edwards, P.O. Box 845, Cape Town.) It shows that at June last the membership was increasing and had reached a total of 440. Four members had resigned because of the introduction into the articles of the "Alien Firms Clause," but these were now reinstated as the clause had been withdrawn. The liaison between the Association and the F.B.I. has so far been a purely tentative one, but the presence of one of the past presidents (Mr. H. R. Brown) in London has been taken advantage of to have the whole matter thoroughly gone into. The Association has devoted a good deal of attention to the agitation for protective duties, is preparing a register of firms represented by its members, new sample rooms are to be opened in Durban, and in many other ways the organisation is watching over the interests of its members.

German Electrical Prices.—The Price Centre of the Central Association of German Electro-Technical Industry has decided to increase prices from August 1st by about 30 per cent.—*Frankfurter Zeitung*, August 3rd, 1922.

Installation Contracts.—Messrs. Francis Polden and Co., Ltd., have secured the contract for the electrical equipment of the new extension at Olympia.

Other important installations being carried out by the company are; the new building for the Guardian Assurance Co., in the City; the National Safe Deposit Building, Aldwych House, Kingsway, and other London buildings; Hook End Farm, Reading; Roffey Park, Horsham; Dr. Barnardo's Homes, Goldings; Mill Hill School, &c.

The A.E.U.—The Executive Council of the Amalgamated Engineering Union has had under consideration the immediate and future position of the organisation due to events which accompanied the recent lock-out, and especially the causes which had led to a serious reduction in the membership. Just before the trade depression the union had a record membership of more than 450,000. Unemployment steadily reduced these figures, and the lock-out increased the number of defections. At the end of last month the total membership was 381,000, or 11,000 less than in the previous month. It has now been decided to invite suggestions from the rank and file with regard to reconstruction, and it is possible that the first step that will be taken will be for the union to associate itself actively with the other organisations in the industry. —*Westminster Gazette.*

Our Foreign Trade.—July Figures.—The following were the values of imports and exports of electrical goods and machinery during July, 1922:—

	July, 1922.	Inc. or dec.	Inc. or dec. 7 months 1922.
Imports.	£	£	£
Electrical goods and apparatus	110,337	4,415	628,045
Machinery ...	635,002	– 218,705	3,199,515
Exports.			
Electrical goods and apparatus ..	596,274	621,317	1,485,437
Machinery	3,191,042	– 2,939,670	18,086,389
Re-exports.			
Electrical goods and apparatus	8,835	3,940	42,665
Machinery	99,902	– 12,413	113,331

A German Amalgamation.—The Electricity Installations Co., of Berlin, is increasing its share capital to 65,000,000 marks for the absorption of the German Telephone Works, Ltd., and the German Cable Industry, Ltd., and the name is being changed to that of the German Telephone Works and Cable Industry Co.

Farm Lighting Plant for Algeria.—U.S. Vice-Consul David C. Elkington, Algiers, reporting in June last, referred to the market for small pumping plant. France leads in the sale of pumps to Algeria, with the United States and Great Britain next, and supplying about equal quantities. There are only three American makes known in the country, while the principal ones from other countries are the Audemard, Guyon, Jandin, Japy, Dumond, and Rateau—all French; and the Worthington-Simpson (British). The sources of motive power in Algeria are steam, gasoline, and "poor" gas, which is a product of the distillation of coal, but is less powerful than the gas originally used for cooking. In Algeria steam is generated by wood, charcoal, coal, fuel oil, and gas oil, named in the order of their importance. Electric motors are not often found in the colony, for the current to run them is not obtainable outside of the larger cities, although country districts are being gradually supplied. The farms which possess independent power and lighting plants are few, but this kind of equipment should have a good market, because of the present lack of electric current throughout a large part of the country. With good crops and favourable exchange the Algerian farmer will prove a good customer for pumps and farm lighting plants. Credit terms usually expected are from 60 to 90 days for purchases, though special arrangements are made for agencies and consignments.

LIGHTING AND POWER NOTES.

Australia.—Queensland.—Ministerial consideration is being given in Queensland to a new scheme, which the Northern suburban local authorities in Brisbane have placed before the Minister for Works, for the installation of an electricity supply system in their respective areas.—*Reuter's Trade Service* (Melbourne).

Swan Hill.—The town of Swan Hill, in Northern Victoria, is to change its existing direct current system to a three-phase, 400/230-volt alternating current system, at an estimated cost of £17,000. Two crude oil engines of 200 b.h.p., and one of 180 b.h.p. will be installed.—*Reuter's Trade Service* (Melbourne).

Barrow-in-Furness.—Year's Working.—The accounts for the year 1921-22 of the municipal electricity undertaking (engineer: Mr. H. R. Burnett) record a total revenue of £77,122—considerably less than that of the previous year—£87,068. Working costs, however, decreased in greater proportion, being £51,010, as against £68,663. Of the gross balance of £26,112 (£18,405), capital charges absorbed £25,738 (£20,944), leaving a net profit of £374, comparing favourably with a deficit of £2,539 in 1920-21. The amount of energy sold fell from 9,282,017 to 6,886,504 kWh, the decrease being due to reduced power sales; private supply showed an increase.

China.—Hanyang.—The Government Bureau of Economic Information reports that 150,000 dollars are being raised at Hanyang, Hupeh, for the installation of an electric light plant.—*Reuter's Trade Service* (Shanghai).

Chudleigh.—Application for Order.—The Newton Abbot Rural Council has decided to support an application by the Chudleigh Electric Light & Power Co., Ltd., for a Special Order to supply electricity to the district.

Crieff (Perthshire).—Electricity Supply.—The Town Council has agreed that the installation and operation of the burgh electricity supply be entrusted to a company to be formed in co-operation with Edmundson's Electricity Corporation, Ltd., on terms to be arranged. It is proposed to form a local company, with a capital of £10,000.

Continental.—France.—A concession has been applied for by the Société Générale d'Enterprises for the erection of a network to serve upwards of 90 villages in the *départements* of Morthan and Côtes du Nord with electricity.

Belgium.—An electricity scheme is shortly to be established in the town of Houx, province of Namur.

Dundalk.—Year's Working.—The annual report on the working of the electricity undertaking for the year ended March 31st last shows a total income of £19,459. Working expenses amounted to £14,747, leaving a gross profit of £4,712. After deduction of capital charges there was a net profit of £769.

Elgin.—Electricity Scheme.—The promoters of the new electricity supply company having been successful in raising the minimum amount, a company has been formed. It is expected that the company will be in a position to supply electricity by November.

Featherstone.—Street Lighting.—The Urban Council has accepted the offer of the Electrical Distribution of Yorkshire, Ltd., for street lighting with 214 lamps of 50 c.p., at £4 each per annum.

India.—Bengal.—A special grant for the hydro-electric survey of Bengal has been sanctioned.—*Reuter's Trade Service* (Bombay).

King's Lynn.—Year's Working.—The annual report on the working of the electricity undertaking for the year ended March 31st last shows a total income of £16,262, as compared with £16,660. Working expenses and capital charges absorbed £15,718, leaving a net profit of £544. The number of kKh sold decreased from 882,315 to 837,067. The cost of generating electricity dropped from 2.769d. to 1.970d. per kWh.

Llanarth.—Mains Extensions.—At a recent meeting of the Urban District Council it was decided to obtain an estimate of the cost of extending the electricity mains to Nantyrhebo, a suburb of the town.

Portsmouth.—Year's Working.—The accounts of the municipal electricity department (engineer: Mr. B. Handley) for the year ended March 31st last, record a total income of £123,756, as compared with £114,384 in the previous year. The working expenditure amounted to £85,966, as against £91,405, leaving a gross profit of £37,790 (£22,979). After deducting capital charges the result was a net profit of £13,740, comparing very favourably with a surplus of £2,072 in 1920-21. This enabled the department to eliminate a deficit brought forward and to transfer £14,498 to reserve. A total of £92,871 was spent on capital account; this included items of £69,052 for machinery, and £21,725 for mains and services. The amount of energy sold was 5,214,138 kWh, as compared with 4,885,782 kWh, and the maximum demand increased from 3,410 to 4,055 kW.

Penypont.—Proposed Temporary Scheme.—The consulting engineer to the Council recently reported on the scheme for electricity supply to Newcastle Higher, the recommendation was that the Council should only prepare a temporary scheme at present and defer the erection of a new generating station. The question was referred to a special committee.

Ripon.—Purchase of Plant.—The City Council has approved a recommendation by the Electricity Committee that an offer of £3,000 be made to the War Office for the North Camp electricity plant as a going concern, including machinery, equipment, cables, land, and buildings, together with the weir in the river Laver, and the right of impounding and taking water from the river, at present held by the War Office.

Shrewsbury.—Year's Working.—The total income of the electricity undertaking for the year ended March 31st last amounted to £23,278. Working expenses amounted to £18,248, leaving a gross profit of £5,030. After providing for interest and sinking fund contributions there was a net profit of £1,259.

Southport.—Temporary Supply.—The Electricity Committee has granted the application of the Birkdale Electricity Supply Co. for a temporary supply of electricity to Birkdale, for the purpose of night loads, on terms to be arranged with the borough electrical engineer.

Taunton.—Price Reductions.—The Town Council has reduced the charges for electricity as follows:—Lighting: up to 25 kWh per quarter, 10½d. per kWh; 25 to 500, 7½d.; 500 to 1,000, 6½d.; beyond, 5d. Power: Under 2,000 kWh per quarter, 3½d.; 2,000 to 4,000, 2¾d.; beyond, 2½d. Cooking and heating: First 50 kWh per quarter, 3½d.; beyond, 1½d.

United States.—Large Hydro-electric Generators.—The Niagara Falls Power Co. has placed an order with the General Electric Co. for two 65,000-kVA, 12,000-volt vertical water-wheel generators, the largest ever built, to be used in an extension to its power house No. 3 at Niagara Falls, N.Y. These generators will be driven by 70,000-h.p. hydraulic turbines, made by the I. P. Morris Department of the William Cramp & Sons, Ship & Engine Building Co., Philadelphia. Each generator will weigh about 700 tons, being 35 ft. in diameter and 26 ft. high. It is interesting to note that the new generators are twice the capacity of the three 32,500-kVA generators now contained in Station No. 3, which at the time of their installation were considered the largest in existence.—*Journal of Electricity and Western Industry.*

West Bromwich.—Year's Working.—The annual report on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £72,957, as compared with £86,753 in the previous year. Working expenses amounted to £52,625 (£67,382), leaving a gross profit of £20,332 (£19,370). After providing for capital charges there was a net profit of £6,775, which was transferred to appropriation account.

Wynyddislwyn.—Electricity Supply.—At a meeting of the District Council the question of electricity supply to Oakdale was discussed. It was stated that 90 per cent. of the residents were desirous of changing from gas to electric lighting as soon as the installations could be made. The wiring charge for five lights in a collier's dwelling would be £5, and the Council expressed the opinion that the contracting company should arrange with the residents for an instalment system of collecting this sum.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—The Melbourne and Metropolitan Tramways Board has submitted to the Minister of Public Works an interim report on the electrification of the cable tramways, and the construction of the more urgently required of the electric lines. The Board's estimate of the cost of electrifying the cable tramways is £4,200,000. The cost of about 30 miles of new electric tramway, with additional rolling stock, is placed at £2,000,000. It is proposed to spread the expenditure over 15 years. The total proposals before the Board represent 153 miles of single track. With regard to conversion, it is proposed that the first lines shall be those which link up present electric systems.—*Reuter's Trade Service* (Melbourne).

Continental.—Sweden.—According to *Svensk Handels' tidning*, an official of the State Railway Board, who has recently been visiting some of the largest engineering works in the country, emphasised the fact that in order to meet probable unemployment in the engineering industry, it was necessary that the electrification of the railway line between Stockholm

and Gothenburg should be started in the very near future. The cost of the electrification of the line in question was originally estimated at Kr.105,000,000, including the locomotives, but as a result of the turn in the market the present cost would only amount to about Kr.50,000,000.—*Reuter's Trade Service* (Stockholm).

Edinburgh.—Inquiry.—An inquiry was recently held in Edinburgh into the Corporation's application for a Provisional Order to include an arrangement by which the Corporation would be empowered to take over the undertakings of the Musselburgh & District Electric Light & Traction Co., Ltd., in a number of adjacent districts. The Commissioners, after deliberation, found the preamble of the Order "not proved" as regarded this clause.

Japan.—Railway Electrification.—*Finance and Commerce* learns that an extensive electrification project has been adopted by the Japanese Department of Railways, and will be carried out with the work of electrifying the Tokio-Odawara and the Tokio-Yokosuka lines. The new project covers the whole Tokio-Kobe trunk line. The total expenditure for the trunk line electrification is estimated at 67,000,000 yen. Of this amount 35,000,000 yen is required for the construction and improvement of locomotives and cars. The number to be built is estimated at 291, including freight cars, passenger cars, express locomotives, special express train locomotives and others. If the financial scheme is approved by the Finance Department part of the amount will be included in the Budget for the year 1923-24. The whole expenditure is to be spread over a period of seven years. According to the plans, the work is to be started with the erection of overhead cables along the present tracks from both terminals. Most of the power is to be obtained from private power companies along the line, about 25 transformer stations being required between Tokio and Kobe.—*Reuter's Trade Service* (Shanghai).

London.—L. & N.-W. Railway Electrification.—A commencement has been made of the electrification of the L. & N.W. Railway line, between Watford and Croxley Green—a distance of about two miles. The construction of a further ten miles of electrified line is under consideration.

Tube Breakdown.—The service on the Central London Railway between Liverpool Street and the Bank was suspended from 9 a.m. to mid-day on the 14th inst., owing to one of the axles of a train running from Wood Lane breaking. The passengers were conducted through the tunnel to Liverpool Street station.

New Zealand.—Wellington.—A Power Station and Tramway Committee appointed by the City Council to investigate the general control and conditions of the tramway services in the city, has made the following recommendations:—Car shed extensions, estimated cost £25,000; new cars, £84,000; duplication of lines, £25,000; construction of limited number of double-deck cars to cope with rush traffic.

When the Mangahao hydraulic-electric scheme is completed the Council will take the power for its tramways from this source. Three rotary converters will be installed. It is estimated that the largest will cost from £50,000 to £60,000.—*Reuter's Trade Service* (Melbourne).

Pontypridd.—Track Renewal.—At a recent meeting of the District Council the electrical engineer reported on the dangerous state of part of the tramway track, particularly at Paulshoughton and Taff Street, the main street of the town. It was decided to immediately renew the former portion of the track and the question of Taff Street was referred to the Tramways Committee.

Sheffield.—Flood Damage.—During the recent heavy floods in the North of England the tunnel conveying some of the Corporation's cables under the River Don, from the Kelham Island station, became flooded, causing an interruption to the tramway system. The tramways were also damaged by the action of the torrents.

South Africa.—Capetown.—The *Cape Times* reports that Mr. Jagger (Minister of Railways and Harbours) recently received a joint deputation from the Chamber of Commerce and the Peninsula Publicity Association on the question of the electrification of the Peninsula suburban line. He intimated that the capital outlay involved by the proposal placed it outside practical politics at present. The Government now had the Natal electrification scheme in hand, and it was anticipated that that project would be completed in about two years. If the scheme proved a success no doubt the electrification of the Peninsula suburban line would afterwards be undertaken.—*Reuter's Trade Service* (Capetown).

United States.—Railway Electrification.—The *Journal of Electricity and Western Industry* states that it is proposed to commence in 1924 the electrification of the American Great Northern Railway. The total estimated cost is $20,000,000. The first stage will be between Klotesh and Havre (Montana), and the second stage from Wenatchee to Seattle, Washington. Seattle will be established as the western terminal for the distribution of electrical equipment.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—Florida-Barbados Route.—President Harding has granted a request for the immediate reopening of the cable between Florida and Barbados for emergency use for transmitting messages to Europe *via* Pernambuco. This cable was closed during the Wilson Administration, on the ground that the connection of the British cable to Brazil would tend to increase the monopoly of the British company.—*Daily Telegraph.*

Seizure of Stations.—Last week we announced the seizure of the Waterville cable station of the Commercial Cable Co. by the Irish "Irregulars." On the 10th inst *The Times* announced that all the ten Transatlantic cables which end in Ireland were in the hands of the Irregulars, who refused to allow them to be used. As a consequence the only cable communication between this country and the United States was *via* Penzance, where four lines are required to do the work of fourteen. Naturally considerable delays are taking place. Traffic is being diverted to some extent through France, and a larger use is also being made of wireless. The Western Union Telegraph Co. announces that, owing to the congestion on the Penzance cables, the deferred or cheap-rate services are temporarily suspended, and full-rate traffic only can be accepted. The stations which have been seized are those of the Commercial Cable Co., the Western Union Co., and the Imperial cable station, all situated on the Kerry coast. It is not known definitely whether the apparatus has been destroyed, as communication is cut between the stations and headquarters in London.

The Post Office stated on the 10th that the deferred services at half-rates to the United States had been suspended by all routes. Diverted services to Canada and the West Indies were also suspended except by Imperial cable, which is maintaining all its normal services to Canada, the West Indies, and Australasia.

Irish "rebels" seized the Central Telegraph Office in the Dublin Post Office late on the night of the 11th inst. An attempt was made to set the premises on fire, and telegraphic communication was interrupted. Free State troops regained possession and a limited service was in operation next day, the attempt to destroy the apparatus having been foiled. The Marconi Co. is trying to relieve the situation as far as possible, but as the Clifden wireless station has been destroyed all wireless messages have to go *via* Carnarvon.

According to *The Times*, the seizure of the cables in Ireland has had its repercussion on cable communication between France and America. In consequence of the heavy strain on the two direct cables from the French coast the restrictions announced by the Western Union Telegraph Co. on the use of the Penzance cables for messages at deferred or cheap rates are also being applied in France. Fortunately the great wireless station at Saint Assise, near Melun, which opened up direct wireless communication with New York on August 6th, is now in full working order, and has had an unlooked-for opportunity of demonstrating its capacity.

Although normal service has not been restored as yet, the situation has greatly improved this week.

Germany.—New Berlin-Rhine Cable.—The *Matin* announces that the German Government has just opened the new underground cable between Berlin and the Rhine. The work on this line was begun in 1914, but was dropped during the war and resumed in April, 1923. The *Matin* suggests that the purpose of this new cable is strategic as well as economic.—*Reuter.*

Netherlands.—Direct Telephone Service.—*The Times* Amsterdam correspondent announces that direct telephone communication between the Netherlands and England was to be inaugurated on the 14th inst. for public use.

Sweden.—The West Coast Radio Station.—It is stated that no decision has yet been reached by the Swedish authorities with regard to the site for the erection of the projected large wireless station on the West Coast. The competition as to whom shall receive the contract to erect the station is particularly keen, and radio companies in the United States, England, France, and Germany are doing what they can to make their offers as attractive as possible. The French offer was placed before the Swedish Telegraph Administration about the end of July by M. Kyticas on behalf of the Société Francaise Radio Electrique.

A representative of the Marconi Co. is in Stockholm this week in connection with that company's offer to build the station in question, and a representative of the American Radio Corporation was also there for the same purpose recently.

Telephone Strike.—The Telegraph and Telephone Operators' Union, with a membership of about 500, went on strike some time ago, and made great efforts to induce the telephone girls to join it. Contrary to what had been expected, it succeeded, and the strike in Stockholm, as well as in Gothenburg, has lasted since July 21st. The telephone girls wanted collective agreement instead of the personal agreements now in force. The Board of Telegraphs did not agree, especially as there would be an increased cost in connection with it, which would fall upon the subscribers. Besides, wages now paid to the telephone girls are

in 1917 37·92 per cent. higher than they were when the increased cost of living has been considered. The Telegraph Administration, therefore, declared that those who wanted to resume work had to appear before a certain time, but the Government said that there would be no objection to a collective agreement, and thus the settlement of the strike was postponed, and the Telegraph Workers' Union insists that all the telephone girls shall be taken back to work immediately and no difficulties whatever be made on account of their having taken part in the strike. This the Board cannot promise, as it will have to give work to those who have helped over the strike. It is 25 years since the last and only previous telephone strike took place, and nothing was gained by it, says the *Financier*.

The Telephone Service.—Irlam Telephone Exchange.—A new telephone exchange was opened at Irlam on August 12th. Provision has been made for the immediate connection of 52 subscribers, including those existing subscribers in the Irlam and Cadishead districts who have hitherto been served from the Urmston Exchange.—*Manchester Guardian*.

New Wembley Exchange.—A new telephone exchange, with accommodation for 1,200 lines, was opened at Wembley, Middlesex, on the 16th inst.

Wireless Telephony.—Broadcasting.—Amateurs, whose patience has been tried by the long delay in getting the broadcasting scheme started, will learn with relief that their anxieties are now within measurable distance of an end, says *The Times*, according to which broadcasting in the London area will begin on August 21st, and in the seven provincial areas in six or seven weeks. Such, at any rate, is the expectation of the manufacturers who, on August 11th, combined to form the broadcasting company. Marconi House will be the broadcasting centre for London. The apparatus is in readiness, and all that remains to be done is to secure the Postmaster-General's approval of the company's memorandum and articles of association. Mr. Godfrey Isaacs, managing director of the Marconi Co., stated on Saturday that he did not anticipate any obstacle to the scheme being inaugurated next Monday. The board of directors of the new company will then proceed to deal with the erection of the provincial stations, which are to be at Birmingham, Manchester, Newcastle, Plymouth, Cardiff, Edinburgh or Glasgow, and Aberdeen. Each station will cost, according to Mr. Isaacs, approximately £20,000, and it was estimated recently by Mr. Kellaway that within the next two years the sum of £6,000,000 will be spent on receiving sets and broadcasting stations, 80 per cent. of which amount will go in wages. The Postmaster-General has laid down several conditions under which the broadcasting company will work. In the first place, its profits are limited to 7½ per cent. per annum. For two years the apparatus will be limited to types submitted for the approval of the Post Office by members of the broadcasting company, but to avoid anything in the shape of a monopoly the Postmaster-General has laid it down that any *bona-fide* British manufacturer of wireless apparatus must be allowed to become a member of the broadcasting company simply by taking a £1 qualifying share. The licence of the company will be subject to the maintenance of an efficient service. Towards the expenses of the broadcasting company the Post Office will contribute a portion of the licensing fees paid for receiving sets, and a further contribution will be paid out of the purchase money on each set sold by the manufacturers.

Senator G. Marconi has, according to the *Evening News*, been elected chairman of the new broadcasting company. Until the position of the latter has been definitely established the Postmaster-General will not issue licences for the reception of wireless matter in any public place of entertainment.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—December 18th. Victorian Electricity Commissioners. Supply of a complete brown coal-handling plant.

November 4th. Transformers, induction regulators, and switchgear. (August 11th.)

Melbourne.—Victorian Railways. October 11th. Electric storage battery with accessories and spares (Cont. 35,090). October 18th. Motor generator set and static transformer (Cont. 35,089).*

September 20th. Postmaster-General's Department. Switchboard apparatus. October 17th. Automatic c.b. telephone equipment, together with all associated equipment, including apparatus for use at subscribers' premises. (See this issue.)

Victorian Railways. November 29th. Three electric storage-battery industrial trucks capable of carrying 4,000 lb. at five miles an hour.—*Reuter's Trade Service* (Melbourne).

Belgium.—August 22nd. Municipal authorities of Genappe. Establishment of a central electricity generating station on land adjoining the State railway line. M. Gilson, administrateur-délégué, Genappe.

Brighton.—September 18th. Electricity Department. Two water-tube boilers, superheater, economiser, steel chimneys, fans, feed pumps, steam pipes, valves, &c. (See this issue.)

Chile.—September 14th. Chilean State Railways. Electrical plant for the San Rosendo station. Departamento de Materiales y Almacenes, Alameda station, Santiago, Chile. Representation of the Chilian Railways at Paris, M. Bertrand, Boulevard St. Michel 33, Paris.*

Dublin.—August 24th. Electricity Department. Equipping two Babcock boilers and economiser, Pigeon House Fort, with "Vulcan" system soot-cleaning apparatus. City Electrical Engineer, Dublin.

September 1st. Post Office Stores Department, Irish Provisional Government. 4,000 ft. each casing and covers for wires and cables; 1 ton plumber's solder.

September 15th. 100,000 insulators. (See this issue.)

Edinburgh.—September 5th. Corporation. Conversion of two overhead cranes from mechanical to electrical operation. (August 4th.)

September 5th. Tramways Department. Electrical equipment for 80 electric cars. Manager, Tramways Department.

Greenock.—August 21st. Corporation. Electric lighting work in connection with the erection of 52 tenement houses. Office of Public Works, Greenock.

London.—Metropolitan Asylums Board. August 30th. Electric storage battery at the Grove Fever Hospital, Tooting Grove. (August 11th.)

H.M. Office of Works. September 5th. Supply of electrical and mechanical engineering labour in daywork in Cardiff. (August 4th.)

August 31st. Electric lighting installation at Cornwall House, S.E. (See this issue.)

Islington.—September 20th. Electricity Department. Two water-tube boilers with stokers, draught system, steel chimneys, steam piping, &c.; cooling towers, ponds, pipework, &c. (August 11th.)

Hammersmith.—September 7th. Electricity Department. Transformers, oil-cooled and air-cooled; e.h.p. cables; e.h.p. and h.p. switchgear. (See this issue.)

Manchester. — August 22nd. Tramways Committee. Permanent way points, tongues, crossings, and hardened steel centres; electrodes for welding. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

August 24th. Electricity Committee. Two steel ash wagons and a lighting sling. (August 4th.)

August 31st. Electricity Committee. 420-V ironclad distribution switchgear for auxiliary services. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

August 31st. Electricity Committee. Supply and completion of two coal grabs. (Spec. B38.) (August 11th.)

New Zealand.—September 30th. Teviot Electric Power Board. One horizontal turbine. Francis type, coupled to a 125-kW, 3-phase, 50-cycle, 3,300-V generator; one 7.5-h.p. Pelton wheel; one 5-kW motor generator set; and complete switchboard and power station equipment.*

September 30th. Teviot Electric Power Board. One horizontal turbine, Francis type, coupled to a 125-kW, 3-phase, 50-cycle, 3,300-V generator; one 7.5-h.p. Pelton wheel; one 5-kW motor generator set; and complete switchboard and power station equipment.*

Wellington.—City Council. Erection of a large reinforced concrete power station at Shag Point.

Reigate.—August 22nd. Town Council. H.p. concentric and l.p. twin paper-insulated cable. (August 11th.)

Stockton-on-Tees.—August 31st. District Fund, Gas, and Electricity Committees. Stores, &c., for three months. (See this issue.)

St. Annes-on-Sea.—Electricity Department. 3,530 yd. .5 x .5 x .25 l.p. 3-core armoured cable; 1,460 yd. 7/22 l.p. ditto; 500 yd. .2 x .2 x .1 l.p. ditto. (See this issue.)

Tasmania.—Hobart.—October 2nd. City Council. 750-kW rotary converter and transformer and 550-volt, d.c. switchboard panel. Further particulars from the office of the Agent-General for Tasmania, Australia House, Strand, London, W.C.2.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

India.—Cawnpore.

Riley self-cleaning multiple-retort stoker, for new boilers of Indian Electric Supply & Traction Co., Ltd.—Charles Erith & Co.

Farnham (Surrey).

Electric lighting installations at the Congregational Church and the Farnham Urban District Council offices.—C. F. Williams, Farnham.

France.—The Société Fama, of Paris, has received repeat orders for Riley stokers (selling agents in this country Messrs. Chas. Erith & Co.) for the Gennevilliers power station of the Union d'Electricité, as follows:—A fifth 36-retort stoker for Stirling boiler and two 18-retort stokers for two large B. and W. boilers. A repeat order for six 36-retort Riley stokers has also been placed by the Compagnie Parisienne de Distribution d'Electricité.

London.—Stepney.—Electricity Committee.

Extensions and alterations to Limehouse generating station (£37,370). —I. Jarvis & Sons (accepted).

Two 10,000-kW turbo-alternators and auxiliary plant at Limehouse generating station:—

	£
Richardsons, Westgarth & Co., Ltd. (a)	103,671
Ditto (b)	105,264
Ditto (c)	105,374
*Metropolitan-Vickers Electrical Co., Ltd. (a) (accepted)	107,478
*Ditto (b)	109,838
‡Brush Electrical Eng. Co., Ltd.	109,738
English Electric Co., Ltd.	116,674
Parsons, C. A., & Co. (a)	111,270
Ditto (c)	112,020
Ditto (b)	117,720
**Fraser & Chalmers	74,483
**British Thomson-Houston Co., Ltd.	77,336
**Howden, James, & Co. (a)	80,845
**Ditto (b)	81,208
***Allen, W. H., & Co. (a)	18,950
***Ditto (b)	16,950
***Weir, G. & J.	20,415
***Mirrlees Watson Co., Ltd. (a)	22,807
***Ditto (b)	23,731
***Ditto (c)	23,868
***Ditto (d)	24,643
***Vickers, Ltd. (a)	23,300
***Ditto (b)	23,200
***Hick, Hargreaves & Co., Ltd. (a)	24,416
***Ditto (b)	26,740
***Worthington-Simpson, Ltd.	24,809
***Cole, Marchent & Morley, Ltd.	28,839
††Reyrolle, A., & Co., Ltd.	3,538

* Can be reduced by £1,110 for spares, if not needed. † Can be reduced by £1,024 for spares, if not needed.

‡ Cannot complete first set under two years and second set under two years and nine months.

** Excluding condensing plant.

*** Condensing plant only. †† Switchgear only.

Acting on the recommendation of the Borough Electrical Engineer and Manager, the Committee has accepted the tender "(a)" of the Metropolitan-Vickers Electrical Co., Ltd., at £107,478, which, in the event of the spares not being required, will be reduced by £1,110.

Meters and combined meters and demand indicators for the period ending June 30th, 1923:—

The Committee recommends acceptance of the tenders of the Aron Electricity Meters, Ltd., for combined meters and demand indicators; Ferranti, Ltd., for meters (50 and 100 amps. capacity); and Reason Manufacturing Co., Ltd., for meters (2½ to 20 amps. capacity).

One mile each "C" and "D" troughs and covers (£495).—Sutton and Co. (Overseal), Ltd. (Accepted.)

Fifty tons moulded pitch (£231).—Crow, Catchpole & Co., Ltd. (Accepted.)

Coal for the Limehouse generating station:—

5,000 tons of Scotch washed pea nuts (22s. 6d. per ton).—J. Hudson and Co., Ltd. 5,000 tons of Scotch washed peas (21s. 5d. per ton).—W. Cory & Son, Ltd. 3,000 tons of Littleton 1¼-in. nutty slack (21s. 3d. per ton).—E. Foster & Co. 5,000 tons of Pinxton slack and/or Selston ¾ in. to ⅜ in. (19s. per ton).—Milner, Thomas & Co., Ltd. (Accepted.)

Lanarkshire.—County Council. Accepted:—

Electric lighting work at the County Hall, Hamilton (£372).—Malcolm and Allan.

Luton.

Two Riley self-cleaning multiple-retort stokers, for new boilers at electricity works.—Charles Erith & Co.

Maidstone.—Installation of electrically-driven pumps, motors, wiring, &c., at Barming Heath Mental Hospital.

G. E. Taylor & Co. (accepted)	**£780**
Sleigh & Wood	867
Bowyer & Sons	912
V. G. Middleton	916
Ellis & Ward, Ltd.	957
T. Clarke & Co., Ltd.	969
Cecil Cooper & Co., Ltd.	1,028
W. Weeks & Sons, Ltd.	1,075
Oswald Jones & Co.	1,100
Drake & Fletcher	1,103
Crompton & Co.	1,130
Marryat & Place	1,165
Francis Pedden & Sons	1,258
Commercial Telephone & Electrical Co.	1,396

Rathmines.—Urban District Council. Accepted:—

Two 200-kW Bruce Peebles-La Cour motor converters and switchgear.—R. N. Eaton & Co., of Dublin.

Southend-on-Sea.—Education Committee. Accepted:—

Installing electric lighting at the Education Offices.—Fogden & Barnes.

Torquay.—Town Council. Accepted:—

Turbo-alternator.—British Thomson-Houston Co., Ltd.

Condensing plant.—Cole, Marchent & Morley.

NOTES.

Electrical Installations in British Malaya.—From the annual report of Mr. G. E. Greig, Acting Senior Warden of Mines, Federated Malay States, it appears that there was an increase in the number of installations of electrical plant in the Federated Malay States in 1921. Although the ordinary installations show a falling-off from 110 in 1920 to 101 in 1921, there were in addition 78 self-contained low-voltage lighting plants at work in private houses, &c., as against 45 in 1920. The aggregate kilowatt power of motors of all installations increased from 12,165 in 1919 and 13,117 in 1920 to 14,724 in 1921. A classification of all electrical generating plant employed in the Federated Malay States in 1921 is given in kilowatts as follows:—

	Power.	Other Plant.
Mining	11,000	316
Agriculture	70	268
General	108	156
Government	331	2,475
	11,509	3,215

The increase in general capacity is all the more remarkable in view of the depressed conditions prevailing in most industries during the past year. Mr. Greig reports that the standard of efficiency among the natives in charge and wiremen was low. Suitably-qualified engineers were difficult to obtain owing, no doubt, to the difference between the salary offered and the qualifications demanded by the local enactments.

Dundee Appointment.—The number of candidates is 86 for the Dundee appointment. A short list of seven of these has been selected.

Proposed Service Subways for Manchester.—The special sub-committee of the City Council appointed to deal with the question of subways for the conveyance of cables, gas and water mains, &c., met on August 4th. A report on the subject was presented by the City Engineer. It was stated that the cost of constructing a subway in Mosley Street and the reconstruction of the sewers, &c., would be about £75,000. A further £28,000 would be required to effect the removal of existing cables and pipes into the subway. It is considered that the cost of maintenance would be about the same, but the system would have the advantage of obviating the breaking-up of roads, although this advantage would only be gained by a large capital outlay. The report estimates that the average cost per mile of subway in new streets would be £140,000. The sub-committee, which is composed of members of the electricity, water, gas, and other committees, decided to call for more information before taking any further steps.

Ireland's Power Resources.—Mr. L. J. Kettle, the Dublin city electrical engineer, speaking at a recent meeting of the Dublin Rotary Club, said that Ireland's peat deposits would last for another 250 years, but the water power constituted a permanent source of energy. He warned his audience that the coal supplies were liable to be cut off at any moment. The water resources provided a means of obtaining cheap power, which should be developed at once.

The s.s. Bendigo.—The s.s. *Bendigo*, a large twin-screw steamer of 13,100 tons, built by Messrs. Harland & Wolff, Ltd., to the order of the Peninsular & Oriental Steam Navigation Co., Ltd., for its Australian pasenger service, has just been handed over after satisfactory trials on the Clyde. Needless to say, electricity is used largely on the ship. The electrical installation consists of four main generators and one vertical oil engine-driven dynamo situated well above the water-line. All the water-tight doors, which are electrically operated, can be closed simultaneously from the captain's bridge. The ship's whistle is operated electrically from the bridge. The electrically-driven gear includes large fans for the boilers, also refrigerating and ventilation fans. The two hoists for the pantry and a dough mixer, dish washer, and potato peeler are electrically operated. Loud-speaking telephones have been installed to assist navigation, and there are considerably over 1,000 electric lights and 70 motors in the ship.

Electricity from the Earth?—A French engineer, M. Jules Guillot, claims to have produced a static transformer with which he can make use of earth currents in a practical way. M. Guillot is said to have been at work for some years on his apparatus, by means of which he hopes to collect electricity from the earth in a form suitable for general use.—*Daily Mail.*

American Railway Electrification.—In the course of an address delivered before the Connecticut Section of the A.I.E.E. Mr. Calvert Townley, of the Westinghouse Electric and Manufacturing Co., of New York, said that it was generally admitted that all railway electrification in the U.S.A. had been successful, but he pointed out that not more than about one per cent. of the entire steam railroad mileage of the United States had been electrified as yet, and the average railroad executive might be excused if he looked upon the existing examples as special cases and, therefore, as proving nothing with respect to his own particular problem. For example, the New Haven and the New York Central Railway had to electrify its lines out of New York because of a law passed by the State of New York. The Pennsylvania Co. had to electrify its road out of New York City in order to operate its subway river tunnels. The Norfolk & Western Railway had a peculiar "restricted neck to its bottle" in the Elkhorn grades which would justify almost any expense to remove. In a like manner some special reason could be found for almost every large electrification project. However, it was perfectly safe to say that the attitude of mind of the railroad man had materially changed so that the question always first asked some years ago, "Can it be done?" had now been replaced by the entirely different question, "Will it pay?"

Swiss Water Power.—The *Financial Times* recently published an article from a Berne correspondent upon the position of the Swiss hydro-electric industry as at December 31st, 1920. There were 178 stations of 500 h.p. capacity or over built or actually under construction. These had a minimum rating of 439,962 h.p. in the aggregate, and a maximum of 1,687,121 h.p. The yearly production of energy was 3,930,450,000 kWh.

At the end of 1921 there existed official sanctions for the export of 236,067 kW, as follows:—To France, 153,231; to Italy, 56,826; to Germany, 26,010 kW. The largest hydro-electric station in Switzerland is that at Wäggethal, which is not yet finished; this will eventually have a plant capacity of 140,000 h.p. The Amsteg station of 85,800 h.p. is also not yet completed. The largest finished station is at Olten-Gösgen (80,000 h.p.) and there are eight other stations developing over 50,000 h.p. In addition to these large undertakings there are probably six or seven thousand smaller private installations.

Blast-furnace Gas.—Mr. N. H. Gellert points out in an article in the American technical Press that the value of clean blast-furnace gas as against dirty or raw gas for use in blast-furnace stoves or under boilers has been so well demonstrated as to cause the largest and most progressive steel producers to spend millions of dollars in installing gas-cleaning plant. From 48 to 50 per cent. of the thermal value of the coke charged into a blast furnace issues from it in the form of latent and sensible heat of combustible gas; 30 per cent. of the gas generated is used to increase the temperature of the blast, while 60 per cent. of it is burned under boilers or consumed in gas engines. Now if it be conceded that clean gas is to be preferred there remains the question: Shall it be cleaned by a wet or dry process? From the author's discussion of the heat values of gases cleaned by both methods it appears that dry-cleaned gas at 400 deg. F., even if it contains 35 grains of moisture per cu .ft., has a greater available heat value than wet-cleaned gas at 70 deg. F., which only contains 7.98 grains of moisture per cu. ft. This heat is 6.5 per cent. greater for the former gas than for the latter. At six dollars per ton for coke charged into the furnace it means a saving of 0.156 dollar per ton of iron made in favour of using hot cleaned gas. There is no difference in the flame temperatures of the two gases.

French Water Power.—The development of the water resources of the Alps was the subject of a recent address, by M. Ducrest, before the Société Scientifique de l'Isère. He said that the remedies for seasonal and daily fluctuations in water-power undertakings were, on the one hand, the improvement and extension of the big distribution networks; and, on the other hand, the erection of great complementary generating stations, whose effect would be the regulation of production and the obviation of insufficient seasonal and yearly supplies. Such generating stations should be hydraulic on account of lower cost, and the reservoirs supplying them should be of moderate size, but situated at great heights, or of larger size if situated at lower altitudes. The Alpine regions were specially suited for such reservoirs owing to the torrents from the upper glacial districts. Passing in review a number of reservoir schemes under way in the neighbourhood of Grenoble, the lecturer indicated the many lakes in the Belledonne range which must eventually be harnessed. Two other big schemes lately projected were the Chambon dam on the Romanche and the development of the Laffrey lakes. But while the Chambon dam would benefit existing stations on the Romanche only, the Laffrey scheme would favour the construction of a complementary station meeting, not only the needs of existing consumers, but also future demands. The lecturer concluded by advising the appointment of a committee to study questions of such vital importance to the region at large.

Standard Rates for Battery Hire and Charging.—The motor traders and garage owners in the Dublin district have recently adopted a series of standard charges for recharging batteries used on petrol motor vehicles as follows:—

	Acid and First Charge.	Ordinary Charge.
	s. d.	s. d.
4 and 6 volts, over 20 and up to 40 Ah. ...	4 6	2 0
4 and 6 volts, over 40 and up to 80 Ah. ...	7 0	3 6
4 and 6 volts, over 80 and up to 100 Ah.	9 0	5 0
6 and 12-volt lighting and starting batteries	12 6	7 6

A standard charge of 2s. 6d. for the first day and 1s. per day afterwards has also been adopted as regards the hiring of batteries.

A New Profession.—Amongst the "situations vacant" announced in this issue is one which we hail with interest and pleasure as the very first of its kind—an opening for a farmer to become an electrician, or an electrician to become a farmer. The progress of the application of electricity to farming is slower than we could wish, but progress is being made; the work which Mr. R. Borlase Matthews has already accomplished in this direction will go far towards hastening its development, and we should think that there will be a large number of candidates for initiation into the mysteries of this combination of nature and science.

"Greater London."—The area known as London extends into a number of counties, but it was left to our American contemporary *Electric Traction* to draw our attention to suburban Lancashire. It states: "The new Preston Motor Omnibus service, between the Town Hall and Lytham Road in London seem (*sic*) to have made an auspicious start. In February they carried 68,885 passengers. Total receipts for the month were £537 and the buses earned 24.04d. per bus mile, as compared with 18.08d. per car mile from the tramways. This is certainly a fine showing and would clearly indicate that Londoners in the tributary territory covered by the Preston line have felt the need of the new enterprise." An illustration of an omnibus labelled "Preston Corporation" accompanies the note. This precludes the assumption that the last L.C.C. (Tramways and Improvements) Act embodied the provision of a "Preston Line."

Appointments Vacant.—Professor of Electrical Technology, in the Indian Institute of Science, Bangalore. (Rs.1,500 per mensem); Draughtsman and Clerk of Works (temporary), for the Torquay Electricity Department; Junior Assistant Engineer (300 to 350 taels per month), and three Exchange Managers (clerks in charge) (300 to 350 taels per month), for the Shanghai Mutual Telephone Co., Ltd. Tael=3s.; Teacher of Electrical Engineering for the St. Helens Education Committee; two Electricians (£420 each) for the Nigerian Government Railway; Junior Shift Engineer for the Fulham B.C. Electricity Department. (See our advertisement columns to-day.)

Indian Telephone System.—Great developments are expected in India within a short time in connection with the telephone system. New lines are under construction and others are projected. The telephone branch of the Department of Posts and Telegraphs has now been considerably strengthened and a special officer has been appointed to deal with the telephone projects of the Government, under the chief engineer of the telegraphs. A scheme of establishing telephonic communication between Calcutta and Bombay is being considered. "It is proposed to use the existing copper telegraph lines by means of coils for telephonic purposes." There are already a number of telephone lines worked on the automatic system in existence. Communication is now possible between Simla and Lahore, Lahore and Rawalpindi, Rawalpindi and Peshawar, Lahore and Delhi, Lucknow and Cawnpore, Lucknow and Allahabad, Calcutta and Asansol, Asansol and Leyabad, Bombay and Poona, Poona and Mahableshwar, Bombay and Surat, Surat and Broach, and Broach and Ahmedabad. To link up the Punjab system directly with the United Provinces system the line between Delhi and Bareilly has recently been completed and the line from Delhi to Agra is about to be completed. The Delhi-Bareilly line provides means of communication between Delhi, Lucknow and Allahabad. When repeaters are installed it will be possible to speak from Lahore to Peshawar and from Simla to Lucknow and Allahabad. In the Bombay Presidency the telephone branch of the Department of Posts and Telegraphs intends to open a telephone system at Sholapur and establish communication between Poona and Sholapur. It is proposed to close down the Government telephone exchanges in Calcutta and Bombay and give the companies serving the public in these cities the option of purchasing the Government apparatus at a reasonable price. The Bengal Telephone Co., Ltd., will then take over the entire system in Calcutta. The Bombay Telephone Co. proposes to adopt the automatic system, as it is experiencing considerable difficulty in securing operators. When the telephone systems between Madras and Ootacamund and Madras and Bangalore and Conoor are completed they will be of the relay automatic type. The system between Simla and Lahore is automatic, and the Cawnpore system is a modified Strowger system. Ganeshkhind has also the relay automatic system. In connection with the establishment of long-distance telephones in India, it is mentioned that between Simla and Delhi, Rawalpindi and Murree, Asansol and Loyabad, Bombay and Poona, and Bombay and Surat, there are now three speaking lines (two physical lines with one phantom). Between Broach and Ahmedabad there is at present one speaking line, but another physical and one phantom are to be laid this year, providing three speaking lines. Between Calcutta and Asansol there are three physical and one phantom lines, giving four speaking lines. The others are single speaking lines.—*Financier*

Roller Bearings for Railway Trains.—A new roller bearing for railway coaches which, it is anticipated, will lead to economies in running costs, has recently passed its preliminary trials on the Great Eastern Railway. The new bearing is the patent of the Chain Roller-Bearing Co., Ltd., of Birmingham. It is said that over 60 years ago a train was fitted with bearings having brass rollers by the Eastern Counties Railway (now the G.E.R.). Also about 30 years ago similar tests were made with roller bearings consisting of hard solid steel rollers controlled by a revolving cage. These tests were made on the London, Brighton & South Coast and the South-Eastern Railways, with most satisfactory results. Later trials were made by the Great Western, North-Eastern, Caledonian, and several of the London Underground electric railways, with corresponding success. For upwards of fifteen years roller bearings have been used in India.

Educational.—Huddersfield.—Under the Huddersfield Education Committee a class in wireless telegraphy and telephony is to be established at the municipal Technical College, provided there is a minimum of fifteen students.

United States Electric Vehicle Market.—Business in the truck division of the electrical vehicle market during July was fairly good. Department stores in the metropolitan district recently placed orders for 20 additional trucks. There is only one department store now in New York which is not using electric trucks, but it is intended to substitute electric for gas vehicles when the concern moves to its new store which is now being erected. A Brooklyn baking company recently placed an order for 30 electric trucks and a Newark (New Jersey) baking concern, which now owns 12 trucks, has arranged to increase its fleet to a total of fifty. Messrs. Rauch & Land, Inc., manufacturers of electric passenger automobiles and industrial trucks, have sold eight electric taxicabs for operation in New York. They will be placed in operation on September 15th, and if the taxis are as successful as anticipated the purchaser proposes to augment the fleet. The trade generally is greatly interested in the plan to introduce electric taxicabs in New York, where it is believed they will prove very popular. Electric taxicabs are widely used in Chicago, Detroit, and other western cities, and in the opinion of local traction experts there would appear to be no reason why they should not be equally popular in New York City. The annual Electric Industrial Exposition will be held in New York from October 7th to 14th. Manufacturers of trucks and other electric vehicles are preparing to stage an exhibit of record proportions at the show. Twenty-six electric trucks and passenger cars, valued at $27,235, were exported from the United States during May.—*Reuter's Trade Service* (New York).

The Wimbledon Case.—It is reported that an action brought against the Wimbledon Corporation for wrongful dismissal by Mr. H. Tomlinson-Lee, late chief electrical engineer, has been decided in favour of the latter. The Town Council paid into Court a further two months' salary, making six months in all, and did not attempt to justify its action; the Council will also have to pay the costs of both sides, which amount to a considerable sum.

Aluminium Field Coils.—*Electric Traction* states that since the commencement of operations in Kansas City a year ago a firm of traction motor manufacturers has supplied 500 sets of aluminium field coils. These are of square section, and are formed before a special oxidisation process is applied to them. This process gives the metal a heat- and moisture-resisting coating. After oxidisation the coils are dipped in insulating varnish, taped, dipped, and baked. The terminals are of copper or brass, soldered with a special compound, which prevents electrolytic action. The weight of these aluminium coils is said to be only from 25 to 50 per cent. of that of equivalent copper coils. The use of aluminium for magnet coils was dealt with at some length in our issue of December 5th, 1913.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. J. A. Hartigan has resigned his position as manager of the fan and small motor department of Messrs. S. G. Leach & Co., Ltd., and has been appointed sales manager for London and South of England for the Triumph Electric Manufacturing Co., Ltd., electric fan manufacturers, Birmingham, who have opened offices and showrooms at 58, High Street, Bloomsbury, W.C.2. Telephone: Gerrard 5070.

Rumours having been current regarding the serious accident which lately happened to Dr. Boveri, chairman of Brown Boveri & Cie., of Baden, our readers will be interested in hearing the facts. While on a motor trip to Holland, where he intended to spend his holidays, Dr. Boveri met with a serious accident. Owing to a defect in the car, the latter overturned and rolled down a slope about 13 ft. deep. Dr. Boveri sustained a broken leg and a dislocated shoulder, while Mrs. Boveri, who accompanied him, had a wrist broken and suffered some contusions which, however, are not dangerous. Dr. and Mrs. Boveri are now in the St. Willibrordus Hospital, at Emmerich, on the Rhine, which fortunately is close to the scene of the accident, and the condition of both is as satisfactory as can be expected.

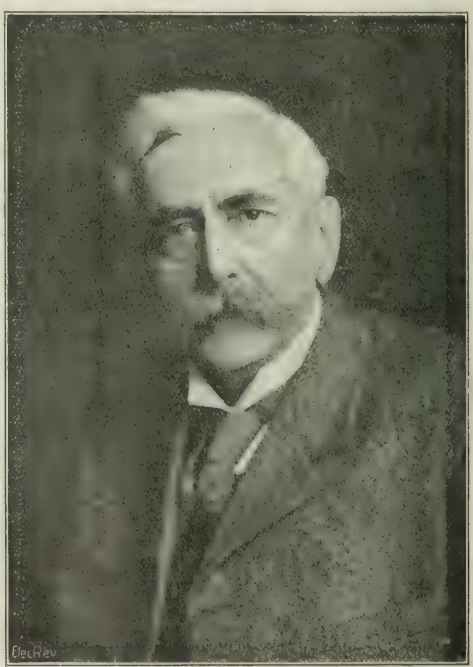
Mr. D. G. Davies, B.Sc., who has for some time occupied the position of resident engineer at the Motherwell power station of the Clyde Valley Electrical Power Co., has been appointed to the position of executive engineer to the Port of London Authority.

Mr. J. R. Blaikie has been presented with an antique Persian rug by the staff and employés of the Bedford electricity department on leaving the service of the Corporation. Mr. Blaikie was engaged as consulting engineer at the Bedford works during the absence of the borough electrical engineer with the Royal Air Force. The extensions were carried out in two stages, the first to meet urgent war demands, and the second, recently completed, to provide up-to-date plant with suitable reserves.

Mr. E. N. Bray has severed his connection with Messrs. Bray, Markham & Reiss, Ltd., and with the Electrical Apparatus Co., with whom they were amalgamated. He has purchased a small works, Whipps Cross Works, Wood Street, Walthamstow, London, E.17, where he intends to manufacture certain types of switchgear. A number of his old staff are with him, and some of them are directors of the new company.

Obituary.—Dr. Gisbert Kapp.—We regret to record the death of Dr. Gisbert Kapp at his home at Selly Park, Birmingham, on the 10th inst. This makes another gap in the ranks of the pioneers of the electrical industry. Dr. Kapp was a most successful designer of electrical machinery, and the original work he did in the early eighties was freely described by him at the time. He was a clear thinker, and the help he so freely gave to others enabled them to follow his success in this direction.

Dr. Kapp was born at Mauer, near Vienna, in 1852. He received his technical training in mechanical engineering at the Zurich Polytechnical School, under Zeuner and Kohlrausch. He came to England in 1875 and spent most of his life in this country. At first he was engaged in the design of centrifugal pumping plant for Messrs. Gwynne & Co., and he then spent some time as the engineering representative of Messrs. Hornsby on the Continent.



Elliott & Fry [*London.*

The Late Dr. Gisbert Kapp.

Dr. Kapp from the first took a keen interest in electrical machinery, but it was not until 1882 that he became directly connected with the electrical side of the engineering profession. In that year Col. Crompton appointed him engineer of his Chelmsford works. This connection, which lasted until 1885, was most fruitful in the development of dynamo design. If one looks back on the dynamos that were then being manufactured and which were exhibited in the Electrical Exhibition in Paris, of 1881, it will be seen that they were all more or less pieces of scientific apparatus. They were deficient mechanically, but the biggest fault lay in the design of the magnetic circuit.

Dr. Kapp introduced many improvements in this direction, and what was more important instructed other electrical engineers in the essentials in the design of the magnetic circuit of a dynamo. The term "magnetic resistance" introduced by him made the magnetic circuit simple to understand, and the methods of calculation he disclosed were almost universally adopted.

In 1885, his paper presented to the Institution of Civil Engineers on "Modern Dynamos and their Engines" was awarded the Telford Premium and Medal.

In 1886 he published his first book on "Electric Transmission of Energy," which is now historic. It is as interesting to read today as when it was first issued. In it the author did much to clear away the uncertainty and mystery with which the general public and many engineers also then regarded electrical engineering. To quote from the preface of this book: "We know that practical success does not so much depend on the system as on the men who plan and carry out electrical work, and the less of a special system and the more of general good engineering there is the better. Many of the general public and even many of our professional brethren regard electrical engineering especially as applied to the transmission of energy as something uncertain, mysterious and, as yet, in the experimental stage. It has been the aim of the author to dispel this impression by presenting the scientific part of the subject in as simple a form as possible and by giving descriptions of work actually carried out."

This book and Dr. Kapp's early papers were certainly successful in this direction, and did more than any contemporary works to enable the ordinary engineer to make sound progress in the subjects dealt with.

From 1886 to 1889 Dr. Kapp was the editor of *Industries*. In 1889 he introduced the multipolar type of direct current dynamo. The first machines of this type were installed in the municipal electricity works at St. Pancras. In spite of their cast-iron field systems they were a success.

It is difficult now to realise how strongly this type of machine was decried by the other designers who adhered to the bi-polar type. Dr. Kapp was then practising as consulting engineer in Westminster, and was responsible for some large undertakings, both at home and abroad. He designed the first Corporation electricity works at Bristol, acting as joint consulting engineer to the Corporation, with the late Sir W. H. Preece.

In 1894 Dr. Kapp was appointed Secretary of the Verband Deutscher Elektrotechniker which was formed by the leading German engineers with the object of standardising electric practice throughout the German Empire. At the same time he acted as editor of the *Elektrotechnische Zeitschrift*.

The next ten years were spent in Berlin. Both high technical skill and power of organisation were needed to produce the series of standard specifications which were issued by the Society with respect to the rating of dynamos, lamps, copper conductors, wiring rules, &c., &c. During this period, Dr. Kapp lectured on electrical design at the Technical High School, Charlottenburg, and the Universities of Dresden and Karlsruhe, both conferred on him their Honorary Degrees of Doctor of Engineering.

In addition to the above responsibilities Dr. Kapp practised as consulting engineer, and his services both as arbitrator and designer of schemes for power, lighting, and traction were widely sought. Thus, Moscow, Trondhjem, Trieste and Leipzig are amongst the towns he advised, and he had an extensive practice in Switzerland and Italy.

In 1905 the University of Birmingham organised a Professorship of Electrical Engineering which was accepted by Dr. Kapp. This he filled with great success until 1918, and a large number of students passing through the University owe their technical training to him.

Dr. Kapp filled many offices with the Institution of Electrical Engineers, and was president in 1910. His contributions to the proceedings were always highly valued.

The Patent Office records are an eloquent testimony to his originality, but the patents issued while numerous show the same thoroughness which characterised all his work. The subject matter in the early days was mostly connected with dynamos and alternator design. Then transformers claimed his attention and patents followed on metering of electricity, negative boosters for tramway return systems, regenerative control for long feeders, signalling, &c., &c. His latest inventions were for improving the power factor of alternating current systems by means of phase advancers, which have been largely adopted.

His appreciation of the work of others and the critical analysis of this for his students made his lectures always interesting. He had the power of separating out the essentials of any particular process and his conclusions were always clear and illuminating. A hard worker himself he had no use for the idler, but there were very few who did not catch from him enthusiasm for the subject under consideration. He led his students to undertake original investigation, and helped them freely in their professional careers.

Dr. Kapp's many friends will miss his kindly hospitality and the evening talks when politics were by no means barred. He was an ardent free-trader and enjoyed always the freedom of opinion possible in this country.

His recreations were sailing, golf, and music. Dr. Kapp in 1884 married Therese Mary Krall, and had two sons, both of whom have followed in their father's profession.—R.W.W.

The funeral of Dr. Kapp took place on Saturday, at the Birmingham Crematorium, Perry Barr. The chief mourners were his sons—Mr. Reginald Kapp, and Mr. Norman Kapp.

Councillor Thomas Pratt.—The death occurred on August 14th, at the age of 67, of Councillor Thomas Pratt, ex-president of the National Chamber of Trade, and governing director of the firm of Christopher Pratt & Sons, Ltd., electrical contractors and house furnishers, Bradford. Mr. Pratt was the second son of the founder of the firm.

Councillor Pratt was one of the founders of the Bradford Chamber of Trade, in 1903, and was its president in 1910. He was president of the West Yorkshire Federated Chambers of Trade in 1914, and president of the National Chamber of Trade in 1918 and 1919. He entered the Bradford City Council in 1920. During and since the war he served in many capacities. He was a member of the Board of Trade Advisory Committee on Road Transport for the North-Eastern Division; the Board of Trade Advisory Committee on Merchandise Marks; the Ministry of Labour Advisory Committee for the Distributive Trades on Disabled Sailors and Soldiers, and many other organisations.

Sir Albert K. Rollit.—We regret to record that Sir A. K. Rollit passed away on Saturday last, at the age of 80 years. Though latterly Sir Albert had not been so prominently associated with affairs in the City of London, he was in earlier years most actively engaged as a president of the London Chamber of Commerce, and of the Associated Chambers of Commerce of the United Kingdom. He was a director of the National Telephone Co., Ltd., and figured prominently in the meetings in the City which preceded the taking over of that company by the Government.

Mr. F. F. Talbot.—The *Railway Engineer* records the death in his 78th year, of Mr. Frank Forrest Talbot, who was for many years Telegraph Superintendent of the Central Argentine Railway. "A member of the Institution of Electrical Engineers, Mr. Talbot went out in 1864 under contract for the construction, organisation and superintendence of the telegraph and signalling of the Northern Railway of Buenos Ayres, and in 1868 took a contract with Brassey, Wythes & Wheelwright for the construction, installation, organisation and working of the telegraph system, lighting, &c., of the Central Argentine Railway (then commenced from Rosario northwards), and with which the Northern Railway was subsequently amalgamated. He continued with the Central Argentine Railway until 1905, when he retired on pension."

Will.—The late Dr. J. T. Merz left £18,980 gross and £18,835 net personalty.

NEW COMPANIES REGISTERED.

Butterworth & Co. (Glasgow), Ltd. (8,315).—Private company. Registered in Edinburgh August 1st. Capital, £2,500 in £1 shares. To carry on the business of armature winding and general repairers of all kinds of electrical apparatus, electrical contractors, engineers, &c. The subscribers (each with 100 shares) are:—C. J. Butterworth, "Auchenmede," Bishopton, electrical engineer; B. J. Graham, 21, Galloway Street, Springburn, Glasgow, electrical engineer; Mrs. Mabel Butterworth, "Auchenmede," Bishopton. The first directors are not named. Solicitors: Black, McClure and MacDonald, 136, Wellington Street, Glasgow.

Pyne Manufacturing Co., Ltd. (183,570).—Private company. Registered August 3rd. Capital, £2,000 in £1 shares (500 pref.). To adopt an agreement with H. D. Pyne and others for the acquisition of the business of an electrical and general engineer and manufacturer carried on at Latimer Road, Teddington, Middlesex. The first directors are:—H. D. Pyne (permanent managing director and chairman), 41, Winchenden Road, Teddington; Mrs. Edith E. Pyne, 41, Winchenden Road, Teddington. Qualification, 50 shares. Registered office, Latimer Road, Teddington, Middlesex.

Hartnell Hiring Co., Ltd. (183,508).—Private company. Registered August 1st. Capital, £6,000 in 4,000 10 per cent. participating pref. shares of £1 each and 8,000 ordinary shares of 5s. each. To carry on the business of electrical and mechanical engineers, electricians, manufacturers of, and dealers in, electrical machinery, motors, dynamos, generators, and apparatus, &c. The life directors are:—K. D. Fairclough, 8, Park Road, Dewsbury (chairman); W. D. Oddy, 47, Gledhow Wood Grove, Leeds (both directors Wilson Hartnell & Co., Ltd.). Qualification, £200. Registered office, 11, New Station Street, Leeds.

Radio Appliances, Ltd. (183,571).—Private company. Registered August 3rd. Capital, £1,500 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in, all kinds of wireless and electrical apparatus, &c. The permanent directors are:—S. M. Travers, 55, Beechwood Avenue, Thornton Heath; F. Hart, 211, Camden Road, N.W.1. Remuneration, £50 each per annum. Registered office, 68, Coleman Street, E.C.2.

Pickvance, Ltd. (183,595).—Private company. Registered August 4th. Capital £5,000, in £1 shares (3,000 ord. and 2,000 pref.). To acquire the business carried on by W. H. Pickvance, at 41a, Regent Street, Wrexham, and to carry on the business of electrical engineering in all its branches. The first directors are: W. G. Pickvance, 61, Ruabon Road, Wrexham, engineer (chairman); Mrs. M. Pickvance, 61, Ruabon Road, Wrexham. W. G. Pickvance is permanent managing director subject to holding £200 ord. shares, with not more than £550 per annum as remuneration, together with 30 per cent. of the available profits in excess of 10 per cent. dividend paid on the ord. shares. Solicitor: W. B. Esam, 29, Bank Street, Sheffield.

Almondsbury and District Electric Supply Co., Ltd (183,582).—Private company. Registered August 4th. Capital, £3,000 in £1 shares. To carry on at Almondsbury, Glos., and elsewhere, the business of an electric light and supply company. The permanent directors are:—W. D. Goodenough, 62, Hampton Road, Redland, Bristol; C. J. [illegible], 27, Ravenswood Road, Redland, Bristol. Qualification, £25. Remuneration as fixed by the company. Registered office, 62, Hampton Road, Redland, Bristol.

Hull Wireless Co., Ltd. (183,624).—Private company. Registered August 8th. Capital £500, in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in instruments, apparatus, and accessories used in connection with radio or wireless telegraphy and telephony, &c. The first directors are:—Mrs. F. H. Jones, 291, Beverley Road, Hull (permanent director and chairman); R. H. Moseley, 48, Hayelock Crescent, Bridlington, E. Yorks. Registered office, 6, Wright Street, Hull.

George F. Sugden & Co., Ltd. (183,588).—Private company. Registered August 4th. Capital £3,000, in £1 shares. To carry on the business of electrical engineers, telegraphy, telephony, radio-telegraphy and radio-telephony, boiler, mechanical, motor, motor transport, agricultural, civil, constructional, metallurgical, marine, naval, aircraft, armour and defence engineers, &c. The first directors are:—F. S. Brook (chairman), 13, Curzon Park, Chester (director of Brook, Hirst & Co., Ltd.); G. F. Sugden, 38, Queen Street, Chester (director of Vaudrey, Ltd.); J. T. de Seyfried, 86, Watergate Flags, Chester. The above directors may appoint two of their number to be managing directors, with not more than £400 each per annum as remuneration. Qualification £200. Remuneration (except managing directors) as fixed by the company. Secretary: G. F. Sugden. Registered office: 9, Albert Square, Manchester.

Knighton Electric Supply Co., Ltd. (183,594).—Private company. Registered August 4th. Capital £6,000, in £1 shares. To carry on the business of an electric light and power supply company, &c. The permanent directors are:—H. J. Clee, 1, Broad Street, Knighton, Radnorshire; H. J. Brokensha, Red Lion Hotel, Knighton, Radnorshire; Dr. J. A. K. Griffiths, Wylcwm House, Knighton, Radnorshire; G. M. Perkins, 6, High Street, Knighton, Radnorshire; J. Atkins, 1, Thames Avenue, Windsor, Berks. Qualification £100. Secretary: P. Parker. Registered office: 6, Broad Street, Knighton, Radnor.

Scottish Wireless Telephone Supplies, Ltd. (12,320).—Private company. Registered August 3rd. Capital £1,500, in £1 shares. To manufacture, buy, and sell apparatus appertaining to wireless installations (telephonic or telegraphic), &c. The first directors are:—J. A. Brockie, 72, Forest Avenue, Aberdeen, electrician; A. Brockie, 79, Salisbury Place, Aberdeen, manager; J. Johnston, 49, Hamilton Place, Aberdeen, advocate. Registered office: 82, Crown Street, Aberdeen.

W. & J. Jamieson, Ltd. (12,325).—Private company. Registered in Edinburgh August 5th. Capital £1,000, in £1 shares. To carry on the business of scientific instrument makers, model and electrical engineers, &c. The subscribers (each with one share) are: J. Jamieson, 68, Shamrock Street, W. Glasgow; scientific instrument maker; William Craig, 68, Shamrock Street, W. Glasgow, scientific instrument maker; R. Harley, 4, Woodburn Place, Glasgow, clerk. The first directors are:—J. Jamieson, W. Craig, and R. Harley. Solicitors: D. & J. Hill. Registered by J. Rankin, 138, West Regent Street, Glasgow.

South Wales Wireless Installation Co., Ltd. (183,686).—Private company. Registered August 10th. Capital £2,000, in £1 shares. To carry on business as indicated by the title. The first directors are:—Lt.-Col. J. Evans, D.S.O., T.D., J.P., Beaumont, Blackwood, Mon.; A. W. Jesseman, 52, Upper Belgrave Road, Bristol; G. Bell, 53, Commercial Street, Newport, Mon.; H. M. Twist, 31, Somerset Road, Newport, Mon.; J. J. Dixon, 11, Dyfrig Road, Cardiff; C. W. Liles, 52, York Place, Newport, Mon. Qualification £100. Secretary: W. H. Liles. Registered office: 18, West Bute Street, Cardiff.

Exceloid Co., Ltd. (183,587).—Private company. Registered August 4th. Capital £1,000, in £1 shares. To carry on the business of manufacturers of, and wholesale and retail dealers in, a preparation styled "Exceloid" for covering electrical, surgical and other instruments, golf balls, motor car appliances, &c. The permanent directors are: B. D. Baker, Victoria Road, Cleveleys; J. D. Birnie (no address given); W. S. Birnie (no address given); W. Birnie, 162, Kelvinside, Derbyshire Lane, Stretford. Qualification, £50. Remuneration as fixed by the company. Secretary: C. D. Harrison. Registered office: 34, Birley Street, Blackpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

D.P Battery Co., Ltd. (44,084).—Return dated July 20th, 1922. Capital £100,000, in £1 shares. All shares taken up; £28,000 paid; £72,000 considered as paid. Mortgages and charges: Nil.

Chamberlain & Hookham, Ltd. (59,920).—Return dated June 13th, 1922. Capital £100,000, in 10,500 ord. and 9,500 pref. shares of £5 each. 10,100 ord. and 8,000 pref. shares taken up, £36,990 paid on 100 ord. and 7,298 pref.; £53,510 considered as paid on 10,000 ord. and 702 pref. Mortgages and charges: Nil.

Sunderland District Electric Tramways, Ltd. (79,054).—Return dated February 28th, 1922. Capital £151,012, in 4,505 non-cum. 6 per cent. pref. shares of £1 each, 95,495 non-cum. 12 per cent. pref. shares of 10s. each, 93,010 ord. shares of £1 each, and 74,990 ord. shares of 1s. each. 95,495 pref. and 74,990 ord. shares taken up; 10s. per share called up on the 95,495 pref. and 74,990 ord. shares taken up; £51,497 paid. Mortgages and charges: £221,315 19s. 2d.

Penarth Electric Lighting Co., Ltd. (52,912).—Return dated June 22nd, 1922. Capital £50,000, in 2,500 ord. and 2,500 pref. shares of £10 each. 500 pref. and 2,500 ord. shares taken up. £25,500 paid, being £10 per share on 2,500 ord., and £1 per share on 500 pref. Mortgages and charges: £15,937.

Singapore Electric Tramways, Ltd.—Sir William Plender, of 5, London Wall Buildings, E.C., was appointed receiver and manager by Order of Court dated August 3rd, 1922.

Electro-Metallurgical Extractions, Ltd.—Particulars of £10,000 debentures authorised July 13th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, whole amount issued.

F. Patrick, Ltd.—Mortgage dated July 25th, 1922, to secure all moneys due, or to become due, from company to London Joint City and Midland Bank, charged on certain land at Swinnow in Bramley, Leeds.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

The annual general meeting was held on Tuesday at the Connaught Rooms, Kingsway, Senatore G. Marconi in the chair. In proposing the adoption of the report the chairman said the past year had been one of unprecedented difficulty, not only for themselves, but for their many associated companies. He was glad to say that this year a manifest improvement had already shown itself in many directions, which gave considerable encouragement regarding the future. The net profit for the year, £275,361, was somewhat less than a year ago, but, feeling that the outlook was distinctly brighter, the directors felt justified in declaring the same dividend, which left £666,850 to carry forward to the credit of the profit and loss account. Whilst they could not pretend to feel satisfied with the results of last year, they nevertheless felt that they had come through a year of almost unprecedented depression with a result better than many of them had dared to hope. Since the last meeting the company had built new wireless stations at Ongar, Essex, which were serving for the conduct of their foreign telegraph business. They had also opened Radio House, in the City, which was now their head telegraph station, from which all their wireless telegrams were transmitted and received. Dealing with the company's claims against various Government departments for infringements of their patents, the chairman said that after they obtained judgment in their favour against the Admiralty in respect of the Lodge patent the matter was referred to the Royal Commission on Awards to Inventors to assess the amount of the compensation. Unfortunately, however, after the case had been heard some days the Admiralty put forward a claim to review the royalties which had already been paid in respect of apparatus supplied. As they could not assent to the Commission's dealing with their claim in that manner, and acting under the advice of counsel, they had taken steps to have the submission to the Royal Commission revoked, so that the settlement of the claim must be somewhat further delayed. As regarded the Post Office, they were still holding up the Petition of Right in anticipation of an amicable settlement. In recent weeks, at an interview between the Postmaster-General and some of the directors, a conversation of a very encouraging nature took place, which caused them to hope to be able to come promptly to an agreement of a comprehensive character. They had not yet been favoured with the promised communication, and could only assume that there must be some good reasons for the delay. It was sincerely to be hoped that the Post Office might now act promptly, for in consequence of indecision month after month and year after year in respect of matters of great importance this country had been sadly left behind in the erection of high-power stations. Referring to Imperial wireless stations and the decision of the Government to establish direct commercial communications with India, South Africa and Australia. Senatore Marconi recalled the action which had recently been taken by the Commonwealth Government of Australia in arranging for a comprehensive scheme of wireless development, the main feature of which, he said, was the establishment of a direct commercial service between Great Britain and Australia. The Australian Government had entered into an agreement with the Amalgamated Wireless (Australia), Ltd., a company which had an exclusive licence of all the patents of the Marconi and associated companies, and in which they held a substantial interest, by which they undertook to establish direct communication between Australia and Great Britain on the one hand, and Canada on the other, and it took over all the existing wireless services, to re-organise and develop them and establish the entire wireless industry of the Commonwealth on a progressive commercial basis. The Marconi Co. was entering into a contract with the Australian company to erect a station in Australia of 1,000-kW power, and they proposed, subject to the licence being granted, to erect a similar station in this country. Referring, in conclusion, to broadcasting, the chairman said that a broadcasting company was in the course of formation, which would erect some eight stations in different parts, whose radius would cover the whole country. They were taking part with all other manufacturers in the company, the sole object of which would be to broadcast the programmes consisting of concerts, educational matter, general information, and, in fact, anything and everything of general interest which from time to time the Post Office regulations permitted. Receiving sets were being placed on the market which would enable everybody at a small cost to receive those transmissions. Those instruments would be scientifically constructed and thoroughly reliable, and men, women and children utterly devoid of any wireless knowledge whatsoever would be able to handle them with ease. They were confident that such receiving apparatus would soon prove as popular in this country as it had proved in America, and it might well be that ere long here, as there, it would be regarded in every household as an article of necessity. They contemplated a very considerable revenue from the new industry, which should provide remunerative employment for some tens of thousands of men and women who had been so long suffering from the severe depression in trade. The one danger with which the industry was menaced, that arising from the depreciation of foreign currencies, had been boldly met and disposed of by the Postmaster-General. The nature of the business was such that the directors had decided upon the policy of granting manufacturing licences to several firms of repute upon terms not insignificant, but nevertheless reasonable, having regard to the value of their patents. Therefore, besides the "Marconiphone," which they might reasonably expect might be most generally in favour, there would be numerous other types of receiving apparatus produced under licence from the Marconi Co.

Mr. Godfrey C. Isaacs, in seconding the motion, remarked that, up to the present, the company had been almost entirely dependent for its business upon foreign governments. They had never had the million to deal with, but with broadcasting they had a public with whom they expected to do a

very big business. There was also now opening up a very excellent prospect of very considerable business in all parts of the world with private customers in wireless telephones. Those new enterprises should benefit, not only the Marconi Co., but the various associated companies in which they held shares.

The report was adopted.

German Companies.

The *Electro-Trust Co.*, of Berlin, which is a financial undertaking associated with the A.E.G. and the Siemens group, reports net profits of 683,000 marks for 1921-22, as compared with 651,000 marks in the previous year. The rate of distribution is 6¼ per cent., as in 1920-21.

The report of Brown, Boveri & Co., of Mannheim, states that the demand was exceptionally brisk in 1921-22. After writing off 2,500,000 marks for depreciation the accounts show net profits of 16,204,000 marks, and the dividend rises from 10 per cent. in 1920-21 to 15 per cent. last year. It has been decided to increase the ordinary share capital by 25,000,000 marks to 175,000,000 marks. The report expresses the hope of participation in the forthcoming orders for locomotives for the Bavarian State Railways.

The *Isaria Meter Works Co.*, of Munich, which belongs to the Brown-Boveri group, reports net profits of 13,828,000 marks for 1921-21, as against 7,897,000 marks in the preceding year. The former figures have been arrived at after deducting 1,864,000 marks for depreciation and placing 1,169,000 marks to a works' maintenance fund. It is proposed to pay a dividend and bonus at the rate of 40 per cent., as against 15 per cent. in 1920-21.

Italian Companies.

Elettricità Alta Italia (capital 48,000,000 lire).—In the past year the company has fully exploited its distribution network. The accounts closed with a net balance of 4,550,000 lire, which allowed of the distribution of a dividend of 8 per cent.

Società Idroelettrica Piemonte (capital 40,000,000 lire).—The report of the council showed that the company had steadily fulfilled its programme in the supply of half a milliard of kWh. The company had taken over the direct working of the Montjovet station. The accounts realised an available balance of 3,725,044 lire, with a distribution of 8 per cent. on the shares.

Società Anonima Officine di Energia Elettrica di Novara (capital 7,500,000 lire).—The balance on December 31st, 1921, was 102,000 lire, which allowed of a dividend of 10.50 lire on each 150-lire share.

Società Varesina per Imprese Elettriche (capital 12,325,000 lire).—The company had been able to secure a considerable supply of current from Switzerland; the obligation to furnish current to the Porto Ceresio railway will shortly terminate. The balance allowed of the distribution of 5 lire per 85-lire share.

Società Elettrica Milam (capital 10,000,000 lire).—The balance of 331,000 lire allowed of the distribution of 4 per cent., dating from July 1st, 1922.

Società Anonima per Distribuzione di Energia Elettrica Ing. Banfi (capital 1,800,000 lire).—The accounts closed with an available balance of 536,754 lire, allowing of a dividend of 25 lire on each 100-lire share.

Società Pavese di Elettricità A. Volta (capital 700,000 lire). —The balance available for dividend, amounting to 195,773 lire, permitted of 7.65 lire on shares to bearer and 9.15 lire on named shares.

Società Anonima di Elettricità del Ticino (capital 700,000 lire).—The year closed with a balance of 194,229 lire, from which a distribution of 15.30 and 18.24 lire to shares to bearer and named shares respectively was authorised.

Società Elettrica Saronnese (capital 500,000 lire).—The working year 1921 realised a profit of 117,913 lire, allowing of a lividend of 10 lire per share.

Società Elettrica Interprovinciale (capital 10,500,000 lire). —The accounts showed a net balance of 685,000 lire, which permitted the distribution of 6 per cent. dividend.

Società Friulana di Elettricità (capital 3,500,000 lire).—The net balance with which the working closed permitted the distribution of a dividend of 23.75 lire per share.

Idroelettrica Ligure Meridionale (capital 550,000 lire).—The accounts showed an available balance of 96,676 lire, from which a distribution of 20 lire per share was made.

Società Ligure de Elettricità (capital 250,000 lire).—The excessive drought had exceptional consequences for the working during 1921, having caused the exhaustion of the company's storage reservoirs. Notwithstanding this, a profit of 41,116 lire was earned, from which a dividend of 7 lire per share was distributed.

The following increases of capital have been made:—Unione Tarantina Elettrogas C. Cacise e C. di Taranto, from 1,600,000 to 2,000,000 lire; Società Forze Idroelettriche Abruzzesi, from 1,500,000 to 3,000,000 lire; Società Elettrica Alto Cremonese, from 800,000 to 1,600,000 lire; Società Anonima De Rossi e C. Imprese Elettriche Idrauliche di Nocera Inferiore, from 225,000 to 1,000,000 lire; and Impresa Elettrica Paravicini, from 47,000 to 600,000 lire.

The *Società Anonima Elettricità Toscana* is distributing 30 lire per share dividend, as the result of the working year 1921; it has enlarged its network and taken over the lighting of the whole of the city of Pisa, where it is located.

The *Società Boracifera de Lardarello* has realised on the working of 1921 a net balance of 855,781 lire, out of which 10 lire per share is to be distributed.

Dividends of 7 per cent. are distributed by both the *Società Marchigiana per Imprese Elettriche*, of Trieste, and the *Società Imprese Elettriche*, of Macerata; as also by the *Società Iesini di Elettricità*, of Iesi.

Closing with the substantial balance of 1,128,397 lire for the year 1921, the *Società Elettrica dell' Italia Centrale* (Rome), whose capital is 12,000,000 lire, has distributed a dividend of 8 lire per share. On the other hand, the *Società Generale per la Illuminazione* (Naples) has sanctioned a dividend of 11.25 lire on a capital of 16,200,000 lire, on the strength of a net balance of only 869,944 lire.

Dividends of 7 per cent. have been fixed in the cases of the three following companies:—*Elettrica del Mezzogiorno d' Italia*, *Elettrica Brindisina*, and *Messines per Imprese Elettriche*, the ordinary shares of the last-named receiving 8 per cent.; the same amount was also sanctioned in the case of the *Elettrica Peloritana, of Messina*.

French Companies.

The *Compagnie Continentale Edison*, of Paris, reports that the results achieved in 1921 were much more favourable than those of the preceding year, and the undertakings in which the company is interested began to emerge from the period of depression. The net profits amount to 439,000 fr., and the dividend is at the gross rate of 25 fr. per share.

The *Société des Ateliers de Constructions Electriques de Lyon et du Dauphiné* states that the scarcity of orders in 1921 brought about ruinous competition and a great fall in sale prices. Referring to the expansion in hydro-electric works and steam generating stations, which is to take place between the present time and 1926, the report states that the company is well equipped for participating in this development. The net profits and balance forward amounting to 415,000 fr., has been carried forward.

The report of *L'Appareillage Electro-Industriel* (*Pétrier, Tissot et Raybaud*) of Lyons, states that although the results obtained in 1921 were inferior to those of the preceding year, they were still satisfactory having regard to the industrial and commercial crisis. In order to remedy the reduction in the volume of the turnover the directors had endeavoured to extend the scope of activity by establishing new depôts and agencies, and by increasing the number of representatives and workers, both in France and abroad, so as to provide new markets, both for high and low-pressure apparatus. After having applied 150,000 fr. to depreciation the net profits are returned at 313,000 fr., and the dividend is at the rate of 60 fr. gross per share.

The *Compagnie des Produits Chimiques et Electrometallurgique Alais, Forges et Camargues*, reporting on the past year, states that the economic crisis had compelled the company entirely to close some of the works, which are still lying idle to-day. The market for aluminium, which remains the principal product made by the company, experienced a slight recovery during the concluding month of 1921 as a consequence of the gradual disappearance of the stocks which were formed in war-time. In June the sales in France were being maintained at a higher level than in 1913, which was the last normal year. The net profits in 1921 were 66,000 fr. If the results did not permit of the payment of any dividend the report states that the company nevertheless paid over 5,500,000 fr. in taxes to the State.

The *Société de Forges et Ateliers de Constructions Electriques de Jeumont*, after referring to the financial interests held in the *Ateliers de Constructions Electriques de Charleroi* and in other undertakings, states that the company's own works were well occupied in 1921, and the value of the turnover exceeded 100,000,000 fr. During the first months of 1922 the orders booked, despite the fall in sale prices, were greater than at the corresponding period in 1921. The electric railway construction syndicate, which had been formed in connection with the Schneider Co., of Creusot, had received orders for 80 goods locomotives and 80 automobiles for the Paris-Orleans Railway Co., one locomotive for the Paris-Lyons-Mediterranean Railway, and 30 locomotives for the State Railway; and the company was now favourably situated for the execution of these orders. The cable factory was well provided with orders for cables of all kinds, and among others underground cables for 60,000 volts had been manufactured for the *Union d'Electricité*, of Paris. After having made provision for depreciation, the accounts show net profits of 11,057,000 fr. for 1921, permitting of the payment of a dividend at the gross rate of 25 fr. (10 per cent.) per share on capital of 80,000,000 fr.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Siemens Bros. & Co.—£466,000 4½ per cent. debenture stock.

Whitehall Electric Investments.—1,500,000 7½ per cent. cumulative preference shares of £1 each, fully paid; Nos. 1 to 1,500,000, and £2,500,000 6 per cent. first mortgage debenture stock, 1925-45.

Yorkshire Electric Power.—26,940 ordinary shares of £1 each, fully paid: Nos. 6,991 to 15,990, 270,891 to 270,990, 278,231 to 279,030, 378,701 to 378,600, 429,251 to 429,350, 494,371 to 495,820, 529,141 to 530,000, 611,711 to 612,210, 639,281 to 640,480, 674,161 to 674,880, and 791,231 to 791,430.

Prospectus.—[illegible] has been in circulation a prospectus offering for subscription an issue of 50,000 shares of £1 each at par in this company, which has been formed "to exploit the commercial side of wireless telephony," and has acquired the business, &c., of the Ashley Radio Co., wireless telephone engineers and manufacturers, of 69, Renshaw Street, Liverpool, the present proprietors of which (Messrs. W. A. Brooke and W. A. McKillop) have joined the board. The issue is made to provide the necessary capital "to cope with and develop the very large and increasing business." The existing works being insufficient, new ones are to be built, and by mass production the concern will place broadcasting apparatus before the public. It is stated that the Ashley Radio Co. has on hand orders for over £65,000 worth of wireless material, and that it possesses "valuable concessions governing manufacture which will be carried out under licence"; further, that it "will become" a member of the Broadcasting Co. now being formed by other wireless manufacturers in this country." The company claims to be "in a unique position in being one of the earliest in the field." £7,000 is to be paid for the business and assets of Ashley Radio Co. and £1,000 for goodwill. It is admitted in the prospectus that as the industry is a new one it is not possible to estimate accurately what the profits of the company will amount to, but substantial dividends are predicted. The list was to close on Tuesday last. The investment is, of course, one of a highly speculative character.

Sheerness and District Electric Power and Traction Co., Ltd.—The net revenue for the past year was £8,289, after meeting debenture interest, &c. The debit balance brought forward is turned into a credit balance of £1,736, which is to be carried forward.

Clyde Valley Electrical Power Co.—Interim dividend for the half-year ended June 30th of 2½ per cent. actual, less tax.

Penarth Electric Lighting Co., Ltd.—Dividend 7½ per cent.; £1,503 to reserve; £2,533 carried forward.

Banbury and District Electric Supply Co., Ltd.—Dividend 3 per cent., carrying forward £1,116.

Birkdale and District Electric Supply Co., Ltd.—Dividend 8 per cent.; £3,500 to reserve; £3,329 carried forward.

Waste Heat and Gas Electric Generating Stations, Ltd.—Interim dividend, 1½ per cent. for the half-year ended July, 1922.

Liverpool & District Lighting Co., Ltd.—Interim dividend of 2½ per cent. actual, less tax.

STOCKS AND SHARES.

Tuesday Evening.

There has been a little stiffening of rates in the Money Market. Not enough to cause any talk about the bank rate, but sufficient to add an element to the restraining influences of holiday-time and the unsettled political outlook abroad. The mad movements in the mark have ceased to operate as a factor of real disturbance. Stock Exchange markets are tolerably steady, and the activity in South African shares serves to redeem the House from the charge of being wholly uninteresting.

The Home Railway department shows a mild degree of animation, too, and the Electric Railway stocks are mostly harder. Metropolitan Consolidated has risen a little over 50 xd, and Districts touched 40 before reacting a trifle. Underground Electric Railways issues are all harder. The new stock in the railway department, whose advent was indicated in this column three weeks ago, is taking the shape of a Central London debenture stock. City & South London 4½ per cent. debenture and the similar security of the London Electric Railway are both quoted at 2 premium.

County of London new ordinary, issued at 22s. 6d., are higher at 3s. 3d. premium, and the 6 per cent. preference, which came out at 20s., are up to 1s. 9d. premium. The latter price, even more than the former, shows how tightly investors will hold to a first-class industrial stock: in spite of what is obviously a tempting profit, the shares are not offered with any degree of freedom, and 2s. premium has been paid for them. British Thomson-Houston new 7 per cent. preference stand at 20s. 3d. Bengal Telephone scrip holds its premium of 3 points, and there is not much change in the trio of Indian Electric stocks recently issued. The Calcutta Tramways sevens are 2 premium, Indian Electric tax-free fives keep around the issue-price of 94, and Madras sevens, which came out at 95, are 4s. premium.

Practically the only alterations in the electricity supply group other than those in the new County of London, are due to the marking ex-dividend of various ordinary shares. Charing Cross ordinary, for instance, are 7⅛; so are Westminsters. County ordinary remain at 1⅛. St. James' at 8⅛, while Metropolitans at 5½ xd have recovered the dividend deducted last pay-day.

Edison Swans are a few pence easier at 3s. General Electric ordinary at 18s. 3d. are sixpence down. Of the engineering shares, Babcock & Wilcox gave way to 58s. 9d. Iron and coal shares are mostly heavy, by reason of a dividend disappointment from the Powell-Duffryn Co. Victoria Falls & Power ordinary shares at 14s., and the preference at 23s. 6d. have not derived much advantage this week from the Cape-inspired activity amongst Kaffirs.

The Marconi meeting was held to-day, Tuesday, but the price underwent no immediate change as a consequence. The report came as a pleasant surprise, the figures being distinctly better than many people had expected would be the case. The price rose ⅛ to 2⅜, but this brought in sellers again, and if reverted to 2¼. Canadian Marconis have drooped to half-a-guinea, and Radios hold their previous prices of 19s. 6d. for the common, 14s. for the preferred.

Eastern Telegraph ordinary is 1¼ lower at 18⅝, and Eastern Extensions at 18⅜ are 2s. 6d. down. Globe ordinary, on the other hand, rose to 19¼, and Westerns, after being better, are now 19, holding their improvement of the previous week. Anglo-American Telegraphs continue dull, the preferred and deferred both showing small declines.

Mexican matters make no further headway, and prices in the Utility group move rather aimlessly. Mexican Light and Power common shares, as an example, are a point higher, although the first mortgage bonds at 65½ are similarly easier. Anglo-Argentine Tramways second preference are firmer, and Brazilian Tractions ⅛ lower. The modest nature of the changes indicates the lack of interest taken in this section at the present time. Rubber shares are lifeless, and there is practically nothing doing in their market.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Aug. 15. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7⅞	—	£8 0 0
Charing Cross Ordinary	8	9	7⅛xd	—	5 17 0
do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6	—	5 0 0
City of London	14	14	2⅝	—	6 18 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1⅜	—	5 16 5
do. do. 6 per cent. Pref.	6	6	1¼	—	5 7 6
Kensington Ordinary	9	10	7⅜	—	7 0 7
London Electric	3½	4	2¼	—	5 11 6
do. do. 6 per cent. Pref.	6	6	5	—	6 0 0
Metropolitan	7	7	5½xd	+ ½	6 7 6
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	8⅛	—	6 17 2
South London	7	7	8½	—	8 0 0
South Metropolitan Pref.	7	7	1⅜	—	5 18 0
Westminster Ordinary	10	10	7⅛xd	—	6 10 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	103	—1	5 16 8
do. Def.	1½	84/6	23½	— ⅛	7 9 0
Chile Telephone	6	6	6	— ⅛	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	18⅜	— ⅛	5 9 1
Eastern Tel. Ord.	10	10	185	—1½	5 8 1
Globe Tel. and T. Ord.	10	10	19¼	+ ⅛	5 8 5
do. do. Pref.	6	6	11½	—	5 6 8
Great Northern Tel.	24	22	29	—	7 11 8
Indo-European	10	10	86½	—	5 17 0
Marconi	25	15	2⅜	—	6 13 4
Oriental Telephone Ord.	12	12	28	—	*5 1 1
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	6/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 8
Home Rails.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	50½	+2	4 9 0
do District	Nil	1	39⅞	+1½	2 11 6
Underground Electric Ordinary	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	+6d.	Nil
do. do. Income	2	4	83½	+1	*4 16 7
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	8⅛	—	7 17 2
do. do. 2nd Pref.	Nil	5½	8⅛	+ ⅛	7 0 9
do. do. 5 per cent. Deb.	5	5	82	—	6 2 6
Brazil Tractions	Nil	Nil	49½	— ⅛	8 1 0
British Columbia Elec. Rly. Pcs.	5	5	76⅛	+ ⅛	6 9 9
do. do. Preferred	5	98/-	68⅜	—	*6 15 0
do. do. Deferred	8	124/-	74½	—	*8 5 10
do. do. Deb.	4½	4½	76	—	5 11 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	72½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	45½	—	Nil
Mexican Light Common	Nil	Nil	22½	+1	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	5	65½	—1	7 11 9
Manufacturing Companies.					
Babcock & Wilcox	15	16	21⅜	— ⅛	5 7 4
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2⅝	—	7 1 2
Callenders	15	15	2⅛	—	7 1 2
6½ Pref.	6½	6½	1⅝	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/-	-3d.	—
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1¼	—	8 0 0
English Electric	8	5	17/6	—	5 14 8
do. do. Pref.	6	6	18/9	—6d.	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/9	—6d.	5 8 0
Henley	15	15	2⅛	—	6 13 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1⅛	—	—
Met.-Vickers Pref.	8	8	2⅞	—	6 11 2
Siemens Ord.	10	10	27/-	—	*7 8 2
Telegraph Con.	20	20	26	—	*4 12 2

* Dividends paid free of Income Tax.

FALSE MARKING AND DESCRIPTION OF GOODS WITH SPECIAL REFERENCE TO ORIGIN.

By THEODORE RICH.

Part III.—Some Pre-War Practices.

Before we can deal with the law on the subject of false trade descriptions it is desirable to point out some of the things which took place before the war, and which will undoubtedly to a greater or lesser extent take place in the future. The question is not merely that of marking but of arranging such surroundings so that the average purchaser of reasonable intelligence will assume that the goods are what, to the knowledge of the manufacturer, merchant, wholesaler or retailer, they are not.

There are a number of ways in which a *de facto* false trade description can be given to goods, but the question is whether it is false within the meaning of the Merchandise Marks Act or under the common law. As an example, a trader of alien origin paints his shop front green, calls himself some such name as the Sligo Linen Company, surrounds his window with shamrocks, and displays in his window and sells cotton handkerchiefs from Manchester or Germany. In such cases the intent to deceive is obvious, but under our law "it is no part of the duty of the Court to enforce the observance of the dictates of morality," and the question is whether an action can be taken in such cases.

Deceptive Business Names.

According to evidence given before the 1920 Committee inquiry (Ref. No. 1,142) "There is a firm trading under the name of an Irish county. They have a number of shops in this country as well as in Ireland, and you might visit their shops every day in the year, and I doubt if you would find Irish goods in any one of them." "We consider it is a very weak point of the law to permit such a thing."

Under the law there is nothing to prevent men who are, apart from easily obtainable naturalisation papers, "alien to the core," from trading as a limited company or a private firm, provided it is registered under any name, however patriotic. This is done every day. A case came into Court some years ago where an English typewriter girl had been asked to pick out a combination of suitable Anglo-Saxon names, and this was, according to law, registered as a title for a limited company, nobody of any of the names having anything to do with the business.

One is entitled to assume that the normal transactions of firms who adopt such artifices will be tinged with fraud and trickery, the use of such names being obviously intended to deceive the public regarding the maker or origin of the goods sold. This sort of thing is called smart business among those to whom old-fashioned honesty is looked upon as synonymous with stupidity.

Deceptive Brands.

Not only can a trader adopt for himself any name he likes in order to deceive the public, but he can brand the goods he sells how he pleases to give the public a false impression, provided he does not imitate the name of another firm so closely as to get within the reach of the law.

In 1904, in a certain case, the defendants, wine merchants, had adopted a Scottish trade name for some whisky they were selling. There was no concern of that name manufacturing for them, and the successors of a firm of the adopted name objected. Doubtless to many whisky drinkers the new name would be more attractive than the original.

Lord Justice Vaughan Williams said: "I have not the slightest sympathy with the defendants or with their mode of conducting business, and I am very sorry myself that, according to the law of this country, you can for trade purposes adopt a name which is not yours." He said the defendants had adopted a picturesque name because they hoped that customers would draw favourable inferences with respect to the wares they sold.

Complaints have been made from time to time that concerns whose policy has been controlled by foreign directors or their nominees have put up works in this country and then sold material quantities of foreign goods not marked with place of origin, sometimes marked with trade marks registered by the superficially British house aided by the use of catalogues, advertisements, and letter paper marked "Works So-and-So."

For instance, before the war when the policy of a certain electrical manufacturing company was practically controlled by men of German origin, a number of illustrated catalogues were sent out not merely to the home market, but also to Colonial markets marked "Works So-and-So" (an English town); the catalogues did not include the names of the German towns, where a material proportion of the work was done.

"Our Works."

Before the war another concern sent out circulars marked in prominent letters some such words as British Association cable, works so-and-so; empty drums to be returned to "our works." Samples were sent out with labels marked in a similar manner. The average buyer was not in a position to know that the cable was of German make.

Another concern, which was taken over by the Public Trustee during the war and was largely controlled by a German firm, sold certain machines before they started making them in England; when the machines were delivered they had on them a small label, "Made at our branch factory in Hanover." People do not always see what they are going to buy; the name of the company was obviously chosen to deceive, and even the label was deceptive: it was claiming that the tail was wagging the dog, the parent house being in Germany.

Before the war very large quantities of German electrical fittings and accessories of English pattern were sold in this country with no mark of origin, quantities being sold through small retailers. Examination of German war store depôts in the North of France showed that quantities of German-made electrical accessories of English and French pattern, which could not be forwarded to their original destinations, were sent forward for use by the German troops, many of them being fitted with zinc or galvanised iron metal work. At one time it was not unusual for some contractors to buy German switches and fit them on to British switchboards for sale at home and abroad. Before the advent of the metallic filament lamp, large quantities of carbon lamps made in Holland were sold under the name of the "London lamp."

In the 1890 inquiry complaints were made of the business in imported goods which were passed through the Customs safely and then a deceptive mark was put on, in some cases after the old mark had been removed.

In the 1919-20 Committee Inquiry, evidence was given about gas mantles (D. 1841). "A British firm, German owned: they called themselves a British firm" used to import 10 million gas mantles a year in a partly finished state. The mantle was "stamped with an English name, finished and boxed in England, and sold as an English mantle." (D. 1843.) At one time when German mantles had a better reputation than those from other countries "a Dutchman, who made mantles before the war, stamped his mantles 'Made in Germany' in order to deceive the British buyer."

In these days a notice on an advertisement, circular, or on a package to the effect that it is an "all British house" means only too often a "British subjects' house," a concern run by men who are by appearance,

speech, and deceptive inborn instincts as "alien" as they possibly can be, and even "made by British labour" may mean that the goods are made by men who know more German than English.

It is a great pity that although such large quantities of German electrical goods were sold before the war without definite indication of their origin, no representatives of the electrical trade as such took part in the 1919-20 Marks Committee; nowadays, it is often difficult to sort out the "wheels within wheels."

During and Since the War.

As early as Christmas, 1919, scores of shops selling fancy articles sold unmarked German goods, and it is well known that a material proportion of the merchants and wholesalers in the fancy goods trade are men of alien extraction; it is, therefore, not astonishing that such men have for years opposed the honest marking of imported goods.

During the war many of those who were foiled in their efforts to obtain imitation British goods from their brothers and cousins in Berlin and Vienna made arrangements to obtain them from the Japanese, the Germans of the East, and therefore, as evidenced by the 1919-20 inquiry, imitation British goods of many classes, from bolts and bicycle parts, to bootlaces, were brought over, many of the things being marked with deliberately deceptive names. India and the Far East have been flooded with falsely marked Japanese goods, especially cheap hardware, a great deal of it of the poorest quality, and although few European customers were deceived, there is little doubt that the reputation of British goods was severely injured by such practices. It is well known that during and since the war a number of Germans began to get a foothold in manufacturing businesses in Holland, Switzerland, and elsewhere, so as to be able to forward assembled or disguised German goods to the countries of the Allies.

According to D. 1835, in the first year after the outbreak of war, 40 million mantles came into this country from Holland. "Holland could not produce all these goods." They were marked "Made in Holland."

Recent legislation, in the teeth of public opinion, so far from opposing false indications of origin, has made deliberate steps to assist them. In the German Reparation Act, Section 2, goods are not counted as German provided "twenty-five per cent. or more of the value of the goods is attributable to processes of manufacture undergone since the goods last left Germany," and in the case of the Safeguarding of Industries Act, 1921, duty is not paid if "twenty-five per cent. or more of the value of the goods at the time of export to the United Kingdom is attributable to processes of manufacture undergone since the goods last left any country in relation to which such an order has been made."

It is obvious that this clause has been put in to reduce the Act to little more than a farce, as assembly, a coat of paint, a label, and packing could in many cases be made to satisfy Customs officials, who are not likely to make extra work for themselves.

During the war, when the Government was forced to yield to public pressure, "anything owing more than 25 per cent. of its cost to German material was treated as a German article. A 1,863, but since the war the situation has been reversed."

Classification.

When dealing with false marks or lack of marks of origin, the following classification will be found convenient:—

I. Goods made abroad and sent into this country to be sold as if they were British.

II. Goods made abroad, mainly or wholly in one country, and sent out or marked as if made in another (*a*) sent here, (*b*) sent direct to another foreign country.

III. Goods made abroad to the order of British merchants, sent to this country falsely marked or with deceptive marking for reshipment to countries where the retailer or ultimate buyer will assume that they are British. (Transit trade.)

IV. Goods made abroad and sold in the country of origin falsely marked as if of British make.

V. Goods made at home in one district and marked or sold as if made in another (*e.g.*, Manchester goods sold as Irish).

Of the above I, II*a*, III and V are affected by British Law, II*b* and IV can be dealt with in theory by foreign law and by diplomatic representations.

The Treaty of Peace at Versailles contains Article 274, in which . . . "Germany undertakes to prohibit and repress by seizure and by other appropriate remedies the importation, exportation, manufacture, distribution, sale or offering for sale in its territory of all goods bearing upon themselves or their usual get-up or wrappings any marks, names, devices, descriptions whatsoever which are calculated to convey directly or indirectly a false indication of the origin, type, nature or special characteristics of such goods."

Owing to the number of friends of Germany in high places in nearly every country in the world, this clause is likely to be as valuable as most of the other clauses in the Treaty.

The great difficulty regarding questions of origin has always been the textile trade and the very strong pro-German element which has unfortunately worked its way into it. Wool, fibres, cops, yarns, materials unbleached, bleached, dyed, callendered, and so on, go backwards and forwards to the Continent in a most bewildering manner, and it is therefore much more difficult to deal with textiles than with other goods. Unfortunately, legislation has taken goods as a whole; what is one trade's food may be another trade's poison. Many people have taken advantage of the peculiar conditions and prejudices of the Manchester trade to checkmate steps desirable for the promotion of honest trade in other directions. There is no reason why textiles should not receive special treatment where future legislation is concerned.

Proprietary Rights and National Interests.

Whenever goods are sold under false marking or trade descriptions, the cases can be divided into two groups:—

(*a*) Where proprietary rights of individuals or corporate bodies are infringed, for instance, where trade marks, trade names, a firm's name, get-up, packing, or where by means of deceptive ticketing or display, goods are sold in such a way that the purchaser, when purchasing goods of one maker, thinks he is getting those of another (with perhaps a better reputation earned by intrinsic merit or skilful advertising).

(*b*) Where the interests of a territorial group of individuals are affected as where, for example, German or Japanese goods are marked, got up, or displayed as British, Sheffield made, Irish, or French, that is to say, sold as if they were made in a certain place or country or by members of a certain group when they were not.

It can be well understood that when goods of some specific firm have been imitated, either by false trade marks, get-up, or display, the party who is most likely to initiate proceedings, whether civil or criminal, is usually the party directly injured. It is in his interests to act as far as the trade in question justifies. Where, however, a certain territorial group has earned a reputation for quality, or where the conditions under which manufacture is carried out, or political circumstances, tend to create a moral duty to give some sort of preference to, or legitimate prejudice for, goods from some national territorial or craft group; then if goods made elsewhere, whether in fact of better, equal or worse quality, are exposed for sale in a deceptive manner, the whole group is injured; people intend to confer their custom in one direction, as they have every right to do, while in fact it is going in another. It is obtaining trade by false pretences.

Esprit de corps is naturally weaker in trade where men are in daily competition than in the army or in professions, and it is much more difficult therefore to get men to make a move in directions meaning considerable expense and inconvenience, in order to safeguard the interests of trade as a whole. If German or

Japanese lampholders are sold as British, it is difficult to say to any one maker, "It is your duty to take steps to stop this." What is everybody's business is too often nobody's business.

It is in the interest of everybody that honest trade should be encouraged, but individuals, societies, and associations hesitate to set the law in motion.

Accusations of Trade Jealousy.

For thirty years many manufacturers have been urging that the Government should take up prosecutions, especially in cases of false marking of origin, the difficulty being that over and over again, as evidenced even in the 1890 report, those who take up such questions in the interest of the trade as a whole are almost invariably accused by the defence of being actuated by "vindictiveness, or spite, or rivalry in trade," the Court, especially a local bench, is then biased. In some cases matters have been made so uncomfortable for those who spent their time and money that they have refused to move again, to the natural delight of the dishonest trader and merchant. The same objection, to a lesser extent, attaches to cases that trade associations take up.

ELECTRICITY DISTRICTS.

Commissioners' Decisions.

The conclusions arrived at by the Electricity Commissioners as the result of two local inquiries held by them recently came to hand too late for publication last week; they are summarised hereunder.

North-West Midlands Electricity District.

The evidence given at the inquiry* held at Wolverhampton in February last with respect to the scheme submitted by the Conference of Authorised Undertakers (the promoters), and the counter-proposal submitted by the Corporation of Walsall for a part only of the district, has been considered, and the Commissioners have arrived at the following conclusions:—

The Electricity District as provisionally determined† should be confirmed subject to the following adjustments:—

The *inclusion* of the municipal borough of Stourbridge, the urban districts of Rowley Regis, and Lye and Wollescote, and the remaining detached portions of the rural district of Tutbury situated within the rural district of Uttoxeter.

The *exclusion* of the municipal boroughs of Macclesfield and Tamworth, the urban districts of Alsager, Bollington, New Mills, Perry Barr, Sandbach, and Yeardsley-cum-Whaley; the rural districts of Congleton, Disley, Dudley, Hayfield and Macclesfield; that portion of the rural district of Tamworth originally included in the district; the parish of Kinver in the rural district of Seisdon and portions of the parishes of Great Barr in the rural district of Walsall and Shenstone in the rural district of Lichfield.

The *exclusion* of the detached part of the rural district of Church Stretton known as the parish of Sibdon Carwood, and of the detached part of the rural district of Uttoxeter situated in the rural district of Tutbury.

The *retention* of the municipal borough of Congleton notwithstanding the statement of conclusions issued by the Commissioners on April 22nd, 1921, in respect of the North Wales and Chester Electricity District.

The technical scheme submitted by the promoters‡ (subject to modifications) will materially improve the supply of electricity, especially within the southern portion of the district which includes the important Cannock collieries area. The Commissioners approve the proposal immediately to extend the system of interconnection now existing between the generating stations at Wolverhampton, Ocker Hill, and West Bromwich by the inclusion of Walsall, and to complete the system of transmission to the Cannock area. Subject to satisfactory proof of a sufficient summer flow in the River Trent at Rugeley, the Commissioners generally approve of the proposal to construct the first section of a capital station at Rugeley, which will be required as soon as the limited local extensions of generating plant at Wolverhampton, Ocker Hill, and West Bromwich proposed by the promoters, and a possible limited extension at Walsall, have been effected. An improvement can be made in the promoters' system of transmission for the southern part of the district which, while maintaining the required capacity and efficiency, will result in a saving of capital expenditure and in the serving of a wider area. When drafting the outlines of the technical scheme for inclusion in the Order, the Commissioners will confer with the promoters on this point.

The proposal of the Walsall Corporation to extend the Birchills station by a further 30,000 kW of generating plant would not be practicable having regard to the limitations on the supply of condensing water, and in comparison with the Rugeley development would not continue to economy of supply, either in the borough of Walsall or in the district. Subject, however, to the necessary consent of the Birmingham Navigation Co. being obtained to the use of the requisite amount of canal water for condensing purposes (1,200,000 gallons per hour) under the existing agreement between the Corporation and the company, the Commissioners are of opinion that there is sufficient water available without recourse to cooling towers to enable a load of about 15,000 kW to be supplied from Birchills, involving, at the most, an addition of two 5,000-kW sets to the plant at that station.

Including the local extensions proposed by the promoters, and the possible extension of the Birchills station, the total plant which can be installed at the four generating centres in the southern area of the district is as follows:—

1. Ocker Hill (Midland Electric Corporation for Power Distribution, Ltd.)	24,000 kW
2. Walsall ...	23,000 kW
3. West Bromwich	7,000 kW
4. Wolverhampton	26,000 kW
Total	80,000 kW

This aggregate of plant, after interconnection of the stations and making due allowance for spare generating plant, should be sufficient to meet the estimated needs of that area, including colliery supplies, until the first section of a new generating station at Rugeley is completed. Meanwhile, and pending the full development of the approved technical scheme for the district, the Commissioners will determine at which of the generating stations, when interconnected, extensions are to be made to meet the growth of load as occasion arises. New demands in the Stafford and Stoke-upon-Trent area, and especially in the more northerly part, can be more economically met for a time from a limited extension of those stations rather than by an extension of the main transmission system from the proposed station at Rugeley, and this alternative will require careful consideration by the Joint Electricity Authority when established.

The proposal of the promoters to constitute a Joint Electricity Authority is approved, but the Commissioners have come to the conclusion that to limit the Joint Authority to representatives only of authorised undertakers who are actually operating would not be in the best interests of the undertakers or of the development of supply in the district. A reasonable representation should be afforded to those local government bodies in whose areas there are at present no supplies of electricity, to the important coal industry, and to the railways, which indicated that they were prepared to contribute a reasonable share of the administrative expenses of the Joint Authority. The total representation of these other interests should not exceed one-third of the total membership of the Joint Authority.

The Commissioners are unable to accept the proposal of the Walsall Corporation that there should be a separate district with a separate authority for the southern portion of the area. However, it will be advantageous to the district for the work of the Joint Authority to be subdivided between committees for the northern and southern portions respectively. The voting proposals of the promoters would not be conducive to efficient administration; each member of the Joint Authority should have one vote only.

Part of the promoters' scheme is to make arrangements as soon as possible after the establishment of the Joint Authority to transfer to it certain generating stations upon terms which are now under consideration. Only those stations which are forthwith to be interconnected need be transferred to the Joint Authority as soon as it is established; the transfer of other stations should be delayed until their interconnection at a subsequent period with the main transmission system. The Commissioners will assist the promoters, if desired, in settling the terms of such transfer.

Regarding the position of the Shropshire, Worcestershire and Staffordshire Electric Power Co. (the Power Co.), by the terms of its Act of 1918, the Power Co. may not supply within this electricity district (except, by consent, within the areas of Walsall, West Bromwich, and the Midland Electric Corporation for Power Distribution, Ltd.) until August, 1923, and during this period nothing is to prejudice any application to procure the cessation or revocation of the Power Co.'s powers in an area comprising the counties of Salop and Stafford (excluding Smethwick) and that part of the county of Worcester then within the area of the Midland Electric Corporation. The promoters and the Power Co. should adjust the area of the Power Co. so that any proposals to amend that area may form part of the approved scheme for the district.

The Commissioners have accordingly decided to prepare a draft Order (*a*) providing for the establishment

*Elec. Rev., p. 317; March 3rd, 1922.
†Elec. Rev., p. 307; September 17th, 1920.
‡Elec. Rev., p. 231; August 12th, 1921.

of a Joint Electricity Authority for the district, with the borrowing and other financial powers conferred by the Electricity Supply Act, 1922. Provision will also be made for the sub-division of work between two committees, one to operate in the northern area, and the other in the southern area; (*b*) embodying the outlines of the technical scheme to be undertaken by the Joint Authority, mainly in accordance with the scheme submitted by the promoters, but subject to modifications, and with provision that further modifications thereof may be made with the approval of the Commissioners; (*c*) requiring the Joint Authority to submit within a period of two years from the date of its formation proposals for securing a supply in unoccupied areas where there is a reasonable prospect of such supply being remunerative.

The Commissioners desire that the promoters should continue, pending the establishment of the Joint Authority, to act as a Provisional Committee with which they can consult. They further hope that the Walsall Corporation will assist by joining the Provisional Committee.

North Lancashire and South Cumberland Electricity District.

Concerning the evidence given at the inquiry§ held in January, 1922, at Barrow-in-Furness into the scheme submitted by the Provisional Joint Committee for the North Lancashire and South Cumberland Electricity District, the Commissioners have arrived at the following conclusions:—

> The survey which has been made as the result of the provisional determination of the district has shown that from engineering and economic points of view the district is too scattered for immediate development as one electrical area under the control of a Joint Electricity Authority, and that no practical advantage would accrue from the formation of such an authority at the present time.
>
> The formulation of the scheme[4] and the inquiry have, nevertheless, served a useful and practical purpose by showing that improvements in the organisation for the supply of electricity can be brought about in certain portions of the district, namely, (*a*) by an extension of the electrical activities of the Corporation of Barrow-in-Furness to cover a wider area of supply; (*b*) by a measure of consolidation in the Lancaster—Morecambe—Heysham area; and (*c*) by a development of supply in the Millom—Bootle area.
>
> The Commissioners are prepared to give favourable consideration to proposals from the parties respectively concerned for bringing about such improvements under Special Order procedure. Such proposals should be so framed, and will be so controlled by the Commissioners, as to aim at an eventual combination of the three areas into one district.

The Commissioners have accordingly decided that it is not necessary or expedient at the present time to proceed with the final determination of the district or to make an Order establishing a Joint Electricity Authority. The district will, however, remain provisionally determined, and the position will be reviewed at a later date in the light of the developments then accomplished.

THE BALTIMORE OIL CIRCUIT BREAKER TESTS.

In view of the tremendous growth of electric power systems it has been realised for some time that much of the old switchgear is not adequate for the increased duty it is called upon to perform; there is also considerable uncertainty as to the actual rating of many of the more modern types of circuit breaker. This state of affairs can be attributed to the fact that the manufacturer is unable to test his product under the conditions under which it has to function in practice.

These circumstances induced the Consolidated Gas, Electric Light & Power Co., of Baltimore, and the Pennsylvania Water & Power Co., U.S.A., to carry out elaborate oil circuit breaker tests on their interconnected 13,200-volt, 25-cycle power system, in co-operation with the Westinghouse Electric & Manufacturing Co. and the General Electric Co., which furnished the switches tested. Generator, transmission line and cable capacities were furnished equalling normal operating conditions and the currents obtained during the tests exceeded those usually met with in short circuits on this system. All the tests were made by throwing "dead" metallic short circuits on the entire connected system, which the breaker under test was called upon to open.[5]

The Canton sub-station in Baltimore was selected as the best location for these tests for several reasons: It is situated about seven miles from Westport, the main steam generating station of the Consolidated Co., and about 41 miles from the hydraulic power plant at Holtwood of the Pennsylvania Water & Power Co. and power could thus readily be supplied from both of these generating stations over a large number of cables and transmission lines, being in this way well distributed on the generators, transformers and feeders, without excessive overloading of any individual units.

Actual test results showed the great effect of sustained voltage; the voltage at Canton, *i.e.*, the re-established voltage, appearing immediately after the short circuit was cleared was never less than 77 per cent. of the normal voltage, even after the heaviest short circuits obtained, and on lighter short circuits was pricaically normal.

The main station at Westport has a generating capacity of 127,500 kW in steam-driven turbo-generators, of which 87,500 kW was usually available for the tests. The generating station at Holtwood, Pa., has a generating capacity of 83,500 kW in water-driven units. There is also one 20,000 kW steam-driven unit at the Pratt Street station in Baltimore. These three generating stations are interconnected through a number of sub-stations, giving the system a combined generating capacity of 231,000 kW. The maximum generating capacity used in the tests was 170,000 kW. Canton sub-station is directly connected with the Westport steam station by four 26,000-volt submarine cables, banks of transformers being provided at either end, and is also tied to the city network by eight 13,200-volt cables through the Pennsylvania Water & Power Co.'s Highlandtown sub-station.

To obtain short-circuit currents of different magnitudes the number of generating units was varied to some extent, but the main variation was obtained by changing the cable connections between the generating stations and the test bus at Canton sub-station so that even in the case of the minimum current used a very large capacity was behind the short circuit.

It is of interest to note that the calculated short-circuit currents were found to be within from 5 to 15 per cent. of those actually obtained during the tests at the time of rupture.

All the tests were made at 13,200 volts, 25 cycles. Short circuits ranging from 950 to 30,800 initial r.m.s. amperes and from 750 to 23,700 ruptured r.m.s. amperes were obtained. The water-power station being far removed from the test bus supplied about 30 per cent. of the initial short-circuit current, 70 per cent. being supplied either by Westport alone or by the Westport and Pratt Street stations. The maximum instantaneous loads on any of the generators did not exceed five times the normal load. Under the heavy short circuits, some cables (4/0) carried from 2,000 to 2,500 amperes.

Most of the short circuits were made across all three phases and ground. A few were across two phases and ground, and several on one phase and ground only. Two-phase and single-phase short circuits produced severe vibration of the turbo-generators. In this connection it should be pointed out that in the Baltimore system the neutral of all generators and transformers is "dead" grounded without any resistance, so that in each three-phase test it was necessary for each individual phase of the oil-circuit breaker to clear its own part of the short circuit without any help from the other phases, as might have been the case in any ungrounded or partially grounded system.

The general method of testing was to throw a dead short circuit on the breaker under test. Two others were in series with the test breaker serving as protective breakers in case of the failure of the test breaker, being set for later opening. A separate switch was used to act as a closing-in breaker exclusively.

The breaker under test was next to the short-circuit connection, which provided a metallic short circuit between all three phases and ground. It was arranged to trip automatically by means of a plunger type relay with "instantaneous" time setting, the only delay being that due to the inherent characteristics of the mechanism and relay. This varied from three to nine cycles (0.12-0.36 sec.).

In no case did the protective breakers fail to clear the test equipment from the bus in the station.

Magnetic stresses produced by heavy short-circuit currents caused a great tendency of leads to shift and whip, sometimes resulting in breakdowns; also very careful attention had to be given to soldered joints and connections, as repeated heating and pulling action caused defective joints to open up with consequent arcs, which sometimes spoiled the tests and often damaged other parts. Not only did this pertain to the connections in the test sheds, but it was also of special importance in the leads in the station connected with the test, in order to prevent trouble being communicated to the rest of the station.

Three oscillographs containing three elements each were used, a total of nine elements and three films.

By far the larger percentage of the short circuits seemed to break the arc at the zero point of the current wave corresponding to the time at which the magnetically stored energy of the system was a minimum.

It is interesting to note that it has been possible to make a total of about 200 short circuits directly on the Baltimore

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§ Elec. Rev., p. 147, February 10th, 1922.
[4] Elec. Rev., p. 721; December 3rd, 1920.
[5] Elec. Rev., p. 230; August 12th, 1921.
* *Journal* of the A.I.E.E., June, 1922. (*Abstract.*)

system at Canton, many of which involved the largest short circuit obtainable at this place without any breakdown whatever of the major equipment of the two operating companies, and with no more than two serious disturbances resulting to the system, one being due to the opening of a disconnector in the station, and the other being caused by the burning open of one of the leads in the station at its terminal. All the tests naturally meant momentary voltage disturbances to the system, and for this reason most of the tests were made after midnight or on Sunday morning when such momentary disturbances could best be tolerated. In some of the later tests the load of a number of the more important customers was also carried on separate generators during apart from the tests. In no case did the generators fall out of step, and in only a few cases was any of the customers' synchronous load lost momentarily. The most sensitive equipment on the system seemed to be the rectifiers used for street lighting which frequently would drop out, but as these could always be restarted immediately, this was not considered of serious consequence. The chief reason for the fact that it was possible to make so many short circuits with so little serious interference with the system lies undoubtedly in the short duration the short circuit was permitted to hang on to the system. usually not more than ½ second and never more than 1 second. Additional reasons may be the fact that short circuits were not made directly at the generating stations so that there could not be any voltage left on the generators to maintain synchronism, and the fact that the system in question is equipped with a carefully designed and adjusted selective relay system.

The individual performances of the breakers shows that the tests have resulted in marked improvements in the design and performance of oil circuit breakers for moderate voltage and high interrupting capacity. The results unquestionably indicate that it is possible, with proper design, to build oil circuit breakers which can be relied upon to satisfactorily interrupt large currents on high-capacity systems many times in succession without damage to the breaker, without any oil throw, and without change of oil or adjustments.

The tests have also proved that it is possible to conduct a series of test directly on a modern system without damage to equipment and without serious interference to its normal operation. It is hoped that this fact will encourage other operating companies to co-operate with the manufacturers in further improvements of oil switches of other designs and ratings to the benefit of the whole industry.

THE SPANISH MARKET.

New Tariff Agreement.

At long last the seller of British goods in Spain now has a definite assurance of his position during the next three years at least. The lengthy negotiations which have been carried on in Madrid for many months have resulted in the agreement of a new draft commercial treaty between Great Britain and Spain, and there is little doubt that it will be ratified. Thereunder the former benefits by all reductions in import duties granted to any other country and also by special reductions in the duties on a number of articles contained in the lower of the two existing schedules. On the whole the British negotiators are to be congratulated on a successful issue, for although the Spanish duties on British goods remain frankly protectionist, they stand in a better position than that in which they have been placed for very many months. During all this period uncertainty, as well as the heavy tariff, has crippled British trade. For the next three years, at any rate, those engaged in the sale of United Kingdom manufactures in Spain know that they are as well placed as any of their competitors other than the Germans. The rivalry of the latter has, however, been checked by both the anti-dumping measures adopted by Spain and also by the fact that German manufacturers can give but poor deliveries.

With regard to the various rates of duty comprised in the new Anglo-Spanish convention, the complete schedule will not be made known until the agreement is made effective. It is clear that the import duties on electrical and allied goods will not be higher than those shown in the following table. By way of comparison, the rates formerly in force are shown side by side with the new rates.

Tariff No.	Articles.	Former rates. Pesetas.	New rates. Pesetas.
29	Asbestos, manufactured (100 kg.)	150	120
70	Glass insulators ... (100 kg.)	30	24
506	Steam engines, weighing more than 10,000 and up to 50,000 kg. ... (100 kg.)	69	62
507	Ditto, more than 50,000 kg. (100 kg.)	40	32
510	Steam turbines, weighing 10,000 to 25,000 kg. ... (100 kg.)	35	32
	Ditto, more than 25,000 kg. (100 kg.)	35	29
516	Electric locomotives (100 kg.)	100	80
	Electrical machinery, weighing:		
624	500-1,000 kg. ... ... (100 kg.)	120	108
625	1,000-3,000 kg. ... (100 kg.)	75	67
626	3,000-5,000 kg. ... (100 kg.)	50	45
627	Over 5,000 kg. ... (100 kg.)	45	36
ex 629	Electric installations, weighing more than 1,000 kg. a.v.	20%	15%
633	Circuit breakers, weighing:		
	1-100 kg. ... ... (100 kg.)		90
	100-1,000 kg. ... (100 kg.)	100	80
	1,000-5,000 kg. ... (100 kg.)		60
	Over 5,000 kg. ... (100 kg.)		40

When, shortly after the Armistice, the United States Government investigated the market for electrical goods in Spain, the conclusion arrived at was that notable developments would occur there because of Spain's ample water-power resources and the relatively small extent to which electricity had been used in the past by the masses of the people.

This conclusion is as sound to-day as it was then, and, in view of the particular interest which the Customs tariff negotiations have lately given to the Spanish market, it will be useful to examine further some of the sections of the American Trade Commissioner's exhaustive report.

With regard to local manufacture, it is not precisely known when this commenced, but there are factories in Madrid and Barcelona that have been in continuous operation for 20 years. Nearly all are very small and make a limited quantity of material, but, during the war, methods were improved and capacity was increased to a considerable extent. The greatest advance has taken place with lamps and wiring devices. Nearly all forms and sizes of drawn-filament and gas-filled lamps are made of a reasonably good quality. The other more important manufactured articles are generators, motors, transformers, meters, insulated wire, storage, and dry batteries, heating and cooking devices, insulators, and carbons.

In connection with lamp manufacture, filament and entrance wire is imported. English wire has been offered for sale, and has given very good satisfaction at lower prices than American wire. All the glass parts are made in Spain. There is a chance of business in furnishing replacement plant and equipment for the lamp factories.

Wiring conduit of the Bergmann type is made in sufficient quantities to fill local needs and also create a surplus for export. The manufacture of wire and cable has been considerably stimulated by the protective import tariff. There are at least six well-equipped works, whose output meets all local requirements.

With regard to motors, upwards of five works are a factor in the market, apart from numerous small shops. The former group claims to be able to produce machines up to 500 h.p. The total capacity of the industry is not equal to all demands, and a number of projects are on foot for establishing electrical works. Motors suitable for direct connection to pumps and ventilating fans are made, but few special types, such as traction or fractional horse-power motors.

Despite a certain amount of local production, there should continue to be favourable opportunities for the sale of foreign-made generators, transformers, meters, switchgear, and controllers.

Industrial Expansion

Because of its natural resources, Spain is potentially an enormously rich country. Mines are being opened, agriculture is being extended, and the metallurgical industries have so developed that steel and iron shapes, beams, boilers, rails, locomotives, and ships are constructed in various cities and ports. The manufacture of sugar (both beet and cane), cotton and woollen cloth, and a great variety of machinery and articles needed in everyday life has been greatly stimulated during the last four years. All these things require power to drive the factories, as well as increased facilities for handling the freight involved in the movement of raw materials and finished products. Whereas coal furnished nearly all the power of earlier days, war-time difficulties of supply opened the eyes of the capitalists and engineers to the possibilities of the hydraulic energy present in all districts. The demand for this has been so insistent that companies which have been in operation a few years have been forced to expand their capacities, even in times when the great difficulties of securing capital or equipment would normally dictate a policy of

inactivity in this direction. New companies are being formed to exploit concessions that have been dormant for years, as well as the concessions that are being issued now, covering streams both large and small.

With all of this increased attention is naturally being drawn to the advantages of electricity for a multitude of uses, such as heating, chemical works, and traction, whereas previously it was employed for lighting only. In this manner a demand is being created for everything electrical for the factory, the shop, and the home. This demand must increase with the availability of a greater amount of relatively cheap energy and the consequent canvassing on the part of the central stations for a larger load. The opportunity for selling such material is now open to all, and those who are first to enter the field in earnest by catering to the peculiarities of the market with respect to designs, credits, and terms of payment will reap the greatest reward in the future.

Competition is severe in Spain and quite out of proportion to the importance of the market. Every well-known European factory is represented either by an office of its own or by agents or travelling salesmen; nearly every American manufacturer has given his agency to some local firm, and, in addition, there are a number of national factories that turn out very creditable goods in increasing quantities. These last are able now to supply practically the entire demand for incandescent lamps, insulated wire, and wiring devices, and are making inroads in the business heretofore obtained by importers of motors, heating apparatus, fans, and insulators. In order to meet this situation, it will be seen that the representative must be selected with care and then backed up by an enduring policy of assistance, with competitive prices, good deliveries, and satisfactory terms of payment.

Branch Factories.

There is a chance for the investment of capital in large enterprises, but this will have to be done in conjunction with local bankers. Technical assistance is needed more than money at this time, and an organisation combining engineering skill with large financial resources could undoubtedly start many projects, such as railway electrification, hydro-electric plants, or manufacturing establishments, and immediately secure plenty of capital to carry them through. This procedure is more desirable than an attempt to do the entire work alone, as there is a tendency towards Spanish ownership or control of all enterprises of any magnitude, and a well-defined feeling in most quarters that only Spanish capital should develop Spanish resources. This is the modern spirit and differs radically from the old idea of simply depositing surplus funds in the vaults of the Bank of Spain or purchasing farm mortgages. All that capital needs now is someone in whom it has confidence to point the way and take the initiative.

Two or three months ago the American Consul at Barcelona reported on the favourable conditions which existed in his district for the sale of electric heating and cooking apparatus. On account of the climate, the high cost of gas, and the unpopularity of oil stoves, the electric heater should be easy to sell in increasing numbers. The opening of several new power stations is expected to lead to a cheapening and more extended use of current. The market is accordingly well worth investigation. The voltages in use in the Barcelona district are 110/220, 125/220, and 150/300. In general the a.c. service at 120/220 V is supplied throughout the district; electric heaters, therefore, equipped for a voltage of 120 or 125 to 225 could be used.

A LARGE CONDENSING PLANT.

A large up-to-date surface condensing plant has recently been completed by Messrs. Cole, Marchent & Morley, to the order of the Corporation of Leeds, for installation at the Whitehall Road electricity works in conjunction with a 12,000-kW, B.T.H. turbo-generator.

The condenser is a vertical one of special construction, and is designed to deal with 220,000 lb. of steam per hour, maintaining a vacuum of 28.5 in. with the barometer at 30 in., and with cooling water at a temperature of about 65 deg. F. The following particulars will give the reader an idea of its magnitude: Area of cooling surface, 46,000 sq. ft.; quantity of circulating water required 2,400,000 gal. per hour (twice that of the total Bradford town supply); shell, including top and bottom water-circulating boxes, 34 ft. high and 11 ft. from side to side; overall dimensions of plant, including exhaust connections and pipework, 58 ft. from back to front, 35.5 ft. high, and 46 ft. from side to side; exhaust opening 12 ft. high and 6 ft. wide; circulating water outlet 42 in. diameter; weight of condenser with pipe work, tube plates, tubes, pumps, &c., 220 tons; and there are approximately 31 miles of tubes.

So as to avoid deep foundations or an excessively high engine-house, the exhaust inlet has been arranged on one side, and the connection to the turbine exhaust outlet is made by a curved adapting pipe with a copper expansion pipe immediately below the turbine exhaust. This arrangement means that the turbine and condenser are side by side, and the top of the circulating water inlet box is at approximately the same level as the top of the turbine.

At the top of the condenser is a deep open box having three connections on one side for the circulating water inlet, outlet connections and weir with a grid box on the other side for an overflow pipe. Gates or dividing plates are fitted in this box to enable the circulating water to flow twice through the tubes when required. For single flow these gates may be raised, and suitable gear is provided which is operated from a platform surrounding the top of the condenser. The centre portion of the condenser, forming the actual condensing chamber, is arranged with the exhaust steam inlet at one end, and the air outlet branches at the other, two of which are supplied, one at the top and one below the centre division of this section, a further branch being arranged at the bottom for connecting to the extraction pump.

A feature of the condenser is the method of staying. There are 48 lateral stays, each 1.5 in. diameter, contained in a cast-iron tube, the tube being a fit between the two sides of the condenser. Four cross girders arranged laterally act also as stays to the condenser shell, and support the tube plates both at the top and bottom. In addition to the lateral stays there are vertical stays to tie the top and bottom tube plates together, the supporting plate in the centre being secured to these stays by means of collars.

The tube plates are of brass, the top one being 15/16 in. thick and the bottom one 1 3/16 in. thick. Each is built up of six sections, and above the top plate a guard plate 1¼ in. thick is fitted, having special bell-mounted openings exactly coinciding with the holes in the tube plate. This is a special provision to meet the presence of foreign matter in the circulating water. The tubes are of 1 in. internal diameter of solid drawn brass and 18 s.w.g. thick, expanded into the top plate and fastened in the bottom plate by cotton tape packings and screwed ferrules.

The base of the condenser forms a water box and settling chamber, having a branch at one side for the circulating water inlet for use when it is desired to convert the condenser into a two-flow. At one end circulating water outlet branches are provided, and in addition there is another branch so that sludge and dirt can be flushed out as required.

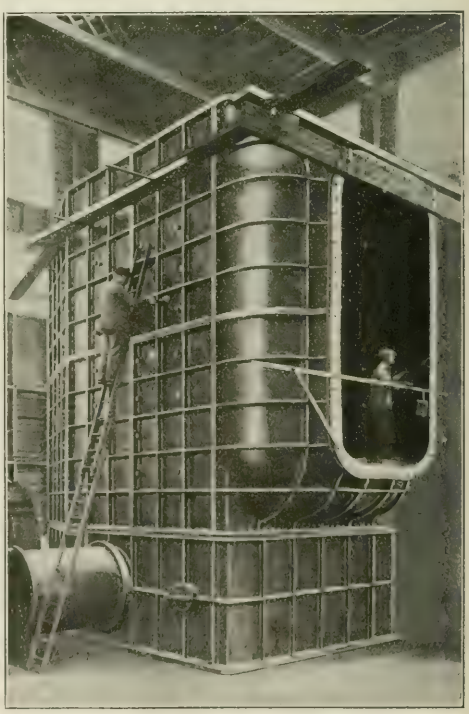


Fig. 1. Condenser for Leeds Corporation, Fitted with "C.M. & M.-Delas" Air Extractors.

As will be seen from the illustration (fig. 1), the condenser is built up of cast-iron plates, each being ribbed to withstand external pressure.

Air extraction is carried out by three sets of "C.M. & M.-Delas" steam jet air extractors of the intermediate condenser type, described in the Electrical Review of October 21st, 1921 (p. 551), two of which are sufficient to deal with the air to be extracted, the third acting as a spare, and these are arranged at the end of the condenser opposite the exhaust branch with a special platform and ladder to ensure easy access to them.

The main feature, which is the basis of the "Delas" patent, is the water jacketing of the combining tube, which results in obtaining a convergent-parallel as against a convergent-divergent combining tube. By continuing the water jacketing to the lower end of the tube, and altering from divergent to parallel, a condensing effect is obtained on the walls of the diffuser, thus effectively ensuring the tube section being full,

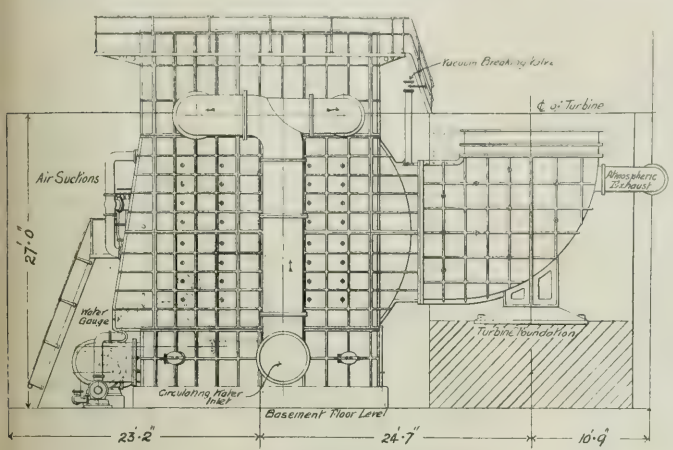


Fig. 2.—Elevation of Condenser.

and preventing the formation of eddies or vacua, and therefore absolute stability is obtained, notwithstanding alterations in load and/or steam pressure. Further, the compression throughout practically conforms to the theoretical isothermic curve, which results in a considerable reduction in steam consumption over other steam jets for a similar duty where the compression follows the adiabatic curve.

There are two extraction pumps of the multi-impeller centrifugal type, one of which, together with a multi-stage rotary boiler feed pump, is driven by an auxiliary turbine developing 102 b.h.p. at a speed of 2,500 r.p.m.; the other is direct coupled to its own electric motor.

The main feed tank or hotwell measures approximately 10 ft. by 10 ft. by 6 ft., and the boiler feed supply tank is 6 ft. by 5 ft. by 6 ft.; both are built up of cast-iron plates.

In connection with these two tanks there is a 6-in. Venturi meter with integrating and recording mechanism, having a range of from 3,000 to 25,000 gal. per hour, with by-pass and valves to enable it to be isolated when required.

The circulating water is pumped from the River Aire through a 42-in. diameter inlet pipe up to the top box of the condenser, and after passing through the tubes to the lower box, it drains back into the river by gravity. The drawing (fig. 2) gives a good idea of the general arrangement of this pipework.

The feature of the "C.M. & M.-Delas" steam jet air extraction principle is that about 85 per cent. of the heat in the steam operating the jets is recovered by heating the water for boiler-feed purposes. With the plant in question both the auxiliary turbine exhaust and the exhaust from the "C.M. and M.-Delas" air extractors pass through a feed-water heater, which is of the surface type having a cast-iron casing with ¾ in. dia., 18 s.w.g. solid drawn brass tubes, and is situated in a convenient position on the side of the condenser, near the auxiliary turbine and air extractors.

Electricity in French Agriculture.—Having surplus power at its disposal the Orleans Railway Co., on the recent occasion of agricultural meetings held at Poitiers and Limoges, drew the attention of agriculturists in the centre of the company's system to the advantages of the use of electricity in the field and in the farm buildings. Continuing this effort the railway company has now organised an exhibition at a congress to be held at Brive next week of agricultural and farm machinery driven by electric motors, including pumps and irrigating plant.

ELECTRIFICATION OF NETHERLANDS RAILWAYS.

Commission's Report.*

In January, 1920, the Minister of the Department of Buildings and Roads and the Board of Management of the Netherlands' Railway appointed a commission to report on the relative desirability of the different systems available for the electrification of railroads. The commission was to base its decision upon the gradual electrification of the entire railway system. This point was considered of special importance because of the relatively small area of the country, and the confusion that would be caused by the installation of different systems.

At the time this commission was formed only two countries could be said to have officially selected a uniform system of electrification; these were Switzerland and Germany, both of which had selected single-phase alternating current. In Sweden this system was also tentatively chosen, but later, on account of the certainty of interference with communication lines, a new investigation was started of the direct-current system.

In England, France, Belgium and Italy commissioners had reported since the Netherlands' commission was first appointed. The following are recommendations made by these several commissions: England, 1,500 volts direct current; France, 1,500 volts direct current (with 3,000 volts for some lines); Belgium, 1,500 volts direct current; Italy, three-phase in the north and direct current in the south.

During the period from February to September, 1920, the members of the commission visited various countries, inspected the several railway systems, and interviewed railway and electrical experts in England, Switzerland, Germany, Sweden and the United States. The question was studied, both from the point of view of the general electrification of railways and industries, and from the point of view of electrifying the roads alone. If the railways were to be electrified on the single-phase system in would be necessary to provide electricity at a frequency of 16⅔ cycles. Studies were made as to the relative desirability of using steam turbines with generators of two frequencies on the same shaft or the employment of frequency-changer sub-stations for all of the railway service. It was the opinion of the commission that the double frequency generating scheme was impracticable, and that the most satisfactory solution required the transmission of all energy at one frequency and over the same transmission lines.

The report makes a careful analysis of the factors entering into the choice of system and the following points are outlined in the "Interim Report":

The three-phase system has more advantages for mountainous countries, but has the disadvantage of requiring two trolley wires, while the three-phase motor is less adaptable to the demands of railroad service. The combination of a national electricity supply system with distribution of power to the railroads offers more advantages with d.c. than with the single-phase system. Overcoming the disturbances in communication lines caused by single-phase supply has not been done satisfactorily; therefore, it cannot be decided in advance what protective measures (assuming a minimum cost) will be sufficient to ensure operation in a manner satisfactory to all reasonable requirements.

It was the unanimous opinion of the commission that the direct-current motor was more simple and reliable than the single-phase type, especially at moderate direct-current voltages, although the single-phase motor has been much improved in recent years. The commission, therefore, is of the opinion that for the Netherlands the direct-current system must be recommended. The potential to be selected lies between 1,500 and 3,000 volts. So far as can be seen at present a potential of 3,000 volts will not be necessary, in view of the short distances between feeding points and the weight of trains to be handled.

The general comparisons cited in the final report between the two available sytems are as follows: The influence on the weak current lines is of special importance in view of the limited space on the railroad, the large number of wires and the difficulty of finding another place for them in a thickly-populated district. The comparatively small distances between the junctions would not give the possible h.p. single-phase system the proper advantage. In connection with these short distances and the density of traffic at the time of electrification the difference in cost of construction and operation will not be very great. The development of automatic sub-stations and the use of mercury rectifiers offers

*From the *General Electric Review*.—Abstract.

more probability of improvement to the entire direct-current system than to the single-phase system. With direct current a greater possibility exists, in general, that a considerable part of the equipment that will be necessary can be manufactured in the Netherlands.

The following summarises the conclusions reached: While it is uncertain whether or not a national electricity supply system will be established, the commission believes that in any case the generating of electricity will have to take place at a frequency of 50 cycles. If a national supply system is not established the Holland railways must be electrified with direct current having an operating potential of 1,500 volts.

THE GLASGOW ELECTRICITY UNDERTAKING.

Annual Report.

We have received from the engineer and manager of the Glasgow Corporation electricity undertaking (Mr. R. B. Mitchell) a voluminous report upon the working of the department during the year ended May 31st, 1922.

The revenue account shows that the total income fell from £1,311,951 to £1,191,438, while working expenses were £739,481, as compared with £969,586 in 1920-21. The decreased revenue was mainly due to lower sales, the scale of charges remaining the same. Generating costs showed a remarkable reduction, from £622,070 to £343,377, and all other items were less than in the previous year with the exception of the amount written off for depreciation which was £118,998 as against £67,161 in 1920-21. Fuel costs were almost exactly halved, the figures for the two years being £168,096 and £235,613. The gross profit for the year was thus £451,957, as compared with £342,365. Against this were debited capital charges totalling £409,379 (£339,635), and the net result was a profit of £42,578—over fifteen times that of the previous year, £2,730. This profit was transferred to the reserve fund, bringing the latter up to £58,821.

The capital value of the undertaking is stated at £6,138,917. The principal items of expenditure on capital account during the year were in connection with the Dalmarnock station:—Additional land and buildings, £33,435; machinery and plant, £173,272; and accumulators, £511. Other large items were Kinning Park sub-station, £29,769; Cadogan sub-station, £70,645; Elliott Street sub-station, £45,587; Buchanan Street sub-station, £25,158; Partick sub-station, £24,833; and mains and cables, £283,556.

The quantity of energy sold was 131,341,783 kWh, as against 154,175,830 kWh in the previous year. The decrease is shown under the heading "Private Consumers." The maximum demand was also lower being 69,900 kW, as compared with 76,964 kW in 1920-21. Connections increased by 7,749 kW to 173,272 kW.

The report states that there are now four 18,750-kW sets installed and in operation at Dalmarnock, and a fifth will be on load during the coming winter. This completes the first half of the works. No. 2 boiler house has been completed; the boiler plant at the works consists of sixteen boilers each of 50,000-lb. evaporation capacity.

In future the Port Dundas station is to run for 10 hours a day only, and no further additions will be made to the plant. The use of the generating plant at the Pollokshaws Road station has been discontinued, converting plant only being in operation. During the year the Elliott Street and Riddrie sub-stations were put into commission, and the following are in course of construction:—Cadogan Street, Buchanan Street, Kinning Park, Alexandra Parade, Bridgeton, Craigton, and Mosspark. The cables laid during the year comprised 5½ miles of l.p. feeders, 8 miles of h.p. feeders, and 7½ miles of distributors on the north side of the Clyde; and 1¾ miles of l.p. feeders, 4¾ miles of h.p. feeders, and 5¼ miles of distributors on the south side of the river.

Anticipating a favourable result from the present year's operations, the Electricity Committee instituted a schedule of reduced charges at the beginning of the year. For lighting the general reduction is 1d. per kWh; for power ¼d. per kWh; and for heating other than domestic ½d. per kWh. The domestic rates are now: Lighting, 4½d per kWh, and heating, &c., 1d per kWh special rates and 2d per kWh ordinary rate.

Wages in the Tramway Industry. The proposal of the employers' side of the National Joint Industrial Council for the Tramway Industry to terminate the existing sliding scale agreement at September 23rd has given rise to protests from the men in many districts. At Sheffield, Birmingham, and Bradford resolutions in favour of necessary action to resist the imposition of wage reductions have been passed. At Newcastle a conference has been held to consider the position. As the Corporation is not a member of the N.J.I.C. local arrangements were suggested. An agreement embodying a compromise has been arrived at between the Manchester City Council and its tramway employés.

REVIEWS.

The Electric Furnace. By J. N. Pring, M.B.E., D.Sc. Pp. xii+185; figs. 241; plates XIX. London: Longmans, Green & Co. Price 32s. net.

The Electric Furnace. By Frank J. Moffett, B.A., M.I.E.E. Pp. x+118; figs. 33. London: Sir Isaac Pitman & Sons. Price 2s. 6d. net.

It is now over 30 years since the electric method of furnace heating first emerged as an industrial possibility, but partly due to natural causes, and partly to our inherent conservatism the method has certainly not attained in this country the extended use that was once expected of it; a failure all the more striking in view of the fact that some of the earliest electric furnace work was carried out in England. The war however, gave a great impetus to the adoption of electric furnace heating, notably for the refining of steel and the fixation of atmospheric nitrogen, and it may be hoped that the fallacy which it is one of the objects of Dr. Pring's book to dispel, namely, that the electric furnace can only be employed in countries blessed with an abundance of water-power, will no longer operate to prevent the development in England of so important and powerful a method of energy-transformation. In making the comparison between the cost of fuel-heated chemical processes and those in which electric heating is employed, the fact is too often overlooked that in the former a considerable proportion of the energy generated is carried away to waste in the flue gases, and a further large proportion is utilised in heating furnace or crucible walls. From the energy standpoint the essential feature of electric heating is that the energy is applied *internally* in the body of the furnace charge, and its amount can be regulated to a nicety. From the chemical standpoint it has the advantage of not producing or requiring any particular gaseous atmosphere. It is where these two principles are appreciated that we find extended application of the electric furnace, and during the last decade it has been above all the steel metallurgists who have realised the value of electric heating in refining their crude product, for it is precisely in this operation that the two characteristics just mentioned are most clearly advantageous.

A considerable part of Dr. Pring's book is devoted to the description of furnaces and processes for the electrical production of steel and ferro-alloys, and the chapters on this subject, which are exceptionally well illustrated with numerous diagrams and half-tone prints, are among the fullest and best in the book. Many, although not all, of the most recent types of furnace are described in some detail, but here, as indeed throughout the book, we should like to have had the space spent on obsolete appliances devoted to a more critical appreciation of the processes which have survived. For example, an account is given of the Hering "pinch effect" furnace; but we have no indication whether, or if at all to what extent, the principle has been applied in practice. We are under the impression that several Hering furnaces are at work in America. Much of the recent success obtained with electric steel furnaces has been a result of improvements in their regulation, a possibility which gives electric heating a great advantage, but practically nothing is said on this, or on the important topic of electrode manufacture which developed considerably in Great Britain during the war.

A long chapter is devoted to the synthesis of nitrogen compounds from the atmosphere. The subject is of extreme importance and the author has summarised our present knowledge and experience very skilfully. We are of opinion, however, that the editor of the series would have done better to relegate this subject—as well as the companion subject the ammonia oxidation process—to a separate volume. It has little in common, from the industrial or technical standpoint, with ordinary electric furnace processes. As the subject is dealt with, more details should have been given of the recent important developments due to Claude, who has given full descriptions of the remarkable and ingenious points in mechanical design which enabled him to employ a pressure of 1,000 atmospheres in the catalytic chamber.

The electric melting of non-ferrous metals is now attaining much importance in America and here too, notably in the Birmingham district, great progress has recently been recorded. The brief chapter describing this work could be much expanded, and some attention should have been given to its economic aspects.

Among the miscellaneous matters dealt with are such interesting subjects as laboratory furnaces, current supply and transformation and pyrometry; refractories, heat problems and electrode terminals, and, in conclusion, chapters on water power and steam power stations. The author has collected and summarised a very great deal of material, but the small space allotted to some of these important sides of the subject have made it impossible for him to do himself or the subjects justice.

With all its limitations, many of which, by a stricter reference to his subject, we hope to see eliminated in a future edition, Dr. Pring has given us in this volume a very timely and an extremely useful record of electric furnace progress and practice. It is no light matter to cover so wide a field of theory, technology, and industry, and electrical engineers, metallurgists, and chemists will be grateful to Dr. Pring,

and to the publishers of this series, for having given them an up-to-date text-book containing so great an amount of information.

Mr. Moffett's little book is intended to indicate briefly what the electric furnace is and what it can now do; it is in a word an introduction to the subject and it fulfils that purpose extremely well. After a brief—in our opinion quite unnecessary—chapter on electrical principles and one on the history of the subject, the author deals with the characteristics of the electric furnace, explaining its *raison d'être* and its advantages. There follow chapters on arc and induction furnaces for steel and iron and resistance furnaces for miscellaneous purposes. Then we have a shorter chapter on the fixation of nitrogen, and finally a few pages on furnace construction, and a brief bibliography. Given the difficult problem of stating all this in outline in 110 pages, we doubt whether it could be done more efficiently and with less waste of words, and with this comment we commend the book to every engineering student and young engineer who wishes to keep abreast of modern electrochemical and electrometallurgical developments.

General Physics. By Ervin S. Ferry. Pp. xiv+732; figs. 600. London: John Wiley & Sons., Ltd. Price 24s. net.

This is a book designed for the use of students, by the professor of physics of the Purdue University. It is written with a special eye to the industrial applications of the principles set forth, and to this end particular attention is given to the exemplification of each fundamental principle in diverse departments of physics, so that the student may have ample opportunity for gaining a thorough grasp of each principle in its essence, and acquire also, at the same time, practice in applying each principle to problems that occur in practical life as they arise. The method is first to develop ideas new to the student, and then proceed to their precise or scientific expression. The illustrations are chosen from such fields as are most likely to arrest the attention of students. Thus problems of range-finding which became so poignantly interesting during the war are introduced to exemplify several applications of the laws governing light and sound. In compiling a work of this character it is always a difficulty to decide exactly what applications of the several physical laws shall be included. Clearly all the applications that the ordinary affairs of life afford, cannot be introduced, or there would be no putting a limit to the size the book might attain. In this case the writer has leaned towards the useful, as distinguished from ornamental or pleasing applications. Thus the relations of the notes of the musical scale and the problems they involve are not mentioned. Another difficulty is to decide to what degree of abstrusiveness the applications of physical laws shall be pursued. Modern investigations indicate that there is absolutely no limit to the progress of science in this direction. In this case the writer has restricted himself to the presentation of such difficulties as may be elucidated by the help of elementary algebra and trigonometry alone. Hence it is not surprising to discover that neither the word *entropy* nor the word *quantum* is to be found in the index. There is, however, a useful section on the electron hypothesis of electricity. The facts upon which all physicists are now agreed are summed up under nine heads, the recapitulation of which is worth reproducing:—

1.—All electrons have the same mass, and this mass is very small compared with the mass of any atom.

2.—All electrons carry equal negative charges numerically equal to the charge carried by a monovalent ion in electrolysis.

3.—In gases electrons move from a region of low electric potential to a region of high potential, with a speed depending upon the potential gradient and upon the pressure of gas.

4.—A gas is rendered conducting by the passage of a stream of rapidly moving electrons.

5.—The impact of rapidly moving electrons on matter develops heat, light, and mechanical force.

6.—Electrons are repelled by other electrons and by all negatively-charged bodies.

7.—Electrons are attracted by positively-charged bodies.

8.—Electrons in motion are accompanied by a magnetic field, which is in circles having their planes normal to the line of motion.

9.—Electrons are emitted by bodies at a sufficiently high temperature and by bodies at a sufficiently low potential. They are emitted spontaneously by a few substances at ordinary temperatures even when uncharged. They are emitted during some chemical reactions and also by some substances when exposed to X-rays or to light waves of short wavelength. So stated, this seems but a slender foundation on which to rear the elaborate edifice known as the electron hypothesis of electricity.

The reader who contemplates purchasing the book will also be interested to know the relative weight accorded by the author to the several branches of the subject with which he deals. This may be gauged by the proportion of the space accorded to the sections into which he divides it. Dynamics 33 per cent., sound 5 per cent., heat 14 per cent., electricity 25 per cent., light 23 per cent.

A notable feature is the collection of numerical problems by which the student is exercised in applying physical laws. There are nearly 700 of them, and their solution may be strongly recommended to all who make use of the book as they are eminently adapted to dispel the illusions to which every reader of physics is subject, namely, that he fully understands the principles he has read about, when in fact he but partially grasps them.

Pattern-Making. By W. Roland Needham. Pp. 114+v, 171 illustrations. London: Blackie & Son, Ltd. Price 2s. 6d. net.

This is an introduction to pattern-making written for the use of boys who are receiving class instruction in the subject, and is intended to be a companion work to a book on foundry practice in preparation by the same author.

The scope covered by the book is small, the treatment being most elementary and expressed in the very simplest language. Very wisely no attempt is made to teach the manipulation of tools, or the building of patterns in detail, a knowledge of such matters being obtainable only at the bench. The close connection that exists between pattern-maker and moulder is constantly emphasised, the scheme of the book being to explain the principles upon which the arrangement and building of a pattern are based, the reader being encouraged to seek continually for the reasons underlying the methods and means adopted.

The relation between pattern, mould, and casting, is first explained, and is followed by a discussion of the materials and tools used, and of the necessity of allowance for contraction and machining, &c. Simple self-coring patterns are then described, together with the use of loose pieces and drawbacks. The necessity for cores and coreprints, and the building of coreboxes are next dealt with, followed by a description of struck work. Metal patterns and the use of plate patterns complete the book. The examples dealt with throughout the book are of the simplest character, such as brackets, couplings, bedplates, &c., and at the end of each chapter a number of simple questions is set upon the subject matter.

The information in the chapter on tools is somewhat meagre—an explanation of the action of a plane iron, together with a better illustration showing both cutting and cover irons, would have been useful. In fig. 40, which shows a bandsaw, the saw itself has been omitted from the drawing, and figs. 44 and 45, which are intended to show contraction rules for iron and brass, are quite valueless—a full size illustration of a few inches only of each rule compared with a standard rule would have been useful.

The book possesses no special features of interest, but is probably useful for those for whom it is written.

Electrical Machinery. A practical study course on installation, operation, and maintenance. By F. A. Annett. Pp. xiv+431; figs. 491. London: McGraw Hill Book Co. Price 18s. net.

This volume represents the compilation into book form of a series of articles which originally appeared in *Power* between 1917 and 1919, under the title "The Electrical Study Course." In addition, there has been incorporated a number of articles on electrical machinery and operation which have appeared in *Power* during the past seven or eight years. There appears to be a demand in the States for this type of home study course, and, while admitting the existence of a number of good books on elementary electricity and magnetism, the author justifies his book on the grounds that it shows "how theory fits into practice."

There can be no doubt that Mr. Annett believes in getting down to business at once, for in his first chapter fig. 1 represents the cutting of magnetic lines of force by a conductor, and the consequent generation of electric current. Beginning with chapters on elementary magnetism and fundamentals of the electric current we pass on to Ohm's law, series and parallel circuits, energy, work and power, electrical instruments, methods of measuring resistance and sizes of conductors. The principles of dynamo-electric machines are then explained, followed by a chapter on d.c. machine construction, which gives a well-illustrated account of armature and commutator construction, but unfortunately falls back on ancient types in the earlier sections on field-magnet building. All types of d.c. generators and motors are treated fully in subsequent chapters, while starters, three-wire systems, and the parallel operation of d.c. generators are given chapters to themselves.

The a.c. section of the book gives consecutive treatment to the principles of alternating currents, 2 and 3-phase circuits, and the synchronisation of alternators operating in parallel. There is an excellent chapter dealing with power measurements in a.c. circuits, and also with transformers, while chapters on a.c. motors and the starting of polyphase motors complete a book which lacks nothing in thoroughness and is remarkably self-contained with regard to both theory and practice.

The impression gained by the reviewer is certainly not that which is commonly associated with a series of articles re-issued in book form. The treatment is continuous and the book bears the stamp of expert technical writing, and while there may be no exact niche for such a work in this country it will no doubt fulfil a useful purpose among the students for whom it has been compiled.

F. H. S. K.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sutton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,818. "Apparatus for testing high-tension spark circuit of internal-combustion engines." A. H. Wirth. July 31st.
20,843. "Electric switches." Northern Electrical Engineering Co., G. Winter and R. Winter. July 31st.
20,876. "Gypsum plaster compositions." J. C. N. Eastick. July 31st.
20,884. "Crystal detectors for wireless apparatus." H. W. Parker and C. J. Siler. July 31st.
20,892. "Electrical couplings." J. C. Crater Lea. July 31st.
20,898. "Determining charge condition of batteries." Celloklay Manufacturing Corporation and A. E. White. July 31st.
20,925. "Rectifier." E. A. S. Vosmaer. July 31st. (Holland, August 1st, 1921.)
20,930. "Electrically controlling bodies at a distance." Soc. Industrielle des Procedes W. A. Loth. July 31st. (France, July 29th, 1921.
20,936. "Resistance switches." Veritys, Ltd., and W. G. Pipkin. August 1st.
20,940. "Sparking plugs." W. A. Judge. August 1st.
20,941. "Sparking plugs." J. Blakow. August 1st.
20,948. "Induction coil boxes." A. H. Liggett. August 1st.
20,950. "Grid leak condensers, &c., for wireless telegraphy, &c." G. Bechtel, K. F. Karlson and T. McGee. August 1st.
20,963. "Sparking plugs." L. Korczynski. August 1st. (Poland, August 1st, 1921.)
20,972. "Electric transformers, reactance coils, &c." W. Hanna and A. Reyrolle & Co., Ltd. August 1st.
20,974. "Devices for securing external sparking plugs." W. H. Duffett. August 1st.
20,980. "Variable plug socket coil holder." A. R. Fotheringham and H. J. James. August 1st.
20,993. "Means for permitting augmentation of illuminating power of incandescent electric lamps." Soc. Industrielle des Appareils Economiques. August 1st. (France, August 6th, 1921.)
21,009. "Coil holders for wireless telegraphy." W. Lee. August 1st.
21,013. "Electrical marine propulsion." A. B. Field and Metropolitan-Vickers Electrical Co., Ltd. August 1st.
21,032. "Inductances used in high-frequency circuits." Dickinson Electrical Manufacturing Co., Ltd., and M. J. O'Keeffe. August 1st.
21,034. "Receiving telephones for wireless telephony." H. R. Rivers-Moore and K. M. Radio, Ltd. August 1st.
21,041. "Amplification and transmission of sound by microphones." Soc. Coupleuz Freres. August 1st. (France, May 8th.)
21,044. "Ceiling mountings for electric fans." Berkeley & Young, Ltd., and J. D. Slater. August 1st.
21,056. "Apparatus for registering pre-determined signal for alarm, &c., purposes for telegraphy, &c." A. C. Fuller. August 2nd.
21,076. "Lighting miners' electric safety lamps." J. R. Linneker. August 2nd.
21,098. "Neutral attachment for arresting high voltage for wireless receivers." J. K. McWhirr. August 2nd.
21,104. "Multi-speed cascade induction motors." L. J. Hunt. August 2nd.
21,108. "Variable condensers for wireless telegraphy." G. F. Barrington. August 2nd.
21,112. "Apparatus for utilising energy of flowing water to produce electricity." F. Horridge. August 2nd.
21,124. "Means for varying electric inductance." H. R. Rivers-Moore and R. M. Radio, Ltd. August 2nd.
21,136. "Sparking plug." H. Ford. August 2nd.
21,139. "Electric permanent safety fuses." E. C. R. Marks (Tutix Akt. Ges.). August 2nd.
21,163. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 2nd. (United States, September 7th, 1921.)
21,164. "Electric angle indicators." P. Moltini. August 2nd.
21,173. "Electrically inducing chemical action." W. J. Rickets. August 3rd.
21,177. "Electric spark detectors, &c." J. B. Percival. August 3rd.
21,191. "Rear lamps for motor vehicles." E. Bonell. August 3rd.
21,199. "Electric switches." W. E. Dempster and J. F. Wheat. August 3rd.
21,211. "Microphones." W. K. L. Dickson. August 3rd.
21,235. "Coil for electromotors." C. Lott. August 3rd.
21,246. "Commutating electrical machines." K. Nobuhara. August 3rd.
21,250. "Controllers for electric motors." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.) August 3rd.
21,251. "Electric capacitance control devices." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.) August 3rd.
21,254. "Current motors." J. Paterson. August 3rd.
21,259. "Safety devices for electric winding engines, &c." British Thomson Houston Co., Ltd., W. J. Pool and C. J. H. Trutch. August 3rd.
21,285. "Speed regulating method for non-synchronous polyphase motors." Soc. Anon. des Acieries et Forges de Firminy. August 3rd. (France, August 5th, 1921.)
21,303. "Commutators." P. B. Pickering. August 4th.
21,324. "Sparking plugs." A. A. Petrie. August 4th.
21,341. "Apparatus for automatic control of railway trains." M. R. Gardner. August 4th.
21,347. "Electric controllers." R. H. Barbour. August 4th.
21,348. "Resistance-capacity wireless amplifiers." D. S. F. Adams. August 4th.
21,349. "Wireless transmission for telegraphy or telephony." Q. C. A. Craufurd. August 4th.
21,353. "Electric motor control systems." W. Barbour & Sons, Ltd., and J. M. L. Slater. August 4th.
21,357. "Electromotors." C. Lott. August 4th.
21,372. "Circuit breakers." British Thomson-Houston Co., Ltd. August 4th. (United States, August 4th, 1921.)
21,373. "Control of motors driving planing, &c., machines." British Thomson-Houston Co., Ltd., and R. D. Given. August 4th.
21,377. "Resistance for [illegible]." Soc. Francaise Radio-Electrique. August 4th. (France, October 11th, 1921.)
21,378. "Means for controlling voltage of alternating current supplied to [illegible]." August 4th. (Germany, August 5th, 1921.)
21,382. "[illegible]." J. C. Crater. August 4th.
21,384. "Compensating device for determination of direction of sounds." [illegible]. August 4th. (France, August 31st, 1921.)
21,385. "Process of igniting metal-vapour rectifiers." Akt. Ges. Brown, Boveri & Cie. August 4th. (Switzerland, September 29th, 1921.)
21,386. "Resistance [illegible]." A. E. Vogan. August 4th.
21,387. "Electric terminals or binding posts." A. C. Brockies and E. A. Graham. August 4th.
21,388. "Telephone receivers." E. A. Graham. August 4th.
21,393. "Switch apparatus for tramways, railways, &c." D. Arcani. August 4th.
21,399. "Intermittent timed switches for flash signs, &c." H. B. Bullingham and [illegible]. August 4th.
21,401. "Sparking [illegible]." J. Partridge. August 4th.
21,409. "Automatic [illegible] rotary converter substations." English Electric Co., Ltd., and G. Schroeder. August 5th.
21,410. "Commutating [illegible] electro-magnetic machines." English Electric Co., Ltd., and G. Schroeder. August 5th.
21,411. "Commutating [illegible] electro-magnetic machines." English Electric Co., Ltd., and G. Schroeder. August 5th.
21,414. "Machine for teaching Morse alphabet by sounds." I. Boulton. August 5th.
21,415. "Aerials for wireless transmission, &c." H. Challis Sowerby. August 5th.
21,429. "Electric heaters, &c." C. E. Garrett. August 5th.
21,433. "Electric diaphragm warning horns." E. C. Browne. August 5th.
21,475. "Safety devices for electrical apparatus." M. Buchholz. August 5th.
21,480. "Publicity sign telegraphs." H. K. Harris. August 5th.
21,481. "Electric storage cells." J. P. Starley and Van Raden & Co., Ltd. August 5th.
21,482. "Coin collecting means for telephones." F. W. Hall. August 5th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

34,411. "Electrical heating elements." R. K. Heath. June 6th, 1921. (183,148.)
36,116. "Method and apparatus for converting direct current into alternative current by electrostatically-controlled valve oscillators." L. A. Hazeltine. November 28th, 1919. (155,789.)

1921.

1,079. "Receiving systems for radio-dynamic energy." J. H. Hammond, Jun. June 27th, 1917. (157,207.)
1,107. "Switching arrangements for telephone systems with electro-mechanical switches." Ges. fur Elektromechanische Telephoneapparate. June 4th, 1914. (157,233.)
1,158. "Conversion of atmospheric electric energy." H. Plauson. March 11th, 1915. (157,264.)
2,330. "Head lamps of motor-cars or vehicles, also applicable to other lamps." W. Slater Greenwood. January 17th, 1921. (183,153.)
2,551. "Electric arc welding applicable for welding studs, tubes, and the like to, or into, metal plates, bodies, and the like." L. J. Steele, H. Martin, and A. E. McCarthy. January 19th, 1921. (183,161.)
5,359. "Insulation of armature windings of electric machines." J. F. Cullin. February 16th, 1921. (183,167.)
5,360. "Wrapping machine more particularly for wrapping insulation round parallel-sided armature or other electrical coils." J. F. Cullin. February 16th, 1921. (183,166.)
5,361. "Insulation of armature windings of electric machines." J. F. Cullin. February 16th, 1921. (183,167.)
5,362. "Machine for positioning armature windings." J. F. Cullin. February 16th, 1921. (183,168.)
5,364. "Apparatus for winding coils for electric machines." J. F. Cullin. February 16th, 1921. (183,169.)
5,365. "Armature testing device." J. F. Cullin. February 16th, 1921. (183,170.)
6,896. "Electrical device for heating liquids and the like." H. J. Preston. March 2nd, 1921. (183,179.)
7,712. "Electric arc lamps." Optische Anstalt, C. P. Goerz Akt. Ges., and Dr. G. Gehlhoff. March 10th, 1921. (183,179.)
10,441. "Electric switches." J. B. Tucker. April 9th, 1921. (183,197.)
10,690. "Method of preventing disturbing induction between adjacent leads carrying approximately the same high-frequency waves." H. A. Gill (Deutsche Telephonwerke Ges.). April 12th, 1921. (183,203.)
10,855. "Rail bonds and like electric couplings or connections." J. Mather and W. Walker. April 13th, 1921. (183,203.)
10,939. "Electric starters for internal-combustion engines." Scintilla (firm of). April 14th, 1920. (161,588.)
11,049. "Methods of refining silicon steel and other metals and alloys." British Thomson-Houston Co., Ltd. (General Electric Co.). April 15th, 1921. (183,217.)
11,065. "Gas producers, electric furnaces, crucible furnaces, and the like." Ferolite, Ltd., and H. B. Clapp. April 15th, 1921. (183,219.)
11,069. "High-frequency electrical apparatus." J. B. Bower. April 15th, 1921. (183,220.)
11,105. "Means for employing radio active substances for curative treatment." J. B. Kramer. April 16th, 1921. (Cognate application, 30,944/21.) (183,224.)
11,235. "Electric lamps, particularly adapted to be carried or supported on the person." G. Oldham and J. Oldham. April 18th, 1921. (Cognate application 1,476/22.) (183,233.)
11,238. "Electric switches." G. J. Sutton. April 18th, 1921. (Cognate application 25,824/21.) (183,234.)
11,299. "Automatically-controlled electrical generating plants." M. V. Sclater (Executrix of A. W. Sclater, deceased). April 19th, 1921. (183,237.)
11,457. "Railway signalling apparatus." W. A. P. Casserat. April 20th, 1921. (183,248.)
11,568. "Electric cooking devices." S. Hnevkovsky. April 21st, 1921. (Convention date not granted.) (163,293.)
11,732. "Electrodes suitable for resistance welding processes." R. F. Woodburn. April 23rd. (183,262.)
11,907. "Electrically-heated kettles and the like." W. Soutter & Sons, Ltd., and W. Soutter. April 26th, 1921. (183,264.)
12,373. "Conductors for dynamo-electric machines." Brush Electrical Engineering Co., Ltd., and C. C. Sutton. April 28th, 1921. (183,273.)
14,535. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). May 25th, 1921. (183,304.)
14,543. "Electrical accumulators." G. Philippart. May 31st, 1920. (163,992.)
14,996. "High-frequency electric generators." G. Krawinkel. May 30th, 1921. (183,312.)
16,221. "Electric storage batteries or accumulators." H. M. Genese. June 13th, 1921. (183,329.)
16,227. "Transmitting apparatus for signalling through water." W. M. Thornton. June 14th, 1921. (183,330.)
16,646. "Electrical transmission." A. M. Taylor. June 17th, 1921. (Addition to 170,647.) (183,334.)
17,870. "Means for handling loads on electrically-driven trucks." J. E. Scott and C. D. Cuppiediteh. July 1st, 1921. (183,345.)
18,185. "Sparking plugs for internal-combustion engines." M. L. Parsons. July 5th, 1921. (Cognate application 2,360/22.) (183,346.)
19,223. "Sparking or ignition plugs." S. R. Seilliere. July 17th, 1920. (166,540.)
19,352. "Electrical control systems." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (183,354.)
20,624. "Electric fuses and the like." F. A. Ross. August 2nd, 1921. (183,362.)
20,874. "Sparking plugs." W. B. Bromwich. February 11th, 1921. (175,237.)
21,467. "Apparatus for condensing the mercury vapour in mercury vapour rectifiers." Siemens Schuckertwerke Ges. August 19th, 1920. (168,054.)
22,470. "Transformers for high voltages." Haefely & Cie. Akt. Ges. E. March 4th, 1921. (Addition to 170,547.) (176,311.)
27,512. "Electric incandescent lamps and other electric apparatus in which an incandescent filament requires to be kept stretched." Naamlooze Vennootschap Metaaldraadlampenfabriek "Holland." July 29th, 1921. (183,389.)
28,423. "Electric bed warmer." F. G. Beale. October 26th, 1921. (183,391.)

THE

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THE WIRELESS SITUATION.

IT is somewhat singular that while this country was in effect the birthplace of wireless telegraphy—for it was here that Signor Marconi, aided by the Post Office Department, developed the new art from the stage of experiment to that of commercial success—the company which he founded has constantly been subjected to Governmental restrictions, interference, and obstruction, to an even greater degree than the ill-treated National Telephone Co. The root cause of the trouble was, of course, the same in both cases—the existence of a Government department engaged in commercial enterprise on similar lines, very jealous of its privileges, and more or less involved in political questions altogether alien to the business itself. In more recent years the situation has been further complicated by the entry of the Admiralty into the field, not, it is true, for commercial purposes, but as a factor more or less independent of both parties and mainly concerned with the naval applications of wireless telegraphy.

It is greatly to the credit of the Marconi Co. that, under such difficult circumstances, it has been able to hold its own, and, as evidenced by the report abstracted in our issue of August 11th, has built up a flourishing business, making a profit in a year of "unprecedented difficulty" of more than a quarter of a million sterling, paying a dividend of 15 per cent. on the ordinary shares, and carrying forward two-thirds of a million. Moreover, a reserve fund has been accumulated which exceeds the issued capital.

These figures, however, do not adequately represent the position of the company, for there are claims outstanding against Government departments, particularly the Post Office and the Admiralty, in respect of services rendered by the company and the use of its patents during the war, which involve very large amounts, and it is greatly to be regretted that almost four years after the termination of the war, these questions remain unsettled. Fortunately we gather from the speech of the chairman, Senator G. Marconi, that there is now some hope that an amicable arrangement with the Post Office will shortly be arrived at, and that this will lead to a settlement of the claims against other departments. The Senator remarked that as a result of the lack of decision on a definite line of policy this country had fallen sadly behind other countries in the erection of long-range stations; the company had been assured in 1920 that sanction would be given for this purpose, but as yet nothing had come of it, and British messages might have to be transmitted through France, Germany, or the United States until our wireless stations were ready.

But for the political fracas in 1912, a claim of Imperial high-power stations would have been erected years ago. In 1920 the Imperial Wireless Telegraphy Committee ruled out the proposal to adopt direct communication with the more distant parts of the Empire, and rejected even a range of 4,000 miles, recommending that the links of the Imperial chain should be only 2,000 miles long; but the conclusions of the Committee have now been thrown over by the Government, which, forced into a progressive policy by the pressure of the Australian Government (which with the aid of the Marconi Co. proved that direct communication was feasible), has decided to abandon the chain and to telegraph directly to India, South Africa, and Australia. As the Australian Government has entered into an agreement with Amalgamated Wireless (Australasia), Ltd., for the erection of a 1,000-kW station (by the Marconi Co.), the South African Government contemplates a similar step, and the Indian Government was about to

do the same when the British Government changed its policy, it would seem that eventually the "Imperial chain" may be replaced by a set of independent units—high-power stations erected and controlled by the Dominion Governments—the only vestiges of the original scheme being the British Government stations at home, in Egypt, and in any of the Crown Colonies where they are found necessary. The Dominions and India have unmistakably evinced their desire to entrust their long-range wireless telegraph communications to the hands of private enterprise, and we are convinced that their preference is well founded; the delays and restrictions to which the home country has been subjected in this connection by the influence of Government departments and political cliques would have been avoided if that policy had been adopted in the first instance, and indeed it would be hard to find a more glaring example of the evils of State control than is afforded by the history of wireless telegraphy in Great Britain and Ireland.

It is interesting to note that the Marconi Company, whose most profitable business has hitherto been transacted with foreign Governments, looks to the broadcasting of wireless telephony as a means to bring it into close contact with the British public by the million; we are pleased to learn that the company intends to grant licences to other manufacturers for the use of its numerous patents, and as unfair competition from abroad has been very rightly restrained by Parliamentary action, a flourishing new industry will shortly be established in this country. There is no doubt that the wonderful development of wireless telephony—one of the scientific miracles of the age—is largely due to the extended and costly researches which have been carried out by the Marconi Company from its inception, and we trust that the seed thus sown will bear an abundant harvest.

INDUSTRIAL PROBLEMS.

The word "fool-proof" is not unknown in its application to electrical apparatus. Perhaps a better word might have been chosen, but if we understand its meaning aright it is intended to convey that the device to which it is applied can be enabled to do its work satisfactorily without injury to the operator and to those in his range of operations and without detriment to the system of which it forms a part. A safeguard against failure, danger, and death. Anything that is really fool-proof is surely a good thing. Such, however, is apparently not the opinion of Mr. George Hicks, the president of the National Federation of Building Trades Operatives, who, in delivering an attack upon the Federation of British Industries, describes it as a most ruthless combination of capitalist interests "like a fabled monster of the deep in the multiplicity of its tentacles," having "its claws well into the building trades," and being out "to make the capitalist world fool-proof." "It will succeed if we are not ourselves fool-proof." If by "the capitalist world" industry be meant, then Mr. Hicks must know that nothing is more vital to the well-being of the people of these islands than fool-proof industry, for it must be safeguarded against failure, danger, and death, if the millions of workers now at work are to continue to earn their livelihood, and if employment is to be secured for the million and a-half of people who are without it. Those who have followed industrial developments in this country during the past eight years have observed that the demand for better organisation came from all quarters. It was urged as most desirable that every worker should join a union and every manufacturer an association, as by such means there could be established machinery necessary for the conduct of negotiations and for dealing with the Government. The Federation movement among industries and industrial associations spread as years passed by, and the power of the unions did likewise, so that the Government of the day had the opportunity of listening to the appeals and arguments of both parties from time to time as we passed through successive awkward stages in the war and in the post-war period. Mr. Hicks recognises that the solidarity of the manufacturers is maintained at a time when he has to ask his audience at Bangor whether the workers shall remain "an example of tragic confusion, of selfish sectionalism, and of bewildering incompetence." The trade unions have been passing through a critical period as the result of the resistance they have been offering to relentlessly operating economic influences, often because of the attitude assumed by extremists who left their leaders in "tragic confusion" when they were trying to do their best for their union members. As we have often said here, the maintenance of trade unions in an effective condition is a very desirable thing, and nobody regrets more than we do the state of impotence to which the extremist minorities have reduced some of them, but it is useless for them to gird at the Federation of British Industries because of their own "tragic confusion." The report of the speech of Mr. Hicks, as received by us, makes no mention of the continued high cost of building and the reluctance of thousands of people to proceed with new work and even with necessary decoration and repair of existing property which, if they could go full steam ahead, might give employment to many of the aforesaid million and a-half. We observe that Mr. C. Tennyson, a deputy director of the F.B.I., has described Mr. Hicks's speech as "unmitigated tosh" and "hot air," and has added that the Federation exists purely for commercial purposes, the only matters of a political interest dealt with being those which have a direct reaction upon industry. If he had been attempting a reply to Mr. Hicks, Mr. Tennyson would have had a big story to tell of constructional effort continuously put forth in order to strengthen the British trade position in all parts of the world so as to bring business to British factories and British workers, and thus benefit the employés connected with the building and many other trades.

But Mr. Hicks is not the only spokesman for Labour whose recent utterances have received attention, for Mr. J. H. Thomas, M.P., has been warning the railway workers. He, too, has used the word "fools," for, in addressing a mass meeting at Chester on Sunday, he said that if the Labour Party came into power to-morrow they could not of their own accord solve the unemployment problem, and "they were only fools and knaves who said they could." Mr. Thomas has his own theory of the causes of present unemployment, but to discuss that would lead us into political matters which in these pages are anathema. There is, however, something in his speech where he is in a measure of agreement with Mr. Hicks, for he said, in dealing with the dispute with regard to the railway shopmen, that the "chaotic position in which they found themselves was due to the damnable jealousy which existed in their own ranks." Perfectly frank utterances these; the pity of it seems to be that they are most necessary, but satisfaction may perhaps be derived from the fact that they were received with "cheers," according to the Chester reports.

What would be better for the millions of industrial workers than that we should have the industrial position so stabilised by the reduction of working costs that abundant work might be obtained for us against foreign competition? All the war-time promises of the politicians and the idealists that everything would be better for everybody after the war have failed to be fulfilled. They were made in that spirit of opportunism or adaptability which seemed to hold the nation together in those times of stress, but they failed to take into account that there never had been such a war of impoverishment before, and they overlooked the probability of the common weaknesses of humanity asserting themselves when the common enemy had been defeated. Now we are "up against it," and the need is for the serious situation to be handled by men who represent all interests, including those of the great bulk of the workers, men who will not be influenced by an extreme minority. We shall win through if we will exercise our reason and show a spirit of goodwill.

Let us quote the closing sentences of a leading article on "Masters and Men" which appeared in the *Daily Telegraph* on Tuesday last:—

"As water finds its own level, so will wages in all trades and occupations in this country be readjusted to world conditions; and more swiftly in this than in any other country, because we can maintain our crowded population only by selling goods or rendering services to people overseas. . . . The best friends of the workers are those who preach the subservience of both masters and men to laws and influences which are beyond their control, and urge that salvation lies in a recognition of the mutuality of their interests. A spirit of co-operation for the common end—the creation of the largest amount of wealth at the highest economic wage—is the only key with which the doors of a prosperous future can be opened.

Coming Conventions.

Similarly to last June, next month is to be a month of several conventions. The only one of purely electrical significance, however, is the meeting of the Municipal Tramways Association at Newcastle from the 13th to the 15th of the month. The subject of roller bearings for tramcars having come very much to the front recently, it is probable that at least one of the papers will deal with this matter. The apportionment of road-maintenance costs—a vexed question which arises annually—will no doubt also make its reappearance.

The meeting of the British Association at Hull from the 6th to the 13th will possess the most general interest, but present indications seem to point to a lack of electrical subjects; during recent years these have been an ever-diminishing quantity at B.A. meetings.

The Institute of Metals will include electro-metallurgical papers in the programme of its autumn meeting. This is being held at Swansea from the 20th to the 22nd. Steelworks drives and the heat-treatment of steels are two subjects receiving attention at the York meeting of the Iron and Steel Institute (September 5th to 8th).

The international transport congress at Brussels, mentioned in our "Notes" columns to-day, will be held early in October. We have no information as to the extent of British participation in this congress, but no doubt the exchange of views which will take place will possess a great deal of interest, and will afford an opportunity for comparing electric traction with other forms of locomotion for limited areas.

An American View of British Development.

It is always interesting, and often informative, to see ourselves as others see us. Consequently an article recently published in *Commerce Reports*, commenting upon British efforts to develop the domestic load, by Mr. R. A. Lundquist, Chief of the Electrical Equipment Division, U.S. Department of Commerce, possesses many features which may be studied with profit by those concerned.

The author deals with the various methods adopted by supply authorities to popularise electricity, and first mentions the "electric home." It will be somewhat of a shock to those who have organised such exhibits to learn that the equipment of the houses is not so thorough as it might be, and compares badly with that of their American prototypes. The author does not mention any particular deficiencies, however, and admits that his information is based on "descriptions"; perhaps the Press is to blame.

Mr. Lundquist avers that a great handicap to the extended use of small domestic appliances is the bayonet-type socket. On account of its heating limitations it cannot "stand up" to the loads which a screw-type socket can carry.

We are more impressed by his third conclusion, *i.e.*, that electrical development has been retarded by the strength of the gas companies' position. He says that "vested interests have always been able to retard the development of competing industries more than has been the case in the United States." We are inclined to believe that in the States the gas companies saw the possibilities of electricity and wisely went into the business, which partly accounts for that lack of opposition which has facilitated the growth of electricity supply. But it is a fact that gas interests are strongly entrenched upon this side of the Atlantic; nevertheless, their defences are falling one by one to the electrical industry. We are forced to agree with Mr. Lundquist that cooking rates and installation costs are far too high, but until the cooking business grows prices will continue to be high—and until prices are reduced the cooking load will not grow. This is wholly dependent upon increased efficiency and lower costs, and in this respect America has the advantage of us. At the same time we are progressing, and nearly every day we hear of a reduction in the price of energy for domestic purposes. A lack of co-operation between supply authorities and electrical contractors is noted. Here, again, matters are improving, and in many districts harmonious relationships prevail. Another point is the small effort put forward by suppliers to bring the attention of the public to the advantages to be gained by the use of small appliances, and, indeed, except in-so-far as supply authorities are members of the E.D.A., this possesses a great amount of truth, speaking generally. There is still ample scope for local exhibitions, showrooms, and practical demonstrations, but many authorities cannot see beyond the cost of these, which is a state of things to be deplored. Mr. Lundquist does not favour the "hire" scheme for cooking appliances, as he thinks it unduly increases the investment of the supply authority. In present circumstances we do not think that there is an alternative: the majority of consumers certainly cannot afford to purchase electric cookers outright, and in any case the gas industry has done well out of the method. Still, in spite of the vulnerability of the industry to criticism, the author is forced to the conclusion that prospects are good, and he thinks that "a growing market for American devices should result," a conclusion that we are insular enough to hope will not be fulfilled before the resources of British manufacturers are exhausted.

The Genne-villiers Visit.—Important Notice.

The date of the visit to the Genne-villiers Power Station is now definitely fixed as Saturday, October 7th, at 2.15 p.m. Members of the party will therefore leave London for Paris on Friday, October 6th. Sunday will be left free for visits to Versailles or Malmaison, or other places of interest in the vicinity of Paris. Members can then return to London on Monday or, which we strongly recommend, spend a further two days visiting the reconstruction work in the devastated areas of the North. Arrangements for this extended visit are well advanced, and we shall shortly circularise all those who have signified their intention of joining the party, giving full particulars as to routes and expense.

Further applications to join the party can only be entertained in the event of members who have already intimated their intention of going finding it impossible to do so, and thereby creating vacancies.

New German Combinations.

A new concentration movement in connection with coal and steel interests on the one hand and electrical undertakings on the other is now in progress in Germany. The former are represented by the Phœnix Mining and Ironworks Co., of Hoerde, and the latter by the Saxony Electrical Works, of Dresden, and the Schorch Electrical Works, of Rheydt. It has already been decided to increase the share capital of the Saxony works from 78,600,000 to 143,000,000 marks. Of this an amount of 26,600,000 marks will be taken over by the Phœnix Company, while the Schorch works are to be brought into close financial connection with the Saxony works. It is reported that other undertakings are also to be included in this new group. Further information has been received to the effect that two associations of merchant electrical firms in Germany have decided to amalgamate under the title of the Association of Electrical Wholesalers and Exporters, with offices in Berlin.

MANSFIELD ELECTRICITY SUPPLY UNDERTAKING.

Mansfield is a twentieth-century development. In 1901, when the electricity undertaking was mooted, the population was 21,000. Now, within four miles of the Town Hall, there are over 105,000 souls. They are still coming, and likely to come—the district being one of the richest in coal in the country, while cotton doubling, boot making, hosiery, ironfounding, quarrying, and tin-box making flourish exceedingly.

Until recently the growth of the Mansfield electricity undertaking has borne little relation to that of the rapidly increasing district it is supposed to cater for. Even now the capacity is small for such a population.

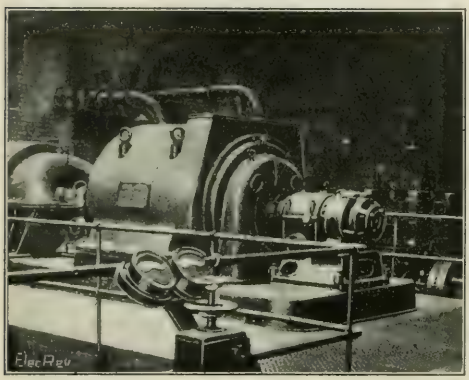


Fig. 1.—Willans-G.E.C. 1,500 kW Turbo-generator.

Due to conservative policy, fear of killing the gas department too soon, and perhaps other influences of a more subtle character not known elsewhere, until quite recently, the generating plant had not been extended since 1911, though the increase in demand had been considerable. In 1913 the limit of reserve was reached, and passed; and 1914 found the load on the works greatly in excess of the normal plant capacity, with reserve. This position was accentuated in 1915 when the supply of electricity to the large Military Camp at Clipstone was undertaken. To enable this to be done, two 250-kW rotary converters, running inverted, were installed. The undertaking, due, shall we say, to good fortune, in spite of overloading and the impossibility of proper overhaul and repairs, experienced no breakdowns, such stoppages as did occur being due to air raids.

In 1917 a serious, but unsuccessful, attempt was made to obtain sanction to extensions from the Ministry of Munitions. At that time, it will be remembered, the coal conservators were in power, and the immediate scrapping of all stations of a capacity less than 100,000 kilowatts was the ruling idea, so Mansfield had to wait until 1919, when permission to extend was given by a less idealistic body.

Orders were placed and contracts entered into, but the times were bad, the builders were at the height of their housing triumph, labour was very difficult, very dear, very slow, and very careless. In consequence two years elapsed before the supply from the new plant was available. It was finally started up in December, 1921, and has been running satisfactorily since then.

The station as now equipped contains three 200-kW Parker-Alley and one 400-kW Belliss-B.T.H. d.c. sets, all equipped with Ledward ejector condensers, and one 1,500-kW Willans-G.E.C. turbo-alternator and surface condenser with Rees Roturbo pumps. There is space in the new building extension for a further 1,500- or 2,000-kW set. There are two 250- and one 500-kW B.T.H. rotary converters; the former are arranged for both direct and inverted running, and are fitted with exciters and induction regulators.

The switchboards, of a total length of nearly 100 feet, comprise five h.p. stoneware cubicles with separate control panels; a rotary converter board with duplicate busbars, and throw-overs for either lighting or traction on the d.c. side, all supplied by the B.T.H. Company; five d.c. generator and battery panels, and 16 feeder panels by Messrs. Bertram Thomas.

There are two storage batteries. One is of the Tudor type, with 292 cells, 1,000-ampere-hour capacity, used generally with the public supply; the other is a D.P. battery of 267 cells, 720 ampere-hour capacity, used in conjunction with a Crompton auto-booster for traction. The latter machine is a development of the original booster made to Mr. Hewlett's specification for Mount Morgan in 1897. The batteries can be used on either supply. The boiler house contains at present three Lancashire 30 ft. by 8 ft., and two Babcock 12,000-lb. boilers, with space for a further extension of 30,000 lb. Water for condensing is obtained from the little River Maun (from which the town gets its name) by two separate pipe lines of 15 in. and 20 in. diameter respectively; the flow is generally sufficient for the needs of the works, but cooling towers are contemplated for the future.

The present stage of development is a transitory one, and the running arrangements are necessarily complicated. The reciprocating plant and batteries are available as reserve up to 1,200 kilowatts, and 500 kilowatts are available either way. The rotaries can be run on either general or traction supply. The water-tube boilers are arranged to supply saturated or superheated steam as required.

The general routine of operation for economical running is as follows: The turbo set takes the load from early morning until after the peak, when one or more reciprocators are run up and changed over. At or before midnight the batteries are used, with one rotary running inverted for the high-pressure supply. The Belliss engine is coupled to two dynamos in tandem, and a good deal of the lighter work is done with this; one dynamo on general supply and the other on

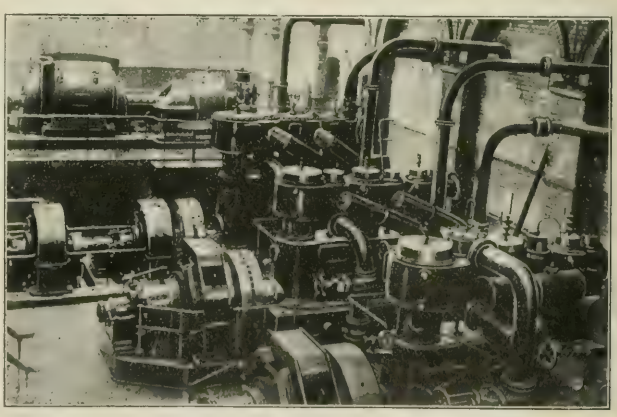


Fig. 2.—Reciprocating Sets and Turbo-generator.

traction. There is a good deal of changing over, which the excellent design of the switchgear makes simple and safe.

The station is further complicated by a "dust factory" or refuse destructor, from which steam is obtained in the way common to such combinations.

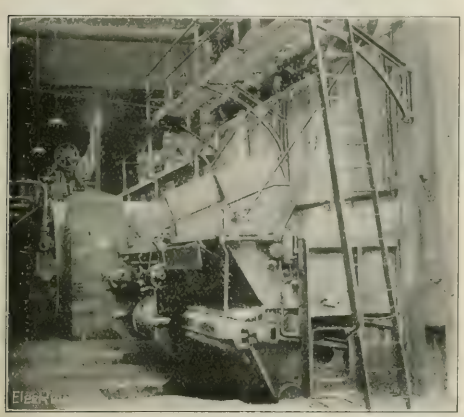


Fig. 3.—The Boiler-House.

Outside the station the past year has seen considerable development. Two new d.c. and one high-pressure a.c. feeders have been laid, at a cost of £12,000, and a similar sum has been spent on supplies to two housing schemes. There are at present over 50 miles of mains, and 100 public lamps are connected.

Mr. E. Holcombe Hewlett, M.I.E.E., M.Am.I.E.E., is the borough electrical engineer, and since 1906 he has been solely responsible for all work that has been carried out; we are indebted to him for the foregoing particulars and for the photographs reproduced herewith.

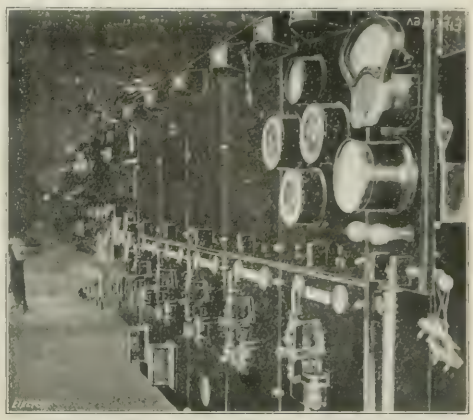


Fig. 4.—High-pressure Switchgear.

ELECTRICAL PROGRESS IN SOUTH AMERICA.

Brazilian Developments Active. Chilean Wireless Extensions. British Contracts Placed.

(By Our Special Correspondent.)

The numerous reports which have been made, at the request of the Brazilian Government, upon the possibilities of utilising the Iguasú Falls for electric lighting and power, have at length resulted in some definite practical steps being taken. The Brazilian diplomatic representative in Buenos Aires has officially informed the Argentine Minister of Foreign Affairs that his Government has accepted the general conditions of the projected treaty proposed by the Argentine Ministry of Foreign Affairs for harnessing the Iguazú Falls and transmitting electricity to the capital of Argentina and other important cities *en route*. This long-outstanding matter having been satisfactorily arranged from a diplomatic point of view, the commercial prospect assumes a more promising aspect. We understand that an American and British syndicate has promised the greater part of the capital necessary for the comprehensive exploitation of these remarkable falls, the commercial possibilities of which have already been commented upon in these columns.

An important alteration in the proprietorship of the Companhia Telefónica Rio Grandense, in Brazil, has recently taken place. The former owner of the power station at Bagé has effected a sale of his power to the firm of Superville, Barbará, Buxton, Guilaym y Cia., which, for the purpose of acquisition, has formed a capital of 1,300,000 milreis, the whole of which has been paid up. It is intended to introduce a number of much-needed improvements in the service of illumination and distribution of power, and, to effect this, an entirely new equipment has been ordered. It is satisfactory to know that the contract has been awarded to a British firm at Liverpool, which is now busily engaged in carrying out the manufacture of the various machinery and equipment which will form the new plant. Much progress has already been made, and it is hoped that the first shipment will take place this month (August). British engineers will be dispatched to Brazil for the purpose of erecting the machinery and seeing it at work before the plant is finally handed over to the new proprietors.

Of all the Brazilian States forming the Union, 20 in number, Sao Paulo has been the most progressive with regard to hydroelectric development. In this part of the country coal is not to be obtained except by importation, the State, geologically, being bare of the mineral. Adjoining provinces are equally unfortunate; the nearest approach to a coal deposit is a form of lignite, which is 25 per cent. ash, and, therefore, of very little value as a fuel. On the other hand, there is an abundant supply of latent water-power, only a small part of which has been developed by hydro-electric installations; but it may be said with truth that no other State in South America is so highly advanced in this respect. All important towns and cities of the State of Sao Paulo have their individual electrical plants, industrial development being greatly assisted by the cheap and continuous power provided. In this part of the Republic are found the headwaters of various rivers forming the main feeders of the vast River Plate basin of Paraguay and Argentina. On the borders of the State no fewer than eight good-sized rivers run their courses; while the country, being of a very mountainous character, provides a number of falls and rapids which could be made to furnish never-failing water-power supplies. A careful computation has been made of the power available in this State; this has been placed at 2,800,000 h.p. in water falls, of which, rather less than one-tenth has been as yet adapted to electrical use.

The Chilean Government has placed a number of orders with European firms, as well as with others in the United States, for the erection of new wireless stations. Among the latest opened by the Navy Department has been a station at Puerto Bories, Ultima Esperanza,

located in the southernmost part of the Republic. Other wireless stations have been established in the Magellan Territory, Tierra del Fuego and in the Patagonian channel region. Work upon these installations has been practically completed, and either the President or one of his Ministers will be invited to open them officially with becoming ceremony. When the whole chain of stations is finished and ready to operate, the Chilean wireless system will unite even the most remote southern parts of the Republic, such as Punta Arenas, with the rest of the country.

A number of graduates of the Santiago Vocational School have recently been dispatched by the Chilean Government to the United States under contract with the Westinghouse Electric Co. to carry out advanced work in the shops of that firm, and, later on, return to Chile as electricians in connection with the Westinghouse contract for the electrification of the railway now being constructed between the port of Valparaiso and the capital, Santiago.

In Columbia, wireless telegraphy is making satisfactory progress. At the request of the Columbian Government at Bogotá, the British Marconi Co. has dispatched a representative, accompanied by a number of technical experts, charged with the task of opening wireless stations at Cucutá, Medellín, Barranquilla, and the central station at Bogotá. The last-named receiving-station is located at Cerrito and the sending station at Chapinera, the two being united by a cable which extends to the central telegraph office. For some considerable time past three young Colombian electrical engineers chosen by the Minister of Hacienda (Promotion) for their conspicuous ability and technical enthusiasm, have been studying wireless telegraphy in London. These promising young engineers are now on their way back to Colombia, and upon their arrival there they will take charge of the station about to be opened.

In Cuba, an organisation known as the Radio Corporation has been formed for the purpose of the importation and sale of radio apparatus. It is hoped that suitable arrangements may be made with British manufacturers of this class of plant, which enjoys a high reputation throughout the Caribbean, and, indeed, throughout South America. The 100-ft. wireless towers of the transmission station of the Cuban Telephone Co. have now been completed, thus enabling Habaña, the capital and chief port of the island, to receive broadcasting from such points in the United States of America as New York, Philadelphia, Pittsburg, Detroit, and other cities. The Cubans are particularly enthusiastic with regard to the progress of wireless telegraphy and telephony, while the Government affords every legitimate encouragement to foreign inventors to bring their ideas before its notice officially. It may, perhaps, be pointed out, however, that this is not a particularly auspicious moment for British contractors to enter into commercial arrangements with the Cuban Government, whose position is rendered insecure owing to internal disturbances and the threatened interference of the United States Government, due to charges of corruption and faulty native administration which have been rightly or wrongly, brought against the present Government.

On the other hand, the present is considered a specially favourable opportunity for British electrical engineers to take up extension and new contract work in South America, owing to the more favourable position of British manufacturers, in comparison with that of American companies, French companies, and German contractors, owing to the effects of their depreciated currency on cable costs. The office of origin usually collects the entire charge for messages for wire and radio communication filed with it, balancing accounts at regular intervals with connecting companies. In the United States, all payments are made in dollars; but in France accounts for cable service are settled in francs at an exchange rate that produces a dollar value of less than 50 per cent. Thus the cost of cabling is 25 cents per word, and the return message is paid for at 11.6 cents per word. The result is that American cable companies have lost money on westbound traffic from France, while a similar situation exists in Latin America, where the currency has a depreciated value in dollars. It is not difficult to understand why the position of the United Kingdom should be a favourable one. British companies connecting in South America with a French cable have solved the exchange difficulty by exacting payment in sterling or francs at the current rate of exchange. The action of the French Government in fixing the value of the franc for telegraph tariffs has been accelerated by the heavy deficit of the Administration of Posts and Telegraphs for 1921, amounting to nearly 2,000,000,000 fr. As the franc is the unit for telegraph tariffs, under the conventions of St. Petersburg and London, the establishment by France of a fixed currency value for the gold franc is likely to be followed by similar action in other signatory countries having depreciated paper currency, and may even have some effect on international tariffs in general.

NOTES FROM INDIA.

(From Our Special Correspondent.)

Darjeeling.—Government has notified in a recent *Gazette* that land in the Darjeeling district is likely to be needed for the construction of an electric power line from the Balasan River to Kurseong. The line will, it is surmised, pass through the Darjeeling and Kurseong Tea Gardens so as to enable planters to make use of motors for driving tea machinery all through the manufacturing season.

Kurseong is a popular little hill station at an altitude of about 5,000 feet, where a fair load for hotel, school and road lighting might be counted on, and also a good load for railway workshops and bungalows. Eventually it is hoped that it may be possible to electrify the Darjeeling Himalayan Railway—a narrow-gauge tortuous line of about 50 miles, between Siliguri and Darjeeling, which is 7,200 feet above sea level. This latter hill station, it may be noted, has a pioneer hydro-electric plant, put down as far back as about 1900. It was a small affair with an awkward periodicity for motors, but it has worked very successfully, and does credit to its designer and to all concerned in its running and upkeep since it was first installed. Very many isolated water-power electric plants are to be found on tea plantations in the Darjeeling and Kurseong districts, but all suffer from the same complaint—scarcity of water during the dry season from March to the end of June, when the monsoon rains flood the hill streams again and a plentiful supply may be counted on for at least six months.

Delhi.—Much controversy has recently taken place as to whether the new Delhi Capital scheme should be continued. Millions have already been spent on buildings, roads, drainage, and electric light and power, but it is argued on various grounds that even at this late hour—the work has been in hand now for about 10 years—it will be more economical in the end to abandon the project than continue lavishing money, that can ill be spared, on a capital which nobody wants. In spite, however, of these arguments, Government has no intention at present of stopping the work, and the construction of Government House, the new Secretariat, and numerous other incidental buildings is being proceeded with actively. Miles of underground cable are being laid, and new transformer stations are being built; and, when completed, the arrangements which are being made for street, road, and avenue electric lighting should eventuate in a very fine scheme indeed. As the policy of the Indian Government is to encourage as far as possible Indian industrial development, it is anticipated that all the poles and castings for this work can be satisfactorily made in India.

Insulators.—A new and very up-to-date pottery work

in Bengal is now manufacturing a large proportion of the insulators required for India, both for Government and for private work. Insulators for 10,000-volt transmission lines have been successfully made, and orders are pouring in to the works from all over the country. Also such trifles as switches, distribution boards, cut-outs, &c., are being turned out by the hundred gross, and special machinery for stamping terminals has been laid down. Undoubtedly British manufacturers of kindred material will feel the influence of this new factory upon their order sheets; but it is inevitable as time goes on that, aided and encouraged by the Government, more and more of the simpler type of electrical requirements will be locally produced. Attempts have been made to manufacture small motors, but it cannot be said that the results have been striking.

THE EFFECT OF WATER-POWER DEVELOPMENT ABROAD ON OUR MANUFACTURING POSITION.

By W. T. WARDALE, A.M.I.E.E.

The modern development of large water powers in all parts of the world sometimes gives rise to the question as to what will be the result of this development on our own position as a manufacturing nation. Will the power so developed involve the gradual slipping away of markets which we now hold, and the establishment of similar industries within economical distance, as regards power transmission, of the great waterfalls?

At first sight this seems to be an inevitable corollary of the above-noted water-power development, and it is quite certain that a good deal of work will in future be carried out in such countries as Sweden, New Zealand, and India, which in the past has been the monopoly almost of the coal-producing countries.

Iron, for instance, can be extracted and worked *electrically* at a much cheaper rate in Sweden than in our own country on account of Sweden's water-power resources; and it is quite a reasonable idea to consider that in the near future, steel for ship plates, boiler plates, and bridge building, may be produced there at a cheaper rate than in this country under the present conditions. India is prepared to supply herself with steel and also with cotton goods of certain qualities, and is making good progress with further works of a similar nature; and wherever iron ore, water power, and a sufficient supply of refractory materials can be found in close proximity, the iron trade will tend to centre and to expand to the limit of the water power—but scarcely any further.

This point, the limitation of water-powers, seems to be overlooked as a rule when Cassandra-like prophecies of our own early industrial extinction are indulged in; but it is a very real limit, and one which in the case of Switzerland, and certain portions of the Western States of America, has been experienced already.

In the States several of the plants near to the Mexican border have experienced the limitation of output alluded to, and have had to consider the installation of fuel-driven machinery, placed not near the falls of the rivers, but well down towards where the great towns lie, and where ample water can be secured for condensing purposes, and coal or oil delivered by train or barge at a reasonable cost. This limit must be reached at every water-power site sooner or later, and, owing to the development of those activities which always follow the establishment of a cheap source of power, the lands so favoured will become more and more power-using countries than they have been in the past. Thus, for some time, we ourselves should be busy in manufacturing and equipping plant for steel works, cotton mills, and shipbuilding yards, in order that these people may have such plant and tools to start working with; for at present many of them have not the experience to make and erect their own. Here, again, these activities will lead to money being handled by the native population in considerably larger sums than has been the case; and they will demand more and more of those things which we and other countries have to offer, and which they, at present, do not or cannot make. The low-paid labour of these lands will also assist us in the handling of the problem, for it is quite certain that when once the works indicated are started, native labour will find itself at a premium in many lines, and will have to be remunerated on a higher scale than has been the case; just as in Finland and other European countries, the establishment of a regular market in any one line as a result of good power facilities, will soon tend to lift the wages level to that of the highest-paid lands in Europe, and so assist to equalise matters somewhat as between one country and another.

The effect will come gradually, as, owing to the demands of railways in the newer countries, we ought to experience a fairly good time in making generating, transmitting, and running plant for these concerns, and in keeping our ships busy in taking plant to them and bringing food, wool, and other products home again.

Our own coal-producing and handling trade will have to come into line, produce with modern plant, in modern ways, and cease to look upon the trade as a means of holding the country by the throat, either for the purpose of wringing profits out of the nation or of making it pay higher wages than industry can stand. Unless this be done, and done willingly, the products of the works situated in countries having abundant water-powers will come here in larger and larger quantities, whilst the demand for coal will shrink until half our pits cannot find a market for their output; to some extent this is already being experienced as the result of the trade slump and of the equipment of a proportion of our best ships with oil fuel-burning apparatus. The equipment of the pits with the speediest and most modern types of coal-cutting and coal-handling plant will do a good deal to bring down our own fuel costs as a manufacturing nation: whilst the extended use of low-temperature carbonisation plant will tend to give us a good, cheap, and clean fuel, and to save for us those valuable by-products which at present are so often destroyed in boiler furnaces, and which we cheerfully buy from abroad when we might make them at home, saving ourselves a considerable sum of money annually, and providing work for large numbers of our population.

The development of the water-power abroad, therefore, will tend to make our own industries modernise their plant and methods or remain idle. Should this latter phase of the matter be developed by the reluctance either of owners to spend money in modernising their plant or of the men to give a good output per man per day, then it may be taken that these manufacturing plants will not stand idle any longer than will suffice to bring down their shares to a give-away price; they will then be snapped up by enterprising men, who will re-equip the plant and train men to carry out what will be virtually new processes which our present men will not understand, because they have refused to do so.

When the limit of the water-power development in any such country is reached, it will then possess a population which has changed from one which led a fairly primitive type of existence, to a community demanding most of the amenities of modern civilisation: owing to the development noted, their [illegible] will only be able to supply a portion of these [illegible] and commodities, the rest having to be found from those countries which possess coal or oil fuel in fair abundance and under fairly workable conditions.

It has been stated that the end of the present supply of oil fuel can be already observed; as our own coal deposits may last for some considerable time to come, it follows that with the loading up of the world's large water-powers, the demand for manufactured goods will come back to those countries not only having good natural coal supplies, but which have the benefit of being situated within the temperate zone in which men can work at a reasonable output in comfort all the year round.

The tendency outlined above can be observed in Europe, in Sweden, where industrial activity is increasing as the result of water-power development, and in India, where steel works and cotton mills are being run under native management, with power from their large watersheds. The other portion of the matter has two sides to it; one, the spectacle of Switzerland having to consider the encouragement of all-night working in some of her industries because the available *economic* water-power development has been reached, and also in the States, where the use of automatic inductor generator stations, situated in adjacent valleys, and tapping small sources of water-power, has been brought to a considerable degree of efficiency; these plants requiring practically no supervision, making use of a cheap and hardy type of generator, and feeding into the main ring at points convenient to the valley and the general supply. The second consideration on this side of the matter is the fact that in our own country we possess large quantities of easily-won refractory materials, which make the working of iron and steel efficient and easy; and these refractories and fluxes are, as a rule, situated in fairly close proximity to the steel and iron-producing centres. Also, the valuable natural asset possessed by South-East Lancashire in particular, in having a naturally humid climate, means that textile goods of fine quality can be spun and manufactured with higher efficiency than in any other part of the world, and that textile engineering will always tend to centralise in that area.

The development of foreign water-powers should therefore make us busy as a manufacturing nation in building plant to be used in conjunction with these power supplies, should make our coal and iron trades recognise that there must be an end to exploitation of the nation for the benefit of a particular industry, and by the time the water-powers are gradually developed to their full extent, should give us ample markets containing large populations demanding our goods, because their own lands have gone beyond the economic limit of their own home production.

ELECTRICITY SUPPLY IN SOUTH AFRICA.*

Electricity Commission and Control Board.

The decision of the Government of the Union of South Africa to commence the electrification of the country's railways during a period of acute financial stringency was a momentous one, but that it was justified would seem to follow from the fact that it is estimated that the financial result of the electrification of one of the initial sections alone will be a saving in working expenses, as compared with steam traction, of no less than £237,510, or 215 per cent., on the net capital outlay.

It will be remembered that in 1917 Messrs. Merz & McLellan, consulting electrical engineers of London, were commissioned to consider the subject, and their report was submitted to the Union Parliament in September, 1919. The Railways and Harbours Board and the Government approved of the proposals made therein and a commencement of the work of conversion was made early this year. The scheme is understood to be one of the largest outside the U.S.A., and the first two sections to be electrified will afford experience of electric traction as applied to both suburban and main lines; the Howick branch line of 24 miles, which diverges from the Glencoe Junction-Pietermaritzburg section at Merrivale, will be worked on the multiple-unit system, while the Glencoe Junction-Pietermaritzburg section of the Natal main line, 171 miles in length, will be operated by means of electric locomotives.

In adopting the railway electrification scheme the advantage of modernising methods of transport was the main, though by no means the only, consideration, for the scheme was regarded not merely as a means of improving railway haulage, but as the beginning of the electrification of the country as a whole. Reasons of economy, therefore, dictated that the electricity generating stations which it would be necessary to establish to meet the railway demands should also supply electricity for municipal, industrial, and general purposes within the economic radius of the transmission system.

The Government realised this fact, and accordingly instructed Messrs. Merz & McLellan to investigate the general subject of electricity supply in the Union. The resulting reports were issued in April, 1920, and November, 1921, and the views expressed therein induced the Government to decide on the centralisation and the generation of electricity used to establish regional systems of generation and distribution for all purposes. The necessary interlinking of the systems will be facilitated, it is hoped, by legislation that is about to receive which also provides that future development shall be along such lines as will ensure "an abundant supply of electricity at the lowest possible cost."

The work involved is considerable and important as it will be realised that the Government and people of South Africa have embarked on one of the most important and far-reaching development schemes that have been undertaken since the establishment of the Union. Funds have already been provided by Parliament for the initial portion of the work, the gross capital outlay on which is estimated at £4,453,690—and this is only a small portion of what the whole scheme promises to become. "A country possessing such valuable raw materials, situated as it is far from other industrial countries, seems bound to develop a number of new industries of this kind as soon as cheap power is available."

In a report dated January, 1916, the Development of Resources Committee of the South African Institute of Electrical Engineers drew attention to the remarkable opportunities for the manufacture, with the aid of electric power, of articles of commercial value extensively used by the agricultural and mining industries in South Africa. The latter industries utilise annually more than two million pounds' sterling worth of chemicals which at present are imported. The necessary raw materials are available in the Union, and with the provision of cheap power supplies South Africa will possess all the essential requirements for electro-chemical industries on a large scale.

By-product recovery from waste coal will be a feature of all super-power stations in future, and the consulting engineers have been asked to consider the advisability of designing the power stations to be built in connection with the railway electrification scheme, so that the necessary plant for the recovery of by-products can be added.

In England in 1920 the Nitrogen Products Committee appointed by the Ministry of Munitions reported most favourably on the prospects of coal by-product recovery in South Africa, and the distribution in bulk of cheap power should stimulate industrial activity and production and create a new spirit of enterprise in potential industries. To facilitate its intentions the Government drafted an Electricity Bill early in 1921; however, the drafting committee did not follow its instructions to frame the Bill on the lines of the Electricity (Supply) Act, 1919 (Great Britain) as recommended by Messrs. Merz and McLellan, and the result of its shortcomings was that the Bill was withdrawn entirely. The Bill was re-drafted and introduced as the Electricity Bill, 1922, when it was seen that much of the criticism of the first measure had been met.

The Bill provides for the establishment of an Electricity Supply Commission, to consist of not less than three and not more than five members, appointed by the Governor-General, who shall fix the term of office, salary, and conditions of appointment; at least one member shall give his whole time to the work of the Commission, the duties of which shall be:—

"(a) The establishment, maintenance and working of undertakings for an efficient supply of electricity, at as low a cost as possible, to Government departments, the S.A.

* This article is based on information obtained from the following sources: The Bill as introduced for the Union of South Africa; Reuter; Daily Service; the *S.A. Railways and Harbours Magazine*; the *S.A. Mining and Engineering Journal*; and the *Transactions* of the S.A. Institute of Electrical Engineers.

Railways and Harbours Administration, local authorities, companies, and other persons carrying on industrial undertakings, or any other persons whatsoever in the Union; "(*b*) the investigation of new or additional facilities for the supply of electricity within any area and the better co-ordination and co-operation of existing undertakings, so as to stimulate the provision, wherever required, of a cheap and abundant supply of electricity."

The Commission will have power, *inter alia*, to (*c*) raise money by way of loan; "(*d*) acquire by purchase, lease, or otherwise, land or rights or interests in or over land, water rights, rights to coal, and to property of any description whatsoever, and to work or otherwise beneficially use any property or rights so acquired; (*e*) acquire by purchase, lease, or otherwise, or to construct and to maintain, alter, or improve buildings, machinery, plant, transmission and distribution lines, waterworks, reservoirs, railways, roads, bridges water-courses, pipe-lines, and any other apparatus or works; . . . . (*k*) purchase or sell coal or other fuel, steam, water, and other materials and stores; (*l*) manufacture and sell any by-products incidental to the efficient carrying on of any work or undertaking which is within its duties, functions or powers."

Before the Commission can establish or acquire an electricity undertaking a permit therefor must be obtained from the Electricity Control Board and the Minister of Mines and Industries must approve of the scheme; the Governor-General can then authorise the Commission to raise by way of loan the capital necessary for financing the scheme. Should it appear that any undertaking established or acquired by the Commission can be more advantageously worked by another undertaker than itself, the Commission can (with the approval of the Governor-General and the Electricity Control Board) call for tenders for the working of the undertaking. It shall be the principle of the Commission that its undertakings shall be carried on neither at a profit nor loss, and its charges for electricity shall be adjusted accordingly.

For the purpose of controlling the supply of electricity by the Commission the Minister of Mines and Industries shall designate no fewer than three or more than five persons to be an Electricity Control Board, which shall have all the powers, jurisdictions and privileges described in Act No. 6 of 1918.

Neither the Commission, nor any person, company, or association, shall carry on or engage in any manner in any existing or future public electricity supply undertaking except by permission of the Electricity Control Board. But no such permit shall be necessary to authorise the generation or supply of electricity by any Government department, or the S.A. Railways and Harbours Administration, any urban local authority, or any undertaking the rated capacity of which is under 500 kW per annum. Any person or association may, without a licence, generate for his or its own use any quantity of electricity, but the supply thereof shall comply with any requirements of the Electricity Control Board made to facilitate co-ordination with other existing or future undertakings. Such a person or association, a Government department, and the S.A. Railways and Harbours Administration, may also supply electricity to other persons, up to 1,000,000 kWh per annum, without needing a licence for the generating station. A licence other than one held by the Commission shall contain a schedule of standard prices chargeable by the licensee, and surplus profits shall be shared with consumers. An appeal can be made to the Electricity Control Board in the case of delay or refusal of the licensee to supply any applicant, and 38 years after the granting of a licence the Governor-General may, subject to two years' notice, expropriate the licensed undertaking on payment of the value thereof at the time of expropriation, no allowance being made by reason that the purchase is compulsory, for goodwill, prospective profits, or similar considerations.

The generation and distribution of electricity within an urban local authority's area shall be under the control of that authority, but the Electricity Control Board's permission shall be necessary for such an authority to supply electricity outside its area; no person or body shall supply electricity within a local authority's area without the latter's consent.

In cases of appeals against the decisions of the Electricity Control Board the decision of the Minister of Mines and Industries shall be final, and with regard to the penalties for contravention of the Act, it is provided, *inter alia*, that an undertaker shall be liable to a fine not exceeding £50 for every day that his failure to comply with the provisions continues, and, in addition, he may be ordered to forfeit the whole of the net revenue derived from the undertaking.

This Bill passed through Parliament before the end of the session in July last. "The general principle of the Bill could not be altered in Select Committee, and the two authorities—the Electricity Supply Commission and the Electricity Control Board—remain as in the original draft; but with vital differences in their constitution. It was feared by many that the Railway Administration might desire to obtain a dominating influence on both these bodies for its own purposes, which would have been highly undesirable for many reasons. The objection has been met by the Select Committee, and no official in the employ of the Railway Administration can now be appointed either to the Supply Commission or to the Control Board. Appointments to the Control Board, too, need no longer be made solely from the Civil Service, though Civil Servants may still be members of the Board. The main criticism against the original Bill was that it gave the Supply Commission special privileges against other undertakers, which might effectually close the door against private enterprise. The criticism has been faced boldly by the Select Committee, which has introduced the important principle that, before establishing any new undertaking, the Commission shall call for tenders, which shall be referred to the Control Board and the Minister. Only after expert advice on them has been given, and after the most careful consideration, shall the Government decide between the Commission and any tenderer. There is, too, an additional safeguard now. Five years after the Commission has established an undertaking, or later if the Minister of Mines and Industries is of the opinion that such an undertaking might be more advantageously worked by another undertaker, tenders for its operation are to be invited. The new provision is, perhaps, the best practical method that could be devised to ensure economical working. The original clause empowering the Commission to differentiate in its charges as between various classes of consumers—a privilege expressly denied to other undertakers—has been deleted, and the Commission is now rightly placed in the same position as other licensed undertakers. A schedule of standard prices will be fixed, subject to periodic revision by the Control Board. These are the main modifications which have been introduced into the Bill. As to the desirability of the Bill in principle there is no controversy, and everyone will hope that it may achieve its essential object of enabling the railways and other industries to obtain cheap electric power."

The magnitude of the task of electrifying the country's railways is indicated by the following figures: Less than 60 years ago there were no railways in South Africa, but, according to Sir W. W. Hoy (general manager of the S.A. Railways and Harbours), there exists to-day a network of 15,000 miles of railways in the Union and adjoining territories, the longest through route being from Cape Town to the Belgian Congo, a distance of 2,600 miles. Since the establishment of the Union on May 31st, 1910, the open mileage of the State-owned lines has increased by 2,650 miles, or 39 per cent., while the mileage worked has increased by nearly 4,000 miles, or roughly 53 per cent. The capital outlay on the system amounts to £100,000,000, having increased by 37 per cent. since 1909, and the general traffic development during the same period is reflected by the following increases: Train-miles, 16,312,000, or 83 per cent.; passengers carried 36,000,000, or 127 per cent.; tonnage of goods carried 3,748,000, or 100 per cent.; tonnage of coal carried 3,752,000, or 72 per cent.; total earnings £13,162,000, or 126 per cent.; earnings per average open mile £940, or 126 per cent.

The physical features of the country traversed by the South African railways vary greatly; on the main lines from the seaboard to Johannesburg the ruling gradients are 1 in 40 in the coastal region, and 1 in 80 inland, whilst the sharpest curve has a radius of 300 ft., and the highest altitude reached is 6,463 ft.

With regard to the general supply of electricity in the Union the Summary of Sir R. N. Kotze (Government Mining Engineer) presents a fairly accurate picture of the present position:—

The only undertaking in South Africa which generates and sells electricity on a scale comparable to that of the world's largest undertakings is the Victoria Falls & Transvaal Power Co., Ltd. With its subsidiary company, the Rand Mines Power Supply Co., Ltd., it supplied, during 1921, 804,000,000 electrical units from its four generating stations at Rosherville, Simmer Pan, Brakpan, and Vereeniging, which have a total plant capacity of 219,500 kVA. Its consumers are mainly gold mines on the Witwatersrand, but some of the municipalities on the Rand also purchase a bulk supply from it, and there are sundry other consumers, such as factories, steel and iron works at Vereeniging, &c.

Before the days of the Victoria Falls Power Co. nearly all the mines on the Rand generated their own electricity, and its principal use was for lighting purposes. The close association of some mines led to the establishment of central stations for groups of mines, and to this class belong the stations of the Randfontein Estates (26,000 kW), the East Rand Proprietary Mines (22,000 kW), and the Kleinfontein Association (6,000 kW), which supply electricity for both light and power, and which to some extent also sell power to neighbouring municipalities and a few other consumers. The central power station (17,000 kW) of the De Beers Co. at Kimberley, had a similar origin, and, besides supplying the needs of the mining company itself, furnishes light and power, to the extent of three and a half million units, to the municipality and tramways of Kimberley.

The other companies selling electricity all operate on a smaller scale and generate mostly for their own use. Two

of these is the Transvaal the Transvaal Gold Mining Estates [illegible] mining companies with [illegible] mining laws of that Province, and sell part of their electricity to other mining concerns and to the townships of Sabie and Pilgrim's Rest.

The larger municipalities have generating plant of their own, both for town lighting, for selling to consumers for light and power, and, in the case of several of them, for running tramways. The installations with a rated capacity of over 1,000 kW are the following:

	kW Capacity.
Johannesburg	13,750
Durban	10,000
Capetown	8,900
Port Elizabeth	3,500
Pretoria	3,200
Pietermaritzburg	2,200
East London	1,700
Bloemfontein	1,650

There are a further 33 municipalities with plant of a capacity mostly under 200 kW. Of other public undertakings of importance mention should be made of the two tramway companies in Capetown, which operate the city and Camp's Bay tramways. They use about five and a half million units per annum, which may be considered as equivalent to a capacity of about 2,500 kW. The Port Elizabeth Tramway Co. has a plant of 900 kW, and uses about 1,000,000 units per annum.

The South African Railways and Harbours Administration has, at the present time, before electric traction is adopted on any of its sections, a fairly large demand for electric power. Its 15 principal workshop and harbour depôts and 160 smaller installations are completely electrified, while the lighting of these and of railway premises and the charging of accumulators for coaches gives rise to a large demand. Over 20,000,000 units were consumed in 1921, and the major portion of this power was purchased from municipalities and transformed or converted as necessary. Durban supplied five million and Capetown four million units. The Pretoria demand of about one and a half million units is at present met by the Administration's station, but arrangements have been made to secure this and a much increased supply from the Pretoria Municipality's new plant. The Administration produces its own electric power at Uitenhage, De Aar, Beaufort West, Touws River, and Standerton. At these last-quoted localities the Administration also fulfils the requirements of the municipalities for a supply of lighting, but otherwise it is not its practice to sell electricity.

The remaining producers of electricity in the Union are private persons and companies who generate it for their own use. Some of these, such as the larger diamond, gold, and coal mining companies, have fairly large-sized plant, the Premier Diamond Mine's plant, for example, being rated at 5,250 kW. The total number of such establishments is given by Messrs. Merz and McLellan as 1,477, with a rated capacity of 115,171 h.p. From the statistics published by the Department of Mines and Industries for December 31st, 1919, it appears that there were in use in South Africa 13,458 electric motors of 595,702 total h.p., and of these 6,289 motors of 120,760 h.p. belonging to industrial concerns, as distinguished from mines.

As might be expected, the type of current adopted in South Africa varies a good deal. The Victoria Falls and Transvaal Power Co., the Randfontein undertaking and the municipalities of Durban and Bloemfontein have three-phase current, with a frequency of 50. Capetown and Johannesburg municipalities both have a two-phase, 50-cycle system and also direct current. Pretoria has direct current only. The smaller municipalities have mostly adopted direct current.

Prices paid naturally show great variation. The Victoria Falls Co. charges .525 penny per unit to consumers with a load factor of 70 per cent. and over, and a higher rate for lower factors. For supply to municipalities the company's tariff varies with the period of contract, and is built up of a charge proportional to the number of kW taken at the peak load and a charge on the units actually consumed. Provision is made in the company's licence for sharing surplus profits with consumers.

The larger municipalities have experimented in various forms of tariff, with more or less success in extending the consumption, but there appears to be little unanimity [illegible] to the most policy to adopt. [illegible] cities are hampered by the need for larger supply stations, and have to adopt their [illegible] to meet the situation.

South Africa cannot boast of water-power resources in the slightest degree comparably to those of Canada. In the Victoria Falls of the Zambesi and the Augrabies Falls of the Orange River [illegible] potential sources of a large quantity of power, but they are situated in areas at present remote from any considerable population, and it will be many years before they are utilised. There are in the Transvaal [illegible] a number of streams from which power could be generated, but their size, situation, &c., do not encourage the belief that anything but comparatively small amounts of power could be generated from them. These will be useful in time, and should be linked up with any general scheme of power supply to embrace the whole country, but they are more likely to be of local use than for transmission to distant consumers.

As against the "white coal" of Canada, South Africa has, in the Transvaal and Natal, and, to a less extent, in the Orange Free State, vast supplies of coal, which can be won at as low a cost as anywhere else in the world, and it is on this source of power that the country must rely. The initial cost of steam-driven generating stations is, of course, high, and the amortisation and interest on such plant alone constitute a heavy charge per unit for current supplied. Still, fuel supply is the next most important item of working expenditure, and ultimately a process may be evolved which will consist in the winning of by-products from coal and the utilisation of the balance, either directly or as producer gas, as fuel. This should yield electricity at a fairly low cost per unit.

For the present and in the immediate future South Africa must rely on coal as the source of power for any large generating plant.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JULY, 1922.

It will be noted with interest that the July returns of electrical exports from this country show a slight improvement, the total value recorded for the month was £809,915, as compared with £782,656 in June.

The electrical imports total of £184,979 for the month, as compared with the June figures of £202,481, represents a bigger falling off in value than in the previous month.

The re-exports, valued at £15,246, show a marked increase as compared with £11,543 recorded for June.

The increased value of the exports was due principally to improved business in the insulated wire and cable and telegraph and telephone wire and cable sections, while the figures for lamp exports show a falling-off of £9,000 as compared with June. In the electrical imports section the machinery totals were nearly £40,000 less than those for the previous month; an increase, however, of £20,000 was recorded in the telegraph and telephone imports section.

Values of Electrical Exports and Imports for July, 1922.

	Exports.	Imports.	Re-Exports.
	£	£	£
Electrical goods and apparatus	86,168	35,982	3,262
Insulated wires and cables ...	138,588	11,338	36
Glow lamps	19,491	12,970	216
Arc lamps and parts	690	928	—
Batteries and accumulators ...	43,630	3,591	95
Carbons	3,554	3,205	259
Meters and instruments ...	17,125	6,148	2,788
Electrical Machinery.			
Railway and tramway motors	20,594	—	—
Other motors and generators ...	136,012	—	—
Switchboard (not telegraph or telephone)	5,880	280	—
Electrical machinery (unenumerated	117,035	74,612	6,411
Telegraph and telephone cable and material.			
Telegraph and telephone wire and cable (not submarine) ...	61,756	2,010	667
Submarine telegraph and telephone cable	21,110	—	—
Telegraph and telephone instruments and apparatus ...	135,273	33,885	1,517
Total ...	£809,915	184,979	15,246

Glasgow Tramways Jubilee.—The city of Glasgow celebrated the jubilee of the tramways on August 18th with a pageant showing ancient and modern types of vehicles. At a luncheon which followed the toast of "The Corporation of Glasgow" was proposed by Alderman Clark, of Rochdale. Other toasts were "The Tramways Committee," by Councillor Mancor, Convener of the Edinburgh Tramways Committee, replied to by Bailie McWhirr, Convener of the Glasgow Tramways Committee; "The Staff, Past and Present," by Sir W. F. Russell, replied to by Mr. Barber Glenn, first secretary of the Glasgow Tramway Co.; Mr. John Young, general manager, Glasgow Corporation Tramways, 1894-1904; and Mr. James Dalrymple, the present general manager. In the evening a reception and dance took place, and every employé was presented with a one-pound Treasury note.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Portable Starter for Large Petrol Motors.

We recently attended a demonstration of an appliance invented by Mr. G. F. Whipple, 38, Newton Road, Rushton, Northants, for starting up the engines of vehicles of the charabanc type. This consists of a small electric motor which drives, through a single reduction gear, a shaft which is secured to the starting handle of the engine. The arrangement is shown in the accompanying illustration (fig. 1). As will be seen, the shaft passes through a ring mounted upon the motor, and it is held by three springs, which take up any

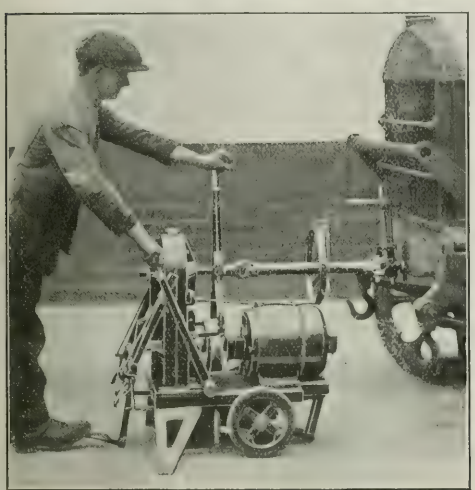


Fig. 1.—A Portable Petrol Motor Starter.

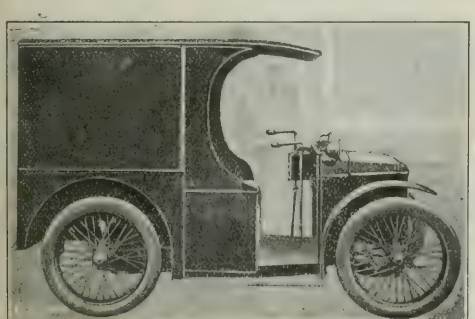


Fig. 2.—A 5-cwt. Electric Delivery Van.

displacement in any direction. A universal joint in the centre of the shaft performs a similar function. To the end of the shaft is fitted an arm, one end of which hooks over the front of the starting handle, while a semi-circular recess at the opposite end fits over the other end of the starting handle. The starting dogs are put into gear by means of a lever which pushes the shaft forward. The whole gear is mounted on a simple trolley, the wheels of which, when it is placed in position, are lifted clear of the floor by the lever seen upon the right of the appliance.

In depôts where it is necessary to start a number of large engines from "cold" every morning, the starter should prove of great utility.

A 5-cwt. Electric Delivery Van.

A small electric delivery van (fig. 2) for loads up to 5 cwt. has recently been put on the American market by the Automatic Transportation Co., of Buffalo, N.Y. It is propelled by a 24-volt, 35-ampere, series-wound motor located under the driver's seat and driving the near side rear wheel through the medium of a roller chain. Power is supplied by a battery of "Exide" accumulators, while the controller is arranged to give five positions, *viz.*, three forward speeds, a neutral position, and a reverse motion. The body of the van has a loading space of 3 ft. 5 in. by 3 ft. 2 in. by 3 ft. 11 in., equal to 38 cu. ft. The vehicle, which has a wheel base of 5 ft. 5 in. and weighs 9 cwt. complete, is fitted with 26-in. dia. wheels and 3-in. pneumatic tires.

The "Electri-Gas" Range.

The Magic Furnace Co., Boston, Mass., U.S.A., whose electric coal range was described in the Electrical Review of November 25th, 1921, has now produced a similar appliance in which both the electrical and gas methods are employed.

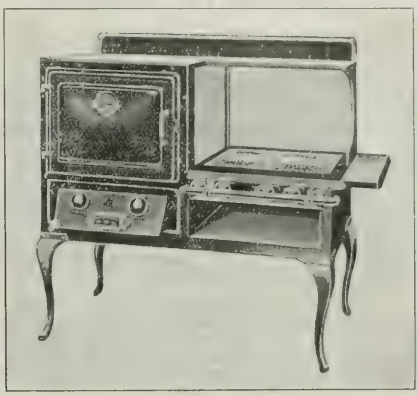


Fig. 3.—The "Electri-Gas" Range.

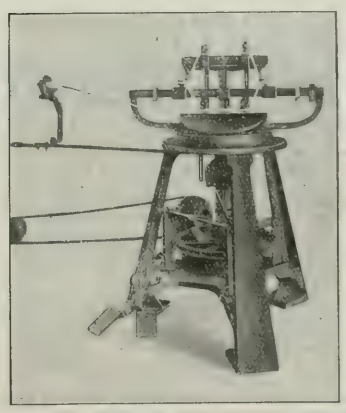


Fig. 4.—The "Quickway" Coil Forming Machine.

The electrical half consists of an oven measuring 18 in. in breadth and depth, and 14 in. in height, an electric grill, and an "outlet" receptacle for the operation of a washing machine, an electric iron, or other appliance. The gas half, which is on the right of the illustration (fig. 3), consists of five burners fitted beneath a perforated table. The gas is lighted electrically by the mere pressing of a button.

The "Quickway" Coil-forming Machine.

The Midland Dynamo & Motor Repairs Co., Ltd., Volta Works, 64, Belgrave Gate, Leicester, has sent us particulars of a new machine for winding and forming coils which possesses the merits of simplicity and ease of operation. This machine, known as the "Quickway," is illustrated in fig. 4. It is adjustable and can be sets up to the required dimensions of the coil in a few minutes. The conductors are arranged to be drawn through a friction clamp which adjusts the tension. The winding position of the machine is such that the wires require practically no handling as they are being fed into position. By means of a friction clutch the machine revolves and draws the wire along the track to form a hair-pin loop which has sides arranged at an angle to suit the slot in the armature which the coil is to occupy.

When the requisite number of turns has been made, by the simple movement of a lever through the friction drive, and by the same mechanism, the coil is stretched ready for taping. The time occupied in winding an average coil is two minutes. The advantages claimed for this machine by the inventor are its speed, simplicity, and efficiency; no wooden blocks or other accessories are required; the machine is a complete unit; and it will deal with all sizes of wire wound stator or armature coils found in practice. The machine is power-driven and can be directly coupled to a small high-speed motor, or shafting.

THE ELECTRICAL MANUFACTURING POSITION IN AUSTRALIA.

Australian newspapers to hand this week contain reports of the speech delivered at the annual meeting of the English Electric Co., of Australia, Ltd., held on June 15th, by Mr. J. B. Nicholson, the chairman. He first described the new works of the company, and the progress being made with manufacturing operations there. He said that the New South Wales Railway Commissioners had favoured them with substantial orders for turbo-alternators, some of which were nearing completion. In other directions they had not been so fortunate. An impression had got abroad that the class of machinery in which the company specialised, although subject to duty, might be allowed into Australia duty free by special regulation. Evidently "pressure had been brought to bear," and not only had importations been allowed duty free, but rebates of duty already paid had been allowed and refunds made in cash.

The position thus created, the chairman asserted, was a most serious one for the company. "Depending upon the declared policy of the Federal Government, and fortified by the promise of orders from the New South Wales Railway Commissioners (since fulfilled) and the Sydney City Council, the company had incurred great expense in laying out its works and equipping them for the manufacture of turbo-generators of large size and of assorted plant. They had felt confident that, with the assistance of designs and information supplied by the English Electric Co., Ltd., the Australian company could turn out such work as cheaply as it could be imported under the tariff. But not only had they had to face a tremendous slump in Home prices, but on top of that they had the action of the Federal Government referred to. In common with others engaged in the metal trades, the company expected to suffer during the present depression, but they were hopeful that, without reducing the standard of living at present enjoyed, some method might be discovered of arranging labour costs to meet competition, with the help of a tariff so compiled as to enable Australia to develop her resources and to employ her mechanics. In this connection he mentioned that English labour was paid 45s. for 55 hours' work. Taking into consideration hours of labour worked, labour costs there were just about one-third of those in Australia. Practically the whole of the cost of locally-made machinery was wages. The country produced all the raw material.

"The iron ore, limestone, and coal are mined by labour. Cartage, railage, or freight to the furnaces resolves itself into a question of labour. From the furnaces at Newcastle or Lithgow the pig-iron or steel is carried to the foundry. Again it is a question of wages cost, until the finished product is turned out of the machine shops. I believe that the only solution is in piece-work. We have to give a price for the work we undertake to carry out—why should not our men sub-contract for their share of it?"

At an extraordinary meeting which followed, a resolution was passed reducing the capital from £600,000 to £500,000 by cancelling 100,000 "A" paid-up ordinary shares of £1 each, which had been surrendered to the company. Mr. Nicholson explained that the company had made a deal with the holder of "A" ordinary shares, and through Standard Wagons, Ltd., had purchased them for £10,000. After the cancellation of these shares the item "goodwill" would disappear from the balance-sheet.

At about the date of the delivery of Mr. Nicholson's speech there appeared in the Australian newspapers a prospectus of the English Electric, Ltd., which was being floated with a capital of £750,000 in £10 shares, of which 40,000 10 per cent. cumulative participating preference) were being offered for public subscription. The vendor and promoter were to take 14,000 ordinary shares of £10 each in part payment. The directors of the company, as advertised, were to enter into a contract between C. Mac McLeod, of Sydney, of the one part, and Wm. Buck, of Melbourne, of the other part, acting on behalf of the company. It was to acquire and equip engineering workshops near Melbourne, Victoria, for the manufacture of all classes of electrical apparatus, including steam and hydro-electric generating equipment in all its several branches, dynamos, turbines, accumulators, fuses, magnetos, cut-outs, switchboards, converters, transformers, meters, and other measuring and recording instruments, regulators and rheostats, batteries, lighting sets, electric locomotives, railway and tramway rolling stock (electric) and appliances, electric furnaces, electric welding machines, and generally everything electrical.

The company was also to manufacture telephones, telegraph, wireless, and X-ray apparatus; and to lease, license or otherwise acquire rights, either separately or conjointly with others, to control, manage or otherwise water, coal and other schemes for the generation of electricity, to erect plant and equipment suitable for the purpose, and distribute, sell or otherwise dispose of the energy produced.

We quote from the prospectus the following optimistic forecast regarding the future electrical opportunities for economic manufacturing in Australia.

"Australia, and Victoria in particular, is rapidly developing enormous schemes for the supply of cheap electrical power, but, despite the fact that we produce the raw and manufactured materials in abundance no attempt has previously been made to manufacture complete electrical generating plant and other equipment in this country. This company contemplates the manufacture of all classes of electrical apparatus and appliances, and directly the works start operations will be in a position to equip huge schemes similar to the Great Morwell Brown Coal undertaking in Victoria, or the Great Lake Hydro-Electric Works in Tasmania, from the smallest switch to the largest generator. The company will be equally competent to manufacture electric tramway and railway rolling stock and undertake railway electrification similar to that in operation in Melbourne or the a.c. system. During the twelve months 1920-21, Australia's importations of the materials under review reached the colossal figures £3,281,164, and directly the electric supply schemes reaching the productive stage release their enormous power to the service of the community the importations will necessarily exceed these figures. The several schemes contemplate the production of several hundred thousand horse power and each 100,000 h.p. involves the consumers in an expenditure of approximately £26,000,000 in the purchase of motors and other services which this company will be in a position to supply. Assisted by a most substantial tariff and anti-dumping regulations designed to prevent overseas manufacturers competing in the Australian market to the detriment of the local industry, practically no opposition, a most up-to-date automatically controlled plant, and an enormous demand, both present and prospective, showing a substantial margin of profit, the company's prospects are exceptionably favourable. This fact induced the vendors to concede a 10 per cent. cumulative participating preferential dividend to the subscribers to this issue. The directors have full confidence that the company will successfully compete both as to quality and price with either foreign or interstate manufacturers, and that at all times the company will dispose of its total production at remunerative rates and more than adequate to maintain the payment of not less than 10 per cent. dividends."

"We would very much like to be making our own telephones, or having them made in Australia," Mr. Poynton, the Postmaster General, is reported by the *Melbourne Herald* to have said. "But the trouble is," he continued, "that a fact recently. "But the trouble is," he continued, "that a factory working solely on telephone material could turn out in one year more than would be required by us for several years, even though the demand for telephones is increasing. The only hope would be to comprise the manufacture of this one with something else. In this connection nothing of a practical nature has yet been placed before us."

Recently Mr. Poynton communicated with English firms, asking whether they would be prepared to inaugurate the manufacture of telephones in Australia. The replies received indicated that the firms would undertake the work provided they were guaranteed a certain amount over and above cost price—in other words, an assured profit. The Government did not see its way clear to agree to this. From time to time the department has been approached by company promoters, who sought assurances of Government contracts in the event of companies being formed to engage in the manufacture of telephones or telephone cable. In each case the department promised that it would give every assistance to local enterprise. So far, however, nothing definite has materialised.

The Italian Electrotechnical Association.—The 25th anniversary of the foundation of the Associazione Elettrotecnica Italiana will be celebrated at Milan on the occasion of the yearly meeting in October this year, to which representatives of foreign electrical associations will be invited. The meeting will last over eight days, and an interesting programme is arranged of visits to important stations and works in the neighbourhood, and of addresses on the drought crisis and its relation to electrical generation, modern high-speed hydraulic turbines, masts and standards for electric lines, aerial conductors, hung and pivoted insulators, dielectric losses in cables, protection against over-pressures, synchronous and autosynchronous motors, and static condensers.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Lightning Conductors of the County Hall.

In your description (August 11th) of the method of using the steel frame of the building as the connection from the points on the roofs to the ground, you remark: "it is believed to be the first example of this method of protection being adopted on a large scale." This plan was considered by the Lightning Research Committee and noted in its 1905 Report, and the Mersey Dock Board's Liver building was protected according to my specification as consulting engineer in a similar manner, which I also applied to the Royal Horticultural Hall and several other important buildings. It is gratifying to hear that the National Physical Laboratory has specified the method which was first installed at Liverpool.

Killingworth Hedges.

Westminster, *August 20th*, 1922.

The Village Power Station.

The communication from the secretary to the Electricity Commissioners, on page 195 of your issue for August 11th, is of interest to a considerable number of people.

The attitude of the Government, through the Commissioners, is difficult to understand. There are numerous small communities desiring to have a supply of electricity, whose situation makes it impossible for the national supply stations to reach them for the next ten or twenty years; and many other small towns and villages, which will always be outside the economical reach of the large schemes.

These communities first inquired about the matter, were told that the supply of electricity was being arranged for on a national basis, and were led to believe that they would be included in such provision. Then, on finding that after 3½ years practically nothing has been done for the large towns, they wish to install small plant of their own, which would in time become linked up to the larger scheme. Such plant is now forbidden to them; but they are told that if the supply is from a private, and not a public station, then they may go ahead.

Does this mean that if the local sawmills or corn mills install plant to light their own premises and provide some amount of power the sawmills may then sell energy to the village, as that will not constitute a public electricity supply? If so, it would be a good plan to make this plain.

During the last three years I have had to hang up, or have had hung up, owing to the do-nothing and dog-in-the-manger policy of the Commissioners, schemes which would have entailed orders for plant and overhead mains alone of well over £30,000; and still the game goes on, and still we pay doles to men out of work. Later on we shall pay doles to meet the loss on the national supply scheme, and then the Government no doubt will feel that the scheme really is launched.

Arcadia.

August 17th, 1922.

The Prospects for Young Engineers Abroad.

As an unemployed engineer, I am interested to know the possibilities of employment abroad, and if engineers with knowledge of conditions abroad would publish their views, I feel sure they would be of assistance to many.

What are the present-day prospects of employment for young technical men of limited experience with manufacturers, power companies, consultants, or railways in the United States, France, or Switzerland?

There are, of course, difficulties in the way, but emigration may be a solution of the problem of obtaining employment for those who cannot make any headway in this country.

Young Engineer.

London, *August 22nd*, 1922.

[We should be glad to receive information on this subject for publication dealing with the existing conditions not only in the countries named, but also in other foreign countries, and in the British Dominions and Colonies.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—Edward George Rowe, formerly trading as Davies & Rowe, electrical engineers and contractors, Tonypandy.—At Pontypridd Bankruptcy Court, on Saturday, the public examination was held. Debtor put his deficiency at £854, and stated that he had acted previously as a Post Office telegraphist. In February, 1919, upon demobilisation from the Army, he entered into partnership with Frederick Howell Davies, who had been formerly employed as a colliery electrician. They each put £20 into the business, which at first was successful. Eventually a slump in trade set in and creditors pressed. In March of this year the partnership was dissolved, the debtor paying £75 to his partner. A day book and ledger with debtors had been kept. The Deputy Official Receiver stated that sufficient money had been lodged with the Official Receiver to enable the creditors to be paid 20s. in the £, and costs of the proceedings, subject to a certain claim being withdrawn. The examination was closed, the Registrar commenting on the satisfactory features of the case.

Last day for proofs for dividend, September 6th. Trustee: Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff.

W. H. Borrows, engineer and electrician, Werrington, Northampton.—Receiving order made August 14th, on debtor's own petition.

W. Caldwell (Caldwell & Son), electrical engineer, 26, Victoria Road, Hale, Chester.—First meeting August 29th, at the Official Receiver's offices, Manchester. Public examination, September 15th, at the Court House, Manchester.

Joseph Ernest Rollinson, 5, Tavistock Chambers, Beastmarket Hill, Nottingham, electrical engineer and contractor.—The first meeting of creditors was held on August 21st, at the Official Receiver's offices, 4, Castle Place, Nottingham. According to the statement of affairs there was a deficiency of £643. It appeared that debtor was employed as an electrician until March, 1919, when he commenced business on his own account as an electrical engineer at his present address with £50 savings. He traded alone until February, 1921, when he was joined by a partner, who put in £400, but the partnership was dissolved in February last, debtor taking over the assets and liabilities, and continuing by himself. The liabilities were returned at £980, against net assets of £337. The creditors decided to appoint Mr. H. F. Holloway, of Messrs. Derbyshire Bros., as trustee, assisted by a committee of inspection.

A. J. Willcox, motor and electrical engineer, The Garage, Farnham Common.—First and final dividend of 4s. 6d. in the £, payable August 30th, at 28, Theobalds Road, W.C.1.

F. H. Dennis, electrical engineer, late of 20, High Street, Chelmsford.—Receiving order made August 19th, on debtor's own petition.

J. F. Ludlow & R. R. Ludlow (Ludlow Bros.), electrical contractors, 196, Church Road, Redfield, Bristol.—First and final dividend of 1s. 7½d. in the £ payable September 1st, at the Official Receiver's office, 26, Baldwin Street, Bristol.

Dissolution of Partnership.—Messrs. J. H. Collie and Frank B. Cox (Collie & Cox, consulting and electrical engineers, 65, Fleet Street, Liverpool) have dissolved partnership. Mr. Collie will continue to represent Messrs. Brook, Hirst and Co., Ltd., and the British Insulated & Helsby Cables, Ltd., and will carry on business under his own name at 8, Harrington Street, Liverpool. ('Phone: "Central 5039.") He will attend to debts, &c., of the late firm. Mr. Cox will continue to carry on business at 65, Fleet Street, Liverpool, representing Messrs. Walter McGee & Co., Ltd., of Paisley ("Emcol" A.C. machines).

Sequestration.—The estates of the Auto Electrical Equipment Co., automobile and electrical engineers, 119-121, Bothwell Street, Glasgow, and J. R. Buchanan, the sole partner thereof, were sequestrated by the Sheriff of Lanarkshire on August 18th; meeting to elect the Trustee and Commissioners August 29th, at the Faculty Hall, St. George's Place, Glasgow. A composition may be offered at this meeting. Particulars of claims by December 18th to Mr. W. Hutchison, agent, 223, St. Vincent Street, Glasgow.

Scheme of Arrangement.—The Westminster Engineering Co., Ltd.—In our issue of July 21st we referred to meetings which had been called at which the different classes of shareholders would consider a scheme of arrangement between the company and themselves. We are asked to state that the arrangement referred to was simply a matter of converting the founders' shares into ordinary shares, and no reduction of capital was involved.

Trade Announcements.—Messrs. M. K. Cooper & Co., of Chapel Walks, Liverpool, have removed their offices to 11, Redcross Street, Liverpool. Telephone No.: "Bank 3924." They desire to receive price lists for electrical household utensils.

The Jeary Electrical Co., Ltd., is shortly opening an electrical showroom at 97, Queen Victoria Street, London, E.C., but its head office, trade counters, &c., will remain at Lambeth Hill.

Messrs. Price's Electrical Supplies, Ltd., of Birmingham, have been appointed agents for Messrs. Cutting Brothers, of Stamford.

Mr. B. L. Mayr, A.M.I.E.E., of Liverpool, has been appointed acting manager of the Liverpool and district depot of Simplex Conduits, Ltd., at 96, Whitechapel, Liverpool. Telephone No.: "4726 Royal."

Mr. E. P. Bennett, joint sales manager of Simplex Conduits, Ltd., has been given the additional appointment of Colonial sales director for Credenda Conduits Co., Ltd., for the purpose of developing the joint sales policy overseas, following upon the successful initiation of a similar policy for the home market early this year.

Messrs. Isle & Jarrett, electricians, have transferred their business from High Street to larger premises at 28, Hangate, Doncaster.

Mr. R. Ballantine, 101, St. Vincent Street, Glasgow, has been appointed Glasgow agent for wireless voltmeters, by the Walsall Electrical Co., Ltd.

Catalogues and Lists.—The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Catalogues P and XC., giving illustrated details of numerous types of "Exide" and "Clifton" portable accumulator batteries.

Electrical Components, Ltd., 90, Great Charles Street, Snow Hill, Birmingham.—Abridged net price list of electrical accessories, including cables, conduits, switches, fuses, bells, and lighting fittings.

Messrs. Crow, Toogood & Co., 56, High Street, Charing Cross Road, W.C.—Net trade price list of electrical accessories and fittings.

Messrs. C. A. Vandervell & Co., Ltd., Warple Way, Acton Vale, W.—An illustrated and priced folder describing "C. A. V." "all rubber" wireless batteries.

Automotive Clearing House, 15, Oxford Street, W.1.—A brochure containing details of services and general information regarding automobiles.

Messrs. L. G. Hawkins & Co., Ltd., 116, Charing Cross Road, W.C.2.—Catalogue No. 73, giving full particulars of "Universal" domestic electrical appliances, including cooking ranges, irons, hot-plates, kettles, bowl-fires, and numerous other devices.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—"Reasons Why" No. 2, a card advertising the "Economic" bayonet cap lampholder, and No. 3 dealing with cord grips and china interiors of lampholders.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 372, a book of illustrations of rolling mill drives installed by the company.

Superlamp, Ltd., 197, Old Street, E.C.2.—Net trade price list of cables, wires, lampholders, fuses, switches, and other electrical accessories.

Messrs. Justus Eck & S. Brook, 4-12, Palmer Street, Westminster, S.W.1.—An illustrated brochure describing the construction of "Garbe-Lahmeyer" oil-immersed transformers.

Messrs. Pooley & Austin, 34, Broadway, Westminster, S.W.1.—A reprint from *Machinery*, describing the manufacture of Wilson-Wolf fractional h.p. motors, for which the firm holds the Southern agency; also four illustrated leaflets dealing with the same subject.

The Triumph Electric Manufacturing Co., Ltd., Steward Street, Birmingham.—An illustrated price list of "Triumph" electric fans of various types.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—An illustrated and priced folder describing the "Kantark" ironclad distribution board.

The Telegraph Condenser Co., Ltd., Norwich House, Southampton Street, High Holborn, W.C.1.—An illustrated brochure describing "T.C.C." static condensers for power-factor improvement.

Medway's Safety Lift Co., Ltd., 35, Surrey Street, Strand, W.C.2.—A pamphlet giving illustrations of four designs of electric pulley blocks for mounting on steel joists.

Messrs. Joseph Adamson & Co., P.O. Box 4, Hyde, Cheshire.—An illustrated pamphlet containing a description of a one-ton electric pulley block for overhead runways.

Messrs. E. Shipton & Co., 40, King Street, Covent Garden, W.C.2.—A leaflet advertising a 4,000-ohm telephone head-set.

Lead.—Under date August 19th, Messrs. James Forster and Co. report as follows: "The statistics published this week confirm our repeated anticipations of ample supplies. From Australia and Burma alone shipments for July are advised at no less than 11,405 tons—of this Australia is responsible for 8,455 tons, against 5,850 in June and 4,800 in May. Arrivals from Spain last month were 5,616 tons, which is more than double the average monthly arrivals from this source for the previous 10 months, and arrivals from Mexico also increased. The Board of Trade returns for July were:—Imports, 15,059 tons; exports, 2,067 tons, leaving for home absorption 12,992 tons. For the seven months, January-July, imports were 104,059 tons, less exports 22,760 tons, leaving for home absorption 81,299 tons, against 68,368 tons for the same period in 1921. In face of these figures heavy premium for near lead should not exist."

For Sale.—Winchester Corporation Electricity Department has for disposal a quantity of Venner time switches, types "B.B." and "B.I." See our advertisement columns to-day.

Book Notices. "M. & C. Machine Mining," August, 1922 (24 pp.). Glasgow: Mavor & Coulson, Ltd. This number, the first of a new volume, contains articles on "Machine Mining in India," "Electrical Measurements," "Underground Conveying," and notes upon various phases of the use of machinery in mines.

The A. C. E. C. Review, July-September, 1922 (44 pp.). London: Ateliers de Constructions Electriques de Charleroi. Included in this issue, which is in French, are articles on the application of electricity to rolling mills; centrifugal pumps; electrical machinery and apparatus for mines; the improvement of the power factor of electrical installations by synchronous machines and static condensers; and studies of oiled cloth, &c., insulation.

Year-book and Diary of the Electrical Contractors' Association of Scotland (58 pp. and diary). Glasgow: Hoxton and Walsh (1918), Ltd.—This is practically a directory of electrical contractors in Scotland, as it gives the names, firms, and addresses of the members of the Association's four branches—Glasgow, Edinburgh, Dundee, and Aberdeen. A short history of the Association appears, with a statement of its objects and scope. Other useful information embodied in the Year-book includes:—Particulars of special insurance rates; forms of indenture, and discharge certificates for apprentices; particulars of Scottish electricity supply undertakings; notes on national and district industrial councils; model conditions of tender; rules for contracts; rules for workmen, &c.

Proceedings of the Physical Society of London. Vol. XXXIV, Part 5, August 15th, 1922. London: Fleetway Press, Ltd. Price 6s. net.

Journal of the American Institute of Electrical Engineers, Vol. XLI, No. 8. August, 1922. New York: The Institute. Price $1.

City and Guilds of London Institute.—Department of Technology.—Programme for the Session 1922-1923, containing general regulations and syllabuses for examinations in technological subjects, &c. London: John Murray. Price 3s. 6d. net.

"The Electrical Handling of Materials," by H. H. Broughton. Vol. III. Electric Cranes. Pp. xxi+336, figs. 299. London: Benn Bros., Ltd. Price 50s. net.

Lemberg Industrial Fair.—Organised with the patronage of the Polish Government, and with the support of the municipality of Lwow (Lemberg), chambers of commerce, and big industrials, the second international industrial show is to be held at the city named from September 5th to 15th. The first show, in 1921, was a great success, attracting 500,000 visitors, and realising 28 milliards of marks of sales.

Swedish Trade with Australia.—The *Melbourne Herald* recently asserted that electric motors and other electrical supplies of the heavier class were being imported into Australia from Sweden in considerable quantities, and at prices so far below the quotations for similar goods of British manufacture as to raise a suspicion among representatives of British firms that the Swedish imports were, in part, of undisclosed German origin.

The Swedish Consul in Melbourne (Mr. Waern) informed the journal that every article imported from Sweden must have a certificate of origin from the British Consul to the effect that it is of Swedish manufacture, and he asserted that "A British Consul in Sweden never gives a certificate without satisfying himself personally as to the facts certified to."

To this the *Herald* replied that Mr. Waern's conception of the value of Consular certificates dealing with manufactures was evidently not fully shared by the British firms whose interests were affected in this instance, as formal representations on the subject of the Swedish imports had been made on their behalf to the Customs Department.

South African Electrical Trade.—The *South African Mining and Engineering Journal* for July 20th, states: "The volume of business which was generally expected about this time has failed to materialise. Prices locally remain unchanged, but home quotations are undoubtedly firming up and are likely to advance in the near future. Things in Germany electrically are about 15 per cent. higher than previously, and likely to go higher. People, said a big importer, are biting, but do not seem to get further. Country orders are small compared with inquiries made; everybody seems to imagine that we have not yet come to the end of our troubles. Stocks are very fair, but orders from Britain are not being executed with promptitude. A large importer said he had had an order on hand in England for eight months which had not yet been executed, which confirmed his information that Britain had at the moment her hands full with orders, which the present trouble in Germany was increasing, and still, he said, there was so much unemployment in the Old Country! This important dealer, to illustrate the bad times through which we are passing, stated that an outside mine, which had owed him an account for over twelve months had, on being pressed at last for a settlement, begged for a further month's respite."

Trade with Samoa.—A United States commercial report shows that during 1921 the United Kingdom supplied 14 per cent. of the imports of Western Samoa, which totalled £408,892; the percentage in 1920 was only 2. Australia and New Zealand together provided 59 per cent. of the total, as compared with 71 per cent. in the previous year. American participation has fallen in the same time from 19 to 18 per cent.

Local Electrical Exhibition.—The E.D.A. informs us that the committee which is arranging the Warrington electrical exhibition has provisionally fixed the week commencing Monday, November 27th, for this exhibition.

Australian Registrations.—The *Melbourne Age* states that Falk, Stadelmann & Co., Ltd., incorporated in London in 1887, authorised capital £650,000, and Welsbach Light Co., of Australasia, Ltd., incorporated in London in 1893, authorised capital £35,000, have been registered in Victoria.

Hydro-Electric Plant Orders.—Since the demand for large-sized water turbines of purely British manufacture induced Messrs. Vickers, Ltd., to take up this class of engineering production in conjunction with one of the leading Swiss hydraulic companies (to ensure that the designs should embody the accumulated experience, extending over many years, of their practice in water-power installations) a number of important contracts have been received. The actual manufacture is carried on at the company's works at Barrow-in-Furness. Recently the New Zealand Government placed with Messrs. Vickers orders for two Pelton turbines, which are now being erected on site, and they followed this up with others for the manufacture of the two Francis turbines, each of 3,100 h.p., for the Hora Hora power station on the Waikato River. These machines, which will operate under a 27-ft. head, are of considerable size, and will give immediate employment to British labour. The technical organisation which Messrs. Vickers have instituted to deal with all hydro-electric matters includes experienced hydraulic engineers, working in close collaboration with the electrical engineering staff of the Metropolitan-Vickers Electrical Co., Ltd., which firm recently obtained the orders for the 6,000-kVA generators and the 100,000-volt switchgear for the Mangahao hydro-electric power station in New Zealand.

Fuller's United Electric Works.—We are informed that a notice is being issued to the unsecured creditors of this company to the effect that consequent upon the trade depression it is necessary to take steps to reorganise the capital. The company has consulted Sir Arthur Whinney, who is engaged on a scheme which will be submitted to a meeting to be held at the earliest possible date. It will be remembered that in 1920 the company made an issue of 200,000 7 per cent. notes in order to provide additional working capital. These notes do not mature until 1925. We are informed that it is hoped that the business, which has a valuable connection, will be kept on foot until the scheme has matured, and to this end the directors are refraining from paying such sums as are due to unsecured creditors so as to prevent anyone obtaining a preference. In the meantime the business is being carried on in order to preserve the goodwill, any necessary supplies being paid for in cash.

Japanese-German Electrical Manufacturing Agreement.—The following particulars are published concerning an agreement reported to have been concluded between the Siemens Schuckert Co. and the Japanese firm Furukawa:—The capital of a new company, to be furnished principally by the Japanese, will be 10 million yen. The factory to be erected with these funds will be ready for operation in two years. The chief electrical articles to be produced will be those which at the present time Japan is obliged to import, namely, telephone apparatus, motors, transformers, measuring instruments, motor vehicles for tramways, electric locomotives, &c. The more delicate articles will be manufactured in Germany and assembled in Japan.—*Reuter's Trade Service* (Berlin).

A Works Visit.—On August 17th, members of the Blackburn Electrical Contractors' Association visited the works of the British Insulated & Helsby Cables, Ltd., performing the journey by motor. The firm provided lunch, and was thanked on the motion of Mr. C. T. Briscoe (chairman), seconded by Mr. J. Walsh (vice-president). Mr. Sprawl responded.

Patent Restoration.—An order has been made restoring Patent No. 121,320 (18,046 of 1917), 1917, granted to Henry Chitty for "Improvements in or relating to commutators for dynamo electric machines."

Boiler Works to be Re-opened.—The works of Messrs. Yarrow & Co., of Glasgow, is being re-opened owing to the development of demand for Yarrow boilers. The works was closed in November last on account of depression in the industry.

Improper Trade Competition in Norway.—A law to combat improper competition was passed by the Norwegian Government on July 7th last. It provides that in the exercise of trade activities or in the service of such activities it is not permissible to undertake for the purposes of competition acts which are improper according to good business custom. No incorrect or misleading statement calculated to convey the impression that a particularly favourable offer is being made for the purchase or sale of goods, or to produce an incorrect impression regarding the business or agreement to which invitation is given, must be made in notices, price lists, circulars, invoices, or other similar business documents, or on goods or their packing. Persons employing such statements can be proceeded against. The exploitation without warrant of technical drawings, descriptions, models, or the like is also prohibited.—*Board of Trade Journal.*

LIGHTING AND POWER NOTES.

Accrington.—Price Revisions.—The Corporation has revised its charges for electricity as follows:—7½ per cent. discount in lieu of 2½ per cent. for lighting and small power users. 5 per cent. to large users, subject to the coal charge restriction; and power supplied for tramway purposes is to be reduced by ¼d. per kWh.

Australia.—Grafton.—A council has been formed of representatives from various governing bodies in the district, with the main object of establishing the proposed Nymboida hydro-electric scheme. The estimated cost of weir, power station, transmission lines, &c., is £80,000. The plant will provide 2,500,000 kWh per annum, and the rate for electricity will be approximately 1½d. per kWh.

Melbourne.—The State Electricity Commission has informed the City Council that it is not willing to renounce the right, acquired by the purchase of a private company, to supply electricity in the Flemington and Essendon district. The Council, in whose area the district is included, has strongly protested against this attitude, holding that the Commission should confine itself to the supply of energy in bulk.

The Morwell Scheme.—It is stated that there is little likelihood of power being obtained from Morwell within a period of eighteen months. In spite of this applications for power are pouring in to the Electricity Commissioners. The scheme will be sufficient to meet all the needs of Melbourne for some time.

The Kiewa Scheme.—The Melbourne *Age* states that the Kiewa scheme has not been abandoned, as rumoured in certain quarters. The Electricity Commissioners are still carrying out surveys and recording flows, &c. Of course, if it is found that power cannot be generated at prices comparable with the cost of energy from other sources it will not be possible to proceed with the development. The *Herald* states that two other schemes which are under consideration, one at Sugar Loaf reservoir, and the other at Seven Creeks, are both superior to the Kiewa scheme.

Blairgowrie (Perthshire).—Proposed Electricity Scheme.—The Town Council is considering an electric lighting scheme for the burgh, and is to procure a report from an expert as to cost of water rights, land, plant, &c.

Bognor.—Price Reductions.—The Bognor Gas-Light and Coke Co. has reduced the price of electricity from the June quarter by 1d. per kWh. Lighting is now charged on a sliding scale down to 9d., and power and heating on a sliding scale down to 3d. per kWh.

Brownhills.—Consent to Supply Refused.—The Urban Council has refused consent to an application by Walsall Town Council for powers to supply electricity to collieries in the Brownhills area. The Council has already given permission to the Cannock Chase Colliery Co., Ltd., to supply electricity in that area.

Canada.—Winnipeg.—The Winnipeg Hydro-electric Department is considering the erection of a steam stand-by plant as an auxiliary to the present hydro-electric generating station. Owing to the requirements of many of the consumers of electric power in Winnipeg for an uninterrupted service, the Department has decided that a steam stand-by plant is necessary. While the interruptions on the transmission line have been very few, still the damage caused by such a storm as that of last May, when both the Winnipeg Electric Railway Co.'s and the city's lines were damaged so as to interrupt the service for some hours, has made it essential that measures be taken to provide for such contingencies. It is proposed to install two 12,500-kVA turbo-generator sets with condensers. The boilers will probably be heated with oil fuel. It is also proposed to install a small electric boiler to keep the fuel feed pipes warm and also to keep one of the turbo sets turning over. Plans and specifications for the equipment are being prepared. —*Electrical News.*

New Generator at Chippawa.—The third of the Hydro-Electric Commission's 60,000-h.p. generators at the new Chippawa plant at Queenston was given its initial run recently without mishap. When the new set commences to deliver electrical energy, the total capacity of the plant will amount to 175,000 h.p. Sir Adam Beck stated that the whole of this output would be sold by the middle of August, and that in view of the possible abnormal demand for power consequent on the coal shortage, work on the fourth and fifth sets would be executed as soon as possible.—*Reuter's Trade Service* (Toronto).

Chobham.—Electricity Supply.—The Woking Electric Supply Co., Ltd., has secured powers to extend its cables to Chobham.

Continental.—France.—The Commercial Counsellor to H.M. Embassy, Paris, writes:—The Minister of Public Works in a reply published by the *Journal Officiel* to a question put to him by a Deputy, states that the power of the various hydro-electric stations now existing in France may be estimated at 2,100,000 h.p., and that of stations under construction, which will be completed within two years, at 300,000 h.p. The power of the stations in activity at the end of the war amounted to one and a-half million horse power. There has consequently

been an increase since that date of 40 per cent. in the power available. The power now at the disposal of the country is distributed as follows:—Lighting, heating, small motive power, 650,000; industrial motive power, electro-chemistry, electro-metallurgy, 1,300,000; traction, 50,000; agriculture and various, 1,000,000 h.p. *Board of Trade Journal.*

Italy.—Construction of a new power plant in the district of Branca, Province of Perugia, is announced by the Italian press. The new plant will utilise the national supply of lignite, and is to be subsidised by the Government for the period set by the decree. The station will be of standardised steam-power type, with a capacity of 15,000 kW, divided into three units of 5,000 kW each, two for regular use and one for reserve. Lignite to the extent of 150,000 tons per year will be used, and there will be by-products amounting to 3,000 tons of ammonium sulphate and 2,550 tons of tar yearly. The subsidy is granted for 20 years, and was fixed at 130 lire per kW installed, a total of 1,950,000 lire. The concession will be accorded the Società Lignitifera Umbra, which already holds the exploitation rights on lignite deposits to be used.—*Commerce Reports.*

Czecho-Slovakia.—From the report for 1921 of the Böhmische Landesbank, it appears that that institution has taken a share in the 30,000,000 kronen 5 per cent. provincial loan for the construction of the Parschnitz generating station, near Trautenau, and in the issue of the 15,000,000 kronen 5 per cent. loan for the building of a hydro-electric station on the Iser River. Furthermore, the bank has taken a share in the issue of a 5 per cent. loan for the construction of the contemplated central station at Reichenberg, which is to be an auxiliary to the Engelsberg station. Altogether 18,200,000 kr. was set aside for electric undertakings in 1921. Up to the end of 1921 the aggregate sum allotted to electrification had totalled 62,259,774 kronen.

The supply of electricity in Southern Bohemia is mainly a question of hydraulic generation. The yearly output of the temporary station at Letoschitz on the Moldau, built by the Provincial Committee, totals six million kWh. In the Wotawa district it is intended to construct two falls near Bergreichenstein and Kieslingbach respectively, with a common high-pressure station, reckoned to yield about 72 million kWh annually. In the Sawa district generating stations are planned at Smrcna, Ledetsch, and Svetla. It is also intended to utilise the water power of the Zelivka and the Sedlitz, while a fall on the Trnavka, near Krelovitz, is yet another scheme. In the Luznitz district the falls are estimated to be capable of yielding 2,500 h.p. The total water-power of Southern Bohemia amounts to about 120,000 h.p., of which only 24,000 h.p. is already utilised. With the exception of the hydro-electric station at Holub, all the works hitherto undertaken have been carried out by the Provincial Committee. It is noteworthy also that there exist in Southern Bohemia considerable deposits of turf and lignite coal, which are to be used for a large generating station in contemplation. This is to be linked with the above hydro-electric works by a high-pressure line and will serve as support in the seasons of drought.

Douglas. Application for Loan.—The Douglas Corporation recently applied to the Tynwald Court for sanction to borrow £62,000 to enable it to proceed with the electricity supply scheme which the Corporation has to carry out within two years. The Attorney-General opposed the application, and urged the postponement of the scheme for five years, his justification being the existing indebtedness of the Corporation. For the latter it was urged that matters had proceeded too far to postpone the scheme, and the inhabitants were expecting a supply of electricity, the undertaking would be on a paying basis in two or three years. An amendment delaying sanction to the loan was lost, and the application granted.

East Ham. Year's Working.—The annual report (1921-22) of the municipal electricity undertaking (engineer: Mr. W. C. Haward) records a total revenue of £81,066, an increase of £17,739 upon the previous year's figure. Working expenses decreased by £4,435 to £54,355, leaving a gross profit of £26,651, as compared with £4,477 in the previous year. Capital charges were higher, £12,281, as against £11,480, leaving a net profit of £14,370, comparing satisfactorily with a deficit of £7,003 in 1921-22. The sales of energy amounted to 5,584,580 kWh, an increase of 519,850 kWh, and the maximum load rose from 2,430 to 2,653 kW. The capital expenditure during the year was £10,451, represented principally by the [illegible] of cables.

Electricity District.—North-East Midlands.—The Electricity Commissioners—in substitution for the notice they issued on October 12th, 1921—give notice that they will hold a local inquiry in the [illegible] on October 17th, 1922, and on subsequent days, with reference to the area to be included in the [illegible] and to consider a scheme which has been submitted by the Corporation of Sheffield (Elec. Rev., July 15th, 1921, p. 103) for effecting an improvement of the existing organisation for the supply of electricity in the district and for the formation of a Joint Electricity Authority. The [illegible] and objections which have already been submitted to the Electricity Commissioners in pursuance of the notice issued on October 12th, 1921, will, in the absence of any modification in the meantime from the parties concerned, be duly considered by the Commissioners as if they had been made in pursuance of the present notice.

Emley.—Electricity Supply.—The Yorkshire Electric Power Co., Ltd., in stating that the company has not yet received full powers to supply electricity to the District Council, intimates that it is its intention to make a canvass of the district at an early date.

Glasgow.—Lighting Improvements.—Improved electric lighting is being installed in a section of Maryhill Road as a test in conjunction with the refitting of a part of Alexandria Parade recently completed. It is the intention to augment the lighting of all the main arteries, and a number of central streets have already been dealt with.

Great Yarmouth.—New Plant.—The Corporation has installed new plant at the power station at a cost of £36,000; which was formally set in motion by the Mayor recently. The chief electrical engineer stated that, owing to increased demands, it would be necessary to install a 2,000-h.p. turbo-generator, bringing the output of the undertaking up to 4,000 h.p. The scheme, when completed, will have cost £60,000.

Hayward's Heath.—Overhead Supply System.—Permission to erect overhead wires for the transmission of electricity has been granted, and the installation will shortly be commenced. A generating station is to be erected in the Queen's Road district.

Hitchin.—Extension of Station Sanctioned.—The Electricity Commissioners have given their consent to the extension by the Electric Supply Corporation, Ltd., of the existing generating station at Hitchin by the installation of one 295-kW set.

Holmfirth.—Change of System.—Having received an intimation from the Electricity Commissioners expressing the opinion that immediate steps should be taken to change the existing system of electricity supply for the district, and proposing that the Council should obtain a bulk supply of electricity from the Yorkshire Electric Power Co., Ltd., the Urban District Council has decided to adopt the suggestions.

India.—Hydro-Electric Schemes.—*Indian Engineering* states that the Punjab Government has appointed a Board to discuss hydro-electric schemes in the Punjab. The most important project which will have to be examined, with any improvements and modifications which subsequent surveys may have rendered advisable, will be that prepared some years ago by Sir John Benton at the request of the Maharaja of Patiala. It consists of driving a two-mile tunnel through the ridge which is the axis of the long flat loop of the Sutlej below Bilaspur suspension bridge. Below this tunnel site, at the apex of the loop, is the site for the proposed Bakhra Dam. The Patiala proposal is to pass about 2,000 cusecs of water through the tunnel and back into the river, for generating 100,000 h.p. This is quite independent of the Punjab dam scheme, though any heading up of the water level reaching the tunnel inlet would be of advantage to the Patiala work.

The same journal recently published an article upon the hydro-electric sources of the State of Mysore, with particulars of a number of schemes which have been drawn for their utilisation. Among these is the Bhatkal scheme, which, by the use of three rivers, is expected to provide 40,000 h.p. The Sivasumudrum project already consists of six installations giving a total of 25,000 h.p. The Krishnaraja Sagara scheme is intended primarily to ensure a regular supply of water to the Sivasumudrum scheme, but there are other possibilities if the demand calls for their development. Surveys have been made of two other possible sites—the Shimsha and the Mekedatu Falls. Probably 40,000 h.p. could be provided by the former falls, while the latter are capable of being developed to the extent of about 10,000 h.p. The principal difficulty resides in the methods which must be adopted to maintain the water supply as between the monsoon and dry periods; every scheme requires the construction of a reservoir of large capacity.

Kingston-on-Thames.—Year's Working.—The annual report for the year 1921-22 upon the electricity undertaking (engineer, Mr. T. A. Kingham) records a total revenue of £45,841, as compared with £43,254 in the previous year. Working expenses made a total of £27,128 (£31,199), which, together with £1,750, capital expenditure out of revenue, and £11,916, capital charges deducted from the income, left a net profit of £5,046, as against £697 in 1920-22. The energy sold decreased from 1,928,476 to 1,603,018 kWh. During the year prices were reduced as follows:—Lighting from 1s. to 9d. per kWh; and the surcharge of 20 per cent. on power supplies was reduced to 10 per cent. The capital account shows an expenditure during the year of £7,002.

Leamington. Electric Lighting Scheme Dropped.—At a recent meeting of the Corporation a scheme of electric lighting to replace the present gas lighting was put forward, but it was finally decided to continue the present system

Lichfield.—Electricity Supply.—The Rural District Council has decided not to raise any opposition to the proposal of the Cannock Chase Colliery Co., Ltd., to apply to the Electricity Commissioners for a Special Order authorising it to supply electricity in the parishes of Burntwood-Edial-and-Woodhouses, Hammerwich and Ogley Hay, in the area of the Rural Council.

London.—Stepney.—*Year's Working.*—The accounts of the municipal electricity supply undertaking (engineer: Mr. W. C. P. Tapper) for the year ended March 31st, 1922, record a total income from all sources of £257,252, comparing with £229,321 in the previous year. Working expenses were reduced from £175,972 to £168,922, resulting in an increase of gross profit from £53,349 to £88,330. The capital charges were greater, being £69,976, as against £17,487, but the net profit increased from £9,376 to £28,388. The increase in revenue was due to the higher charges instituted during the year, as the sales fell from 28,093,611 to 27,888,661. The prices were reduced again at the beginning of the current year. A total of £215,914 was spent on capital account, the principal items being £129,094 for machinery and £55,320 for mains. It is to be noted that the net profit shown above was subject to a number of charges, including income tax, provision for written-off plant, &c., leaving £3,827 to be transferred to reserve.

Fire.—A fire broke out at the Narrow Street generating station on August 21st, due, it is believed, to the fusing of a connection on the switchboard. The fire was soon extinguished by the fire brigade, but a great part of the district was deprived of light and power for some time.

Westminster.—The Westminster Electric Supply Corporation, Ltd., has arranged that where a water-heating apparatus of the heat storage type is fixed on either the lighting or power circuit, a deduction of 100 kWh per quarter will be made from the total consumption registered by the meter on that circuit for each 50 W of the rated capacity of the water heater. The number of kWh so arrived at will be charged at 1d. per kWh provided that the apparatus is used continuously day and night during the whole of the period and the connections are sealed by the company.

Lydney.—Electricity Scheme.—Preliminary work in connection with the new power station will shortly be commenced. The station, when completed, will have an output of about 30,000 h.p., and will cost, with the transmission lines, &c., nearly £500,000. Electricity will be distributed at 33,000 V to various collieries and industrial undertakings in the Forest of Dean and Stroud Valley. The West Gloucester Electricity Supply Co. is to be formed to carry on the undertaking.

Penybont.—Electricity Supply.—The Council, at a special meeting held recently, decided to apply to the Electricity Commissioners for power to supply electricity to the parishes of Pyle, Kenfig and Tythegstone Higher. Mr. W. Wellbury, manager of the electricity works of the Bridgend Council, who is acting as consulting engineer to the Pennybont Council, stated that if the application were granted it would be possible to give a supply by November. The Council resolved to challenge the Bridgend Council's right to supply electricity to St. Bride's Minor and Newcastle Higher.

Seaford (Sussex).—Proposed Electricity Supply.—The Urban Council on August 14th referred to the General Purposes Committee a proposal to provide electricity for the town.

Southend-on-Sea.—Purchase of Diesel Plant.—The Town Council has applied to the Electricity Commissioners for a loan of £5,000 to cover the cost and installation of a Korting 300-kW Marine type Diesel engine, with pump, accessories, flywheel, &c.

Special Orders.—Confirmations.—The following Special Orders made by the Electricity Commissioners have been confirmed by the Minister of Transport:—Alderley and Wilmslow; Atherstone and District; Edmundson's Electricity Corporation (Dorking and Cromer undertakings); Isle of Wight Electric Light & Power Co.; Lymington (amendment); and Urban Electric Supply Co. (Berwick-upon-Tweed, Redruth, Illogan, Dartmouth, Kingswear, Godalming, and Glossop undertakings).

Taunton.—Price Reductions.—In view of the good results from the past year's working—a net profit of £2,296—the Town Council has approved the following revisions of charges for electricity:—Lighting: Up to 25 kWh per quarter, 10½d. per kWh; 25-500, 7½d.; 500-1,000, 6½d.; above 1,000 kWh, 5d. per kWh; plus 1d. per kWh in the case of "free-wired" installations. Power: Up to 2,000 kWh per quarter, 3½d. per kWh; 2,000-4,000, 2¾d.; above 4,000 kWh, 2½d. per kWh. Heating and cooking: Up to 50 kWh, 3½d. per kWh; and above 50 kWh, 1¾d.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—At a June meeting of representatives of metropolitan municipal authorities the question of railless traction was discussed. The Tramways Board asked for permission to run trolley 'buses on a number of routes owing to the high cost of rails, and in view of the fact that this system was more economical than petrol traction. The representatives of the City Council said that that body would not oppose the Board's designs, and the general opinion was also in agreement, with certain reservations. The Minister of Public Works said that a proviso would be inserted in the Bill giving the municipal authorities the power to make their own terms with the Board.

Announcements made by the Tramways Board from time to time with regard to its contemplated tramways construction and conversion programme, says the *Argus*, may lead to the belief that immediate operations are intended. Inquiries made of the Board's experts indicate that this is not so. The Board is faced with the expenditure during the next 15 years of £6,200,000 in the conversion of the metropolitan cable system and the construction of new electric lines. The whole of the metropolitan cable system, with the possible exception of the city sections of Collins Street, Bourke Street and Elizabeth Street, it is expected, will be converted to electric traction. The route mileage of electric lines will then probably be as follows: Converted electric lines, 40 miles; present electric lines, 64 miles; Essendon tramway, 11 miles; new routes (at least), 30 miles; total 145 miles.—*Reuter's Trade Service* (Melbourne).

South Australia.—The Melbourne *Age* states that an important meeting of metropolitan local authorities was held at Brisbane in July to consider the formation of the proposed tramway trust, which will administer the tramways of Brisbane when they are acquired by the State Government from the Brisbane Tramways Co. The Government has invited the local authorities to appoint six representatives to comprise the trust, together with two representatives who will be appointed by the Government. One of the two Government nominees will be the chairman. The trust, when formed, is to be asked by the Government to prepare a general scheme for the future development of tramways. Under further provisions of the trust the Government is to advance money necessary for the purchase of the tramways from the Brisbane Tramways Co. This amount is expected to be something like £1,750,000. In addition a sum of £500,000 will be advanced for the renovation of tram cars, extensions of existing lines, their alteration where necessary, and provision of new cars.

Railway Electrification.—The Railway Commissioners of New South Wales anticipate that the electrification of the suburban line between Hurstville and Hyde Park will be completed within three years.

Blackpool.—Traction Supply.—Negotiations are pending between Blackpool and Fleetwood authorities for the latter to supply electricity for the Blackpool-Fleetwood tramways at the Fleetwood end of the route.

Canada.—Winnipeg.—The agreement by which the Winnipeg Electric Railway Co. operates the city's tramways expires in 1927, and the City Council then proposes to take over the system. The company states, however, that it cannot raise the capital necessary to effect improvements with such a short period before expropriation. On the other hand, improvements and extensions are urgently required. An extension of the franchise to 1937 is therefore suggested, when a number of subsidiary systems would also be surrendered. As the City Council would probably have difficulty in raising the necessary funds to carry out the extensions it is considered probable that the request for an extension of tenure will be acceded to.

Cardiff.—Cost of Reconstruction.—According to reports on the cost of electric tramway reconstruction at Cardiff, made by the City Treasurer and City Engineer, a sum of £290,586 was spent from 1915 to March 31st, 1922, on sixteen and a half miles of completed single track, equal to £17,484 per mile, or £9 18s. 9d. per yard. In addition, £34,766 was paid to contractors for special work, making a total of £325,352, of which £9,218 was received from unemployment grants. Wages cost £121,301, material £179,753, and haulage £12,629. In 1914 the costs of reconstruction were £3 12s. 3d. per yard, and in 1921 £12 7s. 7d. At present they are £8 10s. 2d. The use of unemployed men increased them by ten to fifteen per cent.—*Times Trade Supplement.*

China.—Shanghai.—The Shanghai Municipal Council has granted the tramway company permission to establish experimental railless tramway loop services to relieve traffic congestion on Nanking Road and the Bund, the Council reserving the right to revert to present track arrangements. A railless freight service will also be introduced as an experiment. It is stipulated that the company shall pay in connection with rail and railless extensions, in addition to the royalty of 5 per cent on gross receipts, a sum of $0.02 silver per car-mile, to apply on all car mileage run by the railless freight and passenger services.—*Eastern Engineering.*

Peking.—The Peking Tramways Co. has received the permission of the municipal authorities to proceed with the construction of four trunk lines with a total length of 51.27 li (approximately 20 miles). The company will purchase 60 closed cars, 30 trailer cars, and other rolling stock.

Derby.—Extension of Time.—The Minister of Transport has extended the time until August, 1923, of the Derby Corporation Act, 1913, for the completion of the tramways.

Dewsbury.—Reduction of Fares Urged.—The Trades and Labour Council recently urged the Yorkshire (Woollen District) Electric Tramways Co., in view of the wages reductions now operating amongst the workers in most industries,

to reduce the tramway fares, but the company replied that the fares had not been increased in the same proportion as railway fares or the cost of commodities generally; and that until the general costs fell to a greater degree the fares could not be revised.

East Ham.—Year's Working.—The total income, during the year 1921-22, of the municipal electric tramways (manager: Mr. W. C. Ullman), amounted to £113,250, as compared with £109,586 in the previous year. Operating expenses totalled £111,123, as against £123,912, leaving a gross profit of £2,127, comparing favourably with a gross deficit of £14,326 in 1920-21. Loan interest, sinking fund, &c., absorbed £20,458, causing a net deficit of £18,331. The previous year's net loss was £33,647. The capital expenditure during the year amounted to £13,408, which included equipments for 10 new cars, £7,922. The number of car-miles run decreased slightly—from 1,440,464 to 1,414,954, and the number of passengers carried decreased in greater proportion—from 17,779,901 to 16,689,698.

Glasgow.—Proposed Acquisition of Paisley System.—Under an agreement with the Paisley & District Tramways Co., the Paisley Corporation has the right to supply electricity to the system. The Glasgow Tramways Committee, in arranging for the acquisition of the Paisley tramways, has recognised this right, but states that the price of energy supplied by the Paisley Corporation is in excess of that at which Glasgow could supply electricity. The matter is now the subject of negotiations. On all other points agreement has been reached.

Roller-bearings Experiments. Experiments are about to be made with roller bearings for tramway cars. It is interesting to note that many years ago trials took place in the city, but at that time roller bearings had not attained the present degree of efficiency, and they were discarded. Should the experiments with the more modern equipment prove satisfactory the matter will be considered by the Corporation Tramways Committee.

Fare Reductions Postponed.—The Tramways Committee decided on August 16th, after considering a report by the general manager, not to make any change in the tramway fares at present.

Leeds.—Coming Fare Reductions.—Despite the unsatisfactory financial position recorded during the past two years, but which is now improving, the Tramways Committee has decided that it is now possible to reduce fares. The Committee has already agreed on reductions which, in general effect, will mean that beyond the first penny stage there will be a reduction of a halfpenny. There is still to be settled the position as to workmen's fares, on which the department has to stand an average loss of some £60,000 per year, and members of the Committee are not decided as to the fairness or otherwise of increasing that loss by reducing the workmen's fares, at the expense of ordinary passengers.

London.—New "Underground" Coaches.—The London Electric Railway Co. is placing contracts for the production of new types of coach for its system. While the manufacturers are bound in certain main essentials, they are being allowed ample latitude for originality and improvement in design. The firms which have secured the contracts are Messrs. Cammell, Laird & Co., Ltd.; the Metropolitan Carriage, Wagon, & Finance Co., Ltd.; the Birmingham Railway Carriage & Wagon Co., Ltd.; the Gloucester Railway Carriage & Wagon Co., Ltd.; and the Leeds Forge Co., Ltd.

Municipal Tramways Association.—Speed Limits.—As a result of representations made by the Association urging the raising of the speed limit for tramcars, the Minister of Transport has consented to consider a revision of existing regulations in this respect in cases where it can be shown that a higher speed limit would be beneficial to the public convenience and that safe working would be maintained. The limit would be 20 miles per hour, but the Minister states that, having regard to delays caused by other traffic, stopping places, &c., he does not think the present average speed would often be exceeded.

Salford. Strike Threat.—The employés of the municipal tramways department have threatened to strike if the Corporation carries out its decision to dispense with the trolley boys. They state that in addition to the extra work for the conductors, which this would entail, 130 boys would be thrown out of employment in a time of great difficulty to obtain work.

West Bromwich.—Contemplated Municipalisation of System.—The Town Council has recently had under consideration the question of taking over the tramway system at the expiring of the company's lease in 1924. It has been calculated that the Council could operate the tramways at a small annual profit. Messrs. A. R. Fearnley (Sheffield) and J. B. Hamilton (Leeds), have acted in an advisory capacity.

Wigan.—Reduced Expenditure.—At a recent meeting of the Council, the chairman of the Tramways Committee stated that as a result of re-organisation, and in spite of a reduction in the number of employés, the past year's average rate of car reconstruction had been maintained. A saving of £11,000 had been effected in April, May, and June, as compared with the equivalent period of 1921.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—The Miami Cable.—In connection with the request which has been granted by President Harding for the immediate re-opening of the cable between Miami (Florida) and Barbados for emergency use for transmitting messages to Europe *via* Pernambuco, Brazil has raised an objection to the re-opening of the cable unless it is also used for South American dispatches, to which use the United States has hitherto objected. It is this objection which has hitherto prevented the cable from being employed, and Brazil's refusal to co-operate in the present emergency has upset the arrangements that were made to relieve the transatlantic cable congestion that was caused by events in Ireland.—*Reuter.*

A large amount of Press work has been diverted to the Post Office wireless station at Oxford (Leafield). This station has for some time been conducting a limited Press service to Halifax, Nova Scotia, an average of 2,000 words being transmitted each night, but during the past week about 8,000 words a night have been signalled to Halifax without detriment to the normal services from Oxford, which include a commercial service to Cairo and a long-distance service of ordinary telegrams and news to ships. Oxford has recently commenced the transmission of short Press telegrams to India, where the signals are read direct by the wireless station at Karachi and sent thence to the newspapers in Bombay and Calcutta. During the present emergency the Imperial cable between Penzance and Halifax, Nova Scotia, has also rendered yeoman service. It has been carrying heavy loads in both directions, and has exceeded all its previous traffic records. Efforts have been made to avoid curtailment of the special facilities given by the "*via* Imperial" route for communication with the oversea Dominions. It is the only cable route on which the deferred service at half rates, or less, to Canada, Newfoundland, and the West Indies has been maintained, and it is the only route on which a week-end service at quarter rates is provided to Australia and New Zealand.—*Financial Times.*

Speaking on August 16th as chairman of the Institute of Politics at the Williamstown Round-table Conference on foreign correspondence and international electrical communications, Mr. Walter Rogers, American delegate to the International Communications Conference of 1920, said the interruption of American communication with Europe might be viewed as another proof of the necessity of laying more cables between the U.S. and Europe by way of the Azores. Although the British monopolistic concession at the Azores had expired (he said) Portugal hesitated to grant landing rights to American companies, probably because of the influence brought to bear by the British cable companies. In order to permit a wide extension of American cable contracts every effort should be directed (he urged) to making the Azores easily available for cable relay purposes. They should virtually be internationalised as a cable centre, and Powers obligated by treaties should not, even in war time, seize or control the cables there. While Britain was developing her "all-red" cable system, touching only British soil, it was for Americans to consider what the United States should do in the direction of devising some great constructive American plan of communications. *Westminster Gazette.*

China. Automatic Telephone Extensions.—The Shanghai Mutual Telephone Co. has recently ordered 500 automatics, to be installed in its East Station, the smallest of the company's plant, as an experiment, but if the project meets with success it is likely that the system will be adopted throughout the city. Dairen has recently installed a 5,000-instrument automatic system and Harbin is now installing a 3,000-instrument system.—*Eastern Engineering.*

New Wireless Station.—We learn from the British Chamber of Commerce *Journal*, Shanghai, that the new wireless station at Liushutun (across the bay to the north of Dairen), the construction of which was commenced last year, was to be opened for public use last month. The total cost has been about £30,000. The installation consists of three steel masts, each 300 ft. high. The method of transmission adopted is that of the Tokio Teishinsho (Department of Communications) and consists of a quenched-spark converter of 7 kilowatts, and an arc converter of 35 kilowatts. By using the latter it is stated that it will be possible to converse direct with Europe and the United States. The power is to be supplied by the new South Manchuria Railway Co.'s power house near Dairen, but as this is not quite ready some of the power is being obtained from Chinchow for the time being.

India.—Automatic Telephones.—In connection with the conversion of the Bombay telephones to the automatic system the Bombay Telephone Co. has placed a contract for the exchange equipment of 11,000 lines, costing approximately £180,000, with the Automatic Telephone Manufacturing Co., Ltd., of Liverpool. The installation is expected to be completed in two years. The contract for the instruments, which will probably amount to another £50,000, has not yet been placed.—*Reuter's Trade Service* (Bombay).

Wireless Telephony.—It is stated in a daily paper that the Marconi Co. is making an application to the Government for liberty to erect a broadcasting station either in Calcutta or in Bombay. The cost of private apparatus ranges from Rs. 150 upwards, and applications for licences are to be forwarded to the Director of Wireless Telegraphy at Simla. The Indian States and Eastern Agency, of Bombay, is arranging to give another demonstration of wireless telephony in Calcutta in October.

Wireless Telegraphy.—Arrangements are being made to improve Colombo's only wireless station at Welikade by adopting the continuous-wave system. The Madras station is to be converted into a high-speed automatic plant for working inland, and the Rangoon station will normally replace the present land lines between Rangoon and Calcutta for traffic between Burma and India. The existing apparatus for communicating with ships is to be replaced by a small station to be erected near St. Thomas Point, which will free the Madras station for inland work.—*Indian Engineering.*

Ireland.—The Telegraph and Telephone Services.—After considerable delay the direct telegraph service between Dublin and Belfast has been restored, and also between Dublin and Limerick. The greater part of South Kerry is still isolated, and likely to be for some time, and all Cork county is isolated. Telephonic communication between Dublin, Belfast, Limerick, Tipperary, Drogheda, and Navan has been restored, but at any moment the service may be interrupted.

Clifden Station Re-captured.—The wireless station at Clifden, County Galway, burned down a few weeks ago by the irregulars of the Irish Republican Army, has been re-captured after a fight of about half-an-hour. The receiver and other portions of essential plant were destroyed by the irregulars and the building partially burned down. It is said that it will take £70,000 to restore the station, which is situated in a wild and desolate part of the country.

Portugal.—Wireless Concession.—The Government has been authorised to contract with the Marconi Wireless Co. for the exclusive right to establish wireless stations in Lisbon, Madeira, the Portuguese African Colonies and the Azores for a period of forty years.—*Financial Times.*

A Portuguese company is to be formed, says the *Financier*, and the fees will be the same as those for submarine cable messages.

Sweden.—West Coast Wireless Station.—The Swedish Telegraph Board has entered into a contract with the Radio Corporation of America for the delivery, at a cost of $432,500, of wireless apparatus for the equipment of the large station that is to be erected on the West Coast of Sweden. The establishment of the station, to which reference was made last week, the maximum cost of which is to be 5,000,000 Swedish crowns, has been approved by Parliament, and the rates will be considerably lower than those at present charged for communication *via* Norway.—*Reuter.*

According to the *Daily Telegraph*, the station will consist of one transmitting station and one receiving station, the former to be built between Varberg and Falkenberg, and the latter near Kungsbacka, both to be finished during 1923.

Wireless Telegraphy.—International Progress.—The progress of international wireless telegraphy is shown by the fact that, since June, 1908, the date of the formation of the Union Radiotélégraphique, the number of shore stations has risen from 76 to 977, and other stations from 246 to 12,622. All the countries of the world are now signatories of the Union Convention save Argentina, Persia, and Turkey. Among the signatories are Czecho-Slovakia and Venezuela (in 1920), Serbia, Croatia and Slovakia (in 1919), the Republics of Ecuador and China (in 1920), and Poland and Dantzig (in 1921). Albania has this year announced its adherence.

Wireless Telephony.—Broadcasting.—The following statement has been issued by the Committee of manufacturers that is at present engaged in creating the Wireless Broadcasting Co.: "The committee has observed that a number of unauthoritative statements have been made with regard to broadcasting, and desires it to be known that until the British Broadcasting Co. is registered, and the board of that company has been appointed, no authoritative statement, in so far as the Broadcasting Co. is concerned, can be made with regard to the future of broadcasting. The memorandum and articles of association of the company are in course of preparation and as soon as they are approved the company will be registered and the Board appointed. Thereafter a full statement will be issued." Mr. Geo. Pells is secretary (*pro tem.*) of the British Broadcasting Co., and the statement was issued from Marconi House, W.C.2.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—December 18th. Victorian Electricity Commissioners. Coal-handling plant for Morwell power station and briquetting works. (See this issue.)

November 4th. Transformers, induction regulators, and switchgear. (August 11th.).

Victorian Electricity Commissioners. January 15th, 1923. Four water-tube boilers, each 4,500 sq. ft., with pumps, piping and structural steelwork for boiler-house.

January 23rd. Back-pressure steam turbine, including a 1,500-kW turbo-alternator.—*Reuter's Trade Service.* (Melbourne).

Melbourne.—Victorian Railways. October 11th. Electric storage battery with accessories and spares (Cont. 35,090). October 18th. Motor generator set and static transformer (Cont. 35,089).*

September 20th. Postmaster-General's Department. Switchboard apparatus. October 17th. Automatic c.b. telephone equipment, together with all associated equipment, including apparatus for use at subscribers' premises. (August 18th.)

Victorian Railways. November 29th. Three electric storage-battery industrial trucks capable of carrying 4,000 lb. at five miles an hour.

Ayr.—Works, including wiring for electric lighting, &c., in connection with new wards and other additions at the County Hospital, Ayr. Jas. Kennedy Hunter, 51, Sangate, Ayr.

Belfast. — September 11th. Electricity Department. Stores (including wires, cable, lamps, electrical accessories, &c.) for six months. (See this issue.)

Brighton.—September 18th. Electricity Department. Two water-tube boilers, superheater, economiser, steel chimneys, fans, feed pumps, steam pipes, valves, &c. (August 18th.)

Chile.—September 14th. Chilean State Railways. Electrical plant for the San Rosendo station. Departmento de Materiales y Almacenes, Alameda station, Santiago, Chile. Representation of the Chilean Railways at Paris, M. Bertrand, Boulevard St. Michel 33, Paris.*

Dover.—September 4th. Harbour Board. Electrical sundries for six months. Forms (2s. 6d. each) from Mr. Rutley Mowll, registrar, Castle Street.

Dublin.—September 1st. Post Office Stores Department, Irish Provisional Government. 4,000 ft. (each) casing and covers for wires and cables; 1 ton plumber's solder.

September 15th. 100,000 insulators. (August 18th.)

Edinburgh.—September 5th. Tramways Department. Electrical equipment for 80 electric cars. Manager, Tramways Department.

Egypt.—Cairo.—September 11th. Ministry of Public Works. Installation of switchboard and system of armoured feeders for works of the Palais de Ras el Tine, Alexandria. Chief electrical engineer, Electrical Service, Ministry of Public Works, Cairo.—*Reuter's Trade Service* (Cairo).

Holmfirth. — September 7th. Electricity Department. E.h.p. switchgear, l.p. switchgear, transformers, underground cables, and feeder pillars. (See this issue.)

London.—Metropolitan Asylums Board. August 30th. Electric storage battery at the Grove Fever Hospital, Tooting Grove. (August 11th.)

August 31st. Electric lighting installation at Cornwall House, S.E. (August 18th.)

Islington.—September 20th. Electricity Department. Two water-tube boilers with stokers, draught system, steel chimneys, steam piping, &c.; cooling towers, ponds, pipework, &c. (August 11th.)

Hammersmith.—September 7th. Electricity Department. Transformers, oil-cooled and air-cooled; e.h.p. cables; e.h.p. and h.p. switchgear. (August 18th.)

County of London Electric Supply Co. October 18th. Supply and erection of steam turbo-alternators for the Barking Power Station. (See this issue.)

Edmonton. September 14th. Board of Guardians. Six months' supply of electric lamps. Mr. E. Ridley, clerk, 77, Bridport Road, Edmonton, N.18.

Manchester.—August 31st. Electricity Committee. 420-V ironclad distribution switchgear for auxiliary services. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

August 31st. Electricity Committee. Supply and completion of two coal grabs. (Spec. B38.) (August 11th.)

September 9th. Waterworks Committee. One electrically-driven air compressor. (See this issue.)

Merthyr Tydfil.—September 5th. Board of Guardians. Electrical fittings for six months. Mr. F. T. James, clerk, High Street.

New Zealand.—Auckland.—February 1st, 1923. Harbour Board. 22 electric cranes for Princes Wharf.—*Reuter's Trade Service* (Auckland).

Plymouth.—September 12th. Electricity Department. Steam turbine-driven rotary boiler-feed pump.

Salford.—Tramways Department. 250 tons tramway rails. General manager, Corporation Tramways, 32, Blackfriars Street, Salford.

South Africa.—October 18th. High Commissioner. Electrification of the South African railways, Maritzburg-Glencoe power house. Equipment: Coal-handling plant, ash-handling plant, and circulating-water screening plant. Specifications from the Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2.—*Reuter's Trade Service* (Capetown).

Bloemfontein.—September 20th. Municipal Council. 1,200 yd. of 4-core, .2 sq. in., 660-V paper-insulated armoured cable.—*Reuter's Trade Service* (Capetown).

Stockton-on-Tees.—August 31st. District Fund, Gas, and Electricity Committees. Stores, &c., for three months. (August 18th.)

St. Annes-on-Sea.—Electricity Department.. 3,530 yd. .5 x .5 x .25 l.p. 3-core armoured cable; 1,460 yd. 7/22 l.p. ditto; 500 yd. .2 x .2 x .1 l.p. ditto. (August 18th.)

Wakefield.—August 31st. Wiring of Holmfield House for electric lighting. Mr. A. C. Allibone, town clerk, Town Hall, Wakefield.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—The municipal authorities of Genappe have postponed the scheme for the establishment of a central electric lighting station in the town, tenders for which were recently invited.

The firm of Noel, Van Gastol & Mettens, of Brussels, who submitted the lowest tender, have secured the contract for the establishment of a system of electricity distribution in the little town of Bertrix.

Thatcham.—Messrs. Daniel Adamson & Co., Ltd., of Dukinfield, have received an order for one of their latest patent electrically-driven crude sewage lifting plants for Messrs. Cropper's new factory at Thatcham, Berks. Mr. W. C. Easdale, of Westminster, is the consulting engineer to the scheme.

Government Contracts.—The following Government contracts were placed during July, 1922:—

Admiralty (Contract and Purchase Department)

Cables (main and service).—Johnson & Phillips, Ltd.
Telephone Cables.—Johnson & Phillips, Ltd.
Underground Cables.—Johnson & Phillips, Ltd.
Dynamometer.—Heenan & Froude, Ltd.
Dynamos.—Laurence, Scott & Co.
Electro-magnetic Clutch.—Sperry Gyroscope Co., Ltd.
Motors.—General Electric Co., Ltd.
Electric Travellers.—Sir W. Arrol & Co., Ltd.

War Office.

Secondary Battery.—D.P. Battery Co., Ltd.
Recorder Cranks.—Gledhill-Brook Time Recorders, Ltd.
Electric Locomotive and Accessories.—English Electric Co., Ltd.
Lamps and Lighting Fittings (various).—Barton & Sons, Ltd.; Cable Accessories, Ltd.; General Electric Co., Ltd.; W. Kent.

Air Ministry.

Batteries.—Siemens Bros. & Co., Ltd.
Electric Fan Regulators.—Mansell & Ogan, Ltd.

Crown Agents for the Colonies

Cable.—Hooper's Telegraph & I.R. Works, Ltd.
Lamps, &c.—General Electric Co., Ltd.
Switchgear.—Metropolitan-Vickers Electrical Export Co., Ltd.
Telegraph Apparatus.—Elliott Bros. (London), Ltd.
Train Lighting Spares.—J. Stone & Co., Ltd.
[illegible] Wilson & Sons.

Post Office.

Telegraph Apparatus.—Eastern Telegraph Co., Ltd.
[illegible] Automatic Telephone Manufacturing Co., Ltd.; General Electric Co., Ltd. (Peel Conner Telephone Works); Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Testing, Protective Apparatus, &c.—British L.M. Ericsson Manufacturing Co., Ltd.; Evershed & Vignoles, Ltd.; General Electric Co., Ltd. [illegible] Telephone Works), Paragon Telephone & Electric Works, Ltd.
Battery Boxes.—Siemens Bros. & Co., Ltd.
[illegible] Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli General [illegible] Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Casing and Cover.—Calder & McDougall, Ltd.
[illegible] and Co. Branch).
Dry Cells.—Ever Ready Co. (Great Britain), Ltd.
Porous Leclanché Cells.—Siemens Bros. & Co., Ltd.
Cable [illegible] Electric Works, Ltd.
C.I. Couplings.—Jones & Attwood, Ltd.
[illegible] Manufacturing Co., 1920, Ltd.
Lamps for [illegible] Ltd.
Electric Hand Lamps [illegible] Ltd.
Interlocking Gear [illegible] & Hobbs, Cables, Ltd.
Insulator Spindles.—Bullers, Ltd.
[illegible] Ltd.
Bronze Wire.—R. Johnson & Nephew, Ltd.
Insulated Bronze Wire.—Johnson & Phillips, Ltd.
Copper Wire.—T. Bolton & Sons, Ltd.; Electro-Metals Co.; Enfield Ediswan Cable Works, Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co., Ltd.).
Flame-proof Wire.—Macintosh Cable Co., Ltd.
G. I. Strand Wire.—Shropshire Iron Co., Ltd.
V. I. R. Wire.—W. Geipel & Co.
Leclanché Rod Zincs.—Eyre Smelting Co., Ltd.; Siemens Bros. & Co., Ltd.
Manufacture, Supply, Drawing-in, and Jointing Cable.—(Newport-Pontypool): W. T. Henley's Telegraph Works Co., Ltd.
Telephone Exchange Equipment.—St. Annes-on-Sea.—General Electric Co., Ltd. (Peel Conner Telephone Works); sub-contractors for accumulators, D.P. Battery Co., Ltd.; for motor generator set, Crompton and Co. Minories.—General Electric Co., Ltd. (Peel Conner Telephone Works); sub-contractors for accumulators, D.P. Battery Co., Ltd.; for motor generator set, Crompton & Co.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

In order to enable us to complete replies to queries received this week, we need the names of suppliers or manufacturers of:—

Windowlight electric signs for shop windows.

NOTES.

Standardisation in Australia.—Owing to the absence of any system of standardisation it is contended that there is an enormous waste of money, material and time in Australian engineering industries. In furtherance of a campaign to introduce the principle of standardisation in the industry a deputation representative of several branches of the engineering profession waited upon the Minister of Customs in May last, says the *Melbourne Age*. The Minister expressed his approval of the campaign, and announced that Mr. Knibbs, the Director of the Institute of Science and Industry, would be invited to submit a report, with recommendations, on the whole subject. This would be referred to the Cabinet for action. He considered an all-Australian conference on the question desirable.

Explosion at German Electro Works.—As the result of an explosion at the Rhine electro works at Knapsack three workmen have been killed and several injured.—*Reuter.*

Institute of Marine Engineers.—The report of the Council for the past year shows an increase of membership from 2,355 to 2,629. The list of papers which have been read indicates a very busy session. The re-opening of proceedings takes place on September 2nd, when Engineer Vice-Admiral Sir George G. Goodwin, K.C.B., is to deliver his presidential address.

Educational.—University of London.—A Goldsmid Entrance Scholarship of the value of £90 (£30 a year for three years), tenable in the Faculty of Engineering at University College, London, will be awarded on the results of an examination to be held in the last week of September. Entry forms must be sent in to the Secretary not later than September 9th.

Canadian Cancer Research.—The Quebec Government has decided to set aside $100,000 (about £22,000) for the purpose of establishing a radium institute, under the control of the University of Montreal, for the experimental treatment of cancer.—*The Times.*

Power Supply for the S.E. & C. Railway.—The Electricity Commissioners have issued a statement (which reached us too late to be published this week) with reference to the inquiry, held on May 30th last, into the application of the Managing Committee of the S.E. & C. Railway Co. for consent to establish a generating station at Angerstein's Wharf, at Charlton, and by the West Kent Electricity Co., Ltd., for consent to the establishment of a generating station at Belvedere, Erith.

The Commissioners, while of the opinion that the Railway Co.'s site is suitable for a 60,000-kW station, have considerable doubt whether a station of an ultimate capacity of 150,000 kW can be economically constructed on it. The Railway Co. expects to complete the first stage of electrification of its lines by June 30th, 1925, and the Commissioners have come to the conclusion that it has been proved to their satisfaction that there are authorised undertakers *willing*, and one is *able*, to supply the Railway Co. adequately at no greater cost than would have been incurred by the Railway Co.'s supplying itself. Therefore, it would be no disadvantage to the Railway Co., and would be a gain to the public interests concerned if the Railway Co. were to take its supply from an outside source, and to enable the parties to confer in order that they may arrange a mutually acceptable contract, the Commissioners have postponed their decision for a while.

The statement will be dealt with in more detail in our next issue.

The Applications of Electricity to Poultry Farming.—A paper on the above subject was read by Mr. R. Borlase Matthews at the sixth annual Poultry Conference, held on August 9th, at Harper Adams Agricultural College, Newport, Salop. Out of the large number of papers presented on various matters of importance to commercial poultry farmers, this paper appears to have excited the greatest interest. One of the points which attracted most attention was the electric lighting of poultry houses—a subject which has not received much consideration in this country, though it is almost universal in the poultry farming districts of America. The object is to increase the hours of feeding during the winter months, experience having shown that there is a direct connection between the hours of activity and egg production.

The question of small electricity generating plant for poultry farmers was considered, and the disadvantage of 32-volt and 50-volt circuits was emphasised. The author advocated bare overhead outside mains joined (by special connectors of his own design) to the interior wiring, which should preferably be twin or triple conductors insulated by toughened rubber or similar compound, such as "maconite." To meet the requirements of the farmer a new system of electric light fittings has been developed by Mr. R. Borlase Matthews. The capital outlay for the electrical equipment, a point upon which very little has been written, was dealt with very clearly. The cost was shown to be much less than for oil engines, while the capital expended on equipping a poultry farm electrically will produce an additional return of from 30 per cent. to 50 per cent. per annum—a matter well worth consideration. A demonstration was given of the "Auto-Countancy" system of account keeping which Mr. R. Borlase Matthews has developed and uses on his own farm.

The conclusion arrived at by the author—and it is amply borne out by the details given in the paper—is that comparatively little capital expenditure is required on the part of any poultry farmer to secure to himself permanent advantage in low labour costs, improved results, and comfortable living—if he spends his money on suitable electrical equipment. Naturally in a development so new to this country competent advice should be sought before making any outlay, but if this is obtained the poultry farmer can proceed with the certainty of increased profits.

The Closing of Londonderry Shipyard.—In view of attacks in the local Press on the conduct of the electricity department of the Corporation of Londonderry, alleging that the shipyard was closed in consequence of excessive charges for electrical energy, the Mayor invited the city electrical engineer, Mr. A. V. Macrory, M.I.E.E., to make a statement to the Council on the subject, which he did on Monday last. Mr. Macrory explained that an agreement had been made (without reference to himself) between the Corporation and the shipyard, which was in operation from November, 1917, to February, 1922; according to this agreement the Corporation undertook to extend the generating plant, provide special cables (costing about £7,000), and supply electricity at special rates, which resulted in average prices ranging from 1.36d. to 1.82d. during the past four years, whilst the load factor never exceeded 26.5 per cent. Being convinced that these charges involved serious loss to the department, Mr. Macrory advised the Corporation to revise them when the agreement expired, and this was done, the new rate, covering the bare cost of production, being under 1.5d. per kWh with a load factor of 20 per cent. and coal at 20s. a ton (less than half the price during recent years). The Shipyard expressed great dissatisfaction with the new terms, and its consulting engineers, Messrs. Sparks and Partners, conferred with Mr. Macrory, who supplied them with all the data asked for.

Councillor Logue, chairman of the electricity department, said the Corporation had lost on an average £5,000 a year for four years under the agreement. The Mayor pointed out that Mr. Sparks had not been able to show that the terms were unfair, and said the Council was resolved not to incur further losses; the Shipyard could install its own generating plant if it thought fit to do so.

In the end the matter was dropped, the view being held that the closing of the shipyard was not the fault of the Corporation. Anyone who knows the present depressed state of the shipbuilding industry will endorse this opinion; the allegation that the yard was closed on account of the excessive cost of power is obviously absurd, for this forms but a small proportion of the working expenses, and the terms offered by Mr. Macrory compare favourably with those prevailing at other industrial centres.

Modern American Street-lighting Practice.—In the paper presented by Mr. Earl A. Anderson at the twenty-seventh annual Convention of the American Society for Municipal Improvements held in Baltimore, Md., some months ago, the types of street-lighting systems most favoured at the present time for lighting the different sections in cities were described. The information contained in this paper shows the effect, therefore, modern street-lighting practice in the U.S.A.

For important business streets in cities, the most widely favoured method of lighting consists in the use of single-light ornamental standards mounted at heights of from 11 to 15 ft. and spaced opposite each other at distances of from 80 to 120 ft. For very narrow streets the lamps may be placed on one side only or staggered at the same spacing. An important increase in efficiency is secured by the use of lamps of 600, 1,000, 1,500 or 2,500 c.p. instead of the three, four or five-light clusters using small lamps which were the vogue before the introduction of the high-powered gasfilled incandescent lamp. There is at present a very noticeable tendency to depart from the use of the opal ball or globe, and to use instead a lantern structure, which by many is considered more pleasing in appearance.

Instead of the single-lamp standards spaced relatively close together, some cities have adopted standards carrying two or even three high-power lamps mounted from 20 to 30 ft. above the street and spaced from 150 to 200 ft. apart. The resultant effective illumination is not greatly different from the more usual arrangement and the exceptionally high mountings minimise any possibility of glare from the lamps. On the other hand, there appears to be much weight on the side of those who contend that in business streets the surrounding brightness of buildings, show windows, &c., is such that there is no possibility of serious glare even with the large lamp at the lower mounting of from 15 to 18 ft., and that the desirable "white way" effect is enhanced by lanterns at these heights spaced from 80 to 90 ft. apart.

The demand for higher levels of illumination in business streets has led in some cities to the consideration of lamp standards carrying two or three 1,000 or 1,500-c.p. lamps each and spaced no more widely apart than previous single-lamp installations. It is quite possible that there will be an increased development of this tendency, especially in the larger cities where the evening business and amusement crowds have become such that in many cities "white way" systems, which were installed largely as an ornamental or advertising feature, are even now barely adequate from the standpoint of lighting safety.

A satisfactory provision for thoroughfares outside the business district is an arrangement of lamps of 600, 1,000, or 1,500 c.p. spaced from 150 to 250 ft. apart, or at a maximum of 300 ft. If the street is very wide it may be necessary to consider each side as a separate street and provide lighting accordingly. The mounting height should be 20 or preferably 25 ft. in order to remove the bright light sources farther from the line of vision, and also in order to obtain a better spread of illumination. In the past, especially where there were wooden pole lines in the streets, it has been common practice to use a lighting fixture suspended from a mast arm. The mast arm has the virtue of bringing the lamp out over the street surface, thereby causing the light rays to clear low hanging foliage of adjacent trees. Bringing the lamp over the pavement also increases the possibilities of seeing objects in silhouette against the bright spot of light beneath the lamp or against the bright streak or glint reflections from the pavement.—A.I.E.E. *Journal*.

Electricity at the North Pole.—The wonders and enjoyment of "listening-in" may be brought to the Esquimaux by Captain Amundsen, who sailed on June 1st from Seattle for the Frozen North, where he will make an aerial survey of the North Pole. For this purpose, an Exide battery of 56 cells has been included among his equipment on the "Maude." This battery is to be used also for radio communication with Washington, and is to furnish electric light during the three years that Captain Amundsen expects to sojourn in the polar regions.

While it will not be possible to get any of the regularly broadcasted concerts for the benefit of his Esquimaux neighbours, Captain Amundsen will be able to put them in touch with the nearest point, which will probably be Nome, Alaska. It is also probable that he may "broadcast" specimens of Esquimaux music which may be picked up by those within 2,000 miles, the radius of his transmitting apparatus.

In addition, Captain Amundsen will keep in touch with Washington four times a day. His radio mesages will be sent and received by relay from Nome to St. Paul Station on the Bering Sea and thence to Washington.

The electric lights which Captain Amundsen will install upon his arrival at his destination will, however, no longer be a novelty for the Esquimaux, who already have been made acquainted with this mode of illumination. In 1914, the Crocker Land Expedition, headed by Captain Donald MacMillan, took a number of Exide batteries, and for the first time in the history of the world the Aurora Borealis had a rival in the form of electric illumination. A few months ago Captain MacMillan returned to the North, and again took an electric lighting system with him.

Captain Amundsen will use aeroplanes upon arriving at the farthest point. From these aeroplanes will be flashed reports to the "Maude," whose powerful transmitting apparatus will relay them back to civilisation.

Such service is necessarily hard on batteries, but Exides have already joined the ranks of Arctic veterans, and nothing short of actual destruction is expected to put them out of commission. The cells taken by the Crocker Land Expedition went through 4,000 miles of storms, and on one occasion were shipwrecked, but never put out of commission.

Reval Industrial Exhibition.—Owing to the success of the Reval Industrial Exhibition this year, the committee of the Exhibition has decided to hold another exhibition next summer. Preparations are being started immediately.—*Reuter* (Reval).

Telephone Progress.—In spite of the vicissitudes through which the British telephone service passed during the war, the arrears of work have been rapidly overtaken and the service is now showing a steady growth. At the end of January last the total number of telephones in the United Kingdom reached the million mark. On April 1st the telephones in Southern Ireland were transferred to the Irish Free State, and thus the Post Office total was reduced by 19,037 telephones; but if the present rate of increase is maintained the Post Office system will comprise over a million telephones by the end of this year.

The Post Office is actively engaged in developing telephonic facilities in rural districts, and, in particular, is drawing the attention of farmers to the value of telephone service in connection with their work. It is estimated that out of 3,110 existing exchanges, 1,930 serve purely rural districts. In addition, the service has been extended in the form of public call offices to 2,250 villages where no exchange exists. Since the beginning of May last 151 rural call offices have been opened. A prominent feature of the urban telephone system is the development of private branch exchange service. There are upwards of 990,000 telephones in the Post Office system; 142,163 provincial stations are joined up to private branch exchanges, and 106,464 London stations are similarly connected.

Automatic exchanges are already working in the following places: Accrington, Blackburn, Chepstow, Darlington, Dudley, Epsom, Grimsby, Fleetwood, Hereford, Hurley (Berks), Leeds, Newport (Mon.), Paisley, Portsmouth, Ramsey (Hunts), and Stockport. The largest of these are Leeds, with 9,600 lines, and Portsmouth, with 5,000 lines. Work is in hand for converting to the automatic principle the exchange systems at Sheffield, Dundee and Broughty Ferry, Gloucester, Gosport, and Brockhurst, Kirkcaldy and Dysart, Shrewsbury, Southampton, Swansea (including Sketty), Torquay, and York, while over thirty other schemes are being developed. In some cases, notably Dundee-Broughty Ferry, Portsmouth-Southampton and Swansea-Sketty, subscribers will use the automatic dialing device for communicating with subscribers on the adjoining exchange in each instance, as well as for calling other subscribers connected with the same exchange as themselves.

Important developments of the trunk wire system are in progress, and £2,230,000 is being spent during the current year under this head. Besides a large extension scheme rapid progress is being made with the work of placing existing routes underground, with the view of securing immunity from damage by storms and for providing for the growth of traffic. The main London-Edinburgh-Glasgow trunk route is being completed by an extension from Leeds to Edinburgh *via* Darlington and Jedburgh, and that from Birmingham to Bristol by the Worcester-Bristol section. Among other important underground routes to be put in hand are the London-Southend, Manchester-Preston, Preston-Lancaster, Colchester-Ipswich, and Edinburgh-Kirkcaldy lines.

For the convenience of users of the trunk lines a system of "fixed time" calls was recently introduced. The arrangement enables subscribers to book calls to be effected at a specified time on payment of a small addition to the ordinary fee.

The Anglo-Continental telephone service has been extended by means of a cable between Aldeburgh and Domburg, and communication with Amsterdam, Rotterdam, The Hague, and other places in Holland is now obtainable. There are at present twelve lines to Paris, three to Brussels, two to Antwerp, and one each to Calais, Lille, and Boulogne. The insertion of telephonic repeaters in trunk lines has greatly extended the range of trunk speech, and if it were practicable to provide additional channels of communication with France and Belgium there is no reason why service should not be extended to Italy, Germany, and other countries. Satisfactory service was, in fact, provided with Genoa during the international conference.

Telegraph Developments.—British progress is in the direction of the wider use of mechanical multiplex systems, by which it is possible to send and receive as many as six telegrams in both directions at one and the same time over a single wire. The first inland installation was fitted to the London-Birmingham main route in 1910; in 1914 a second London-Birmingham circuit was arranged, and in the same year the London-Glasgow and London-Liverpool routes were also converted to multiplex working. The system has since been extended to thirty-seven other main routes, and eighteen will be added this year. A three-station multiplex, or what may be termed a "tri-multiplex" installation, provided in 1920 for the Manchester-Leeds-Newcastle routes, has proved successful and a considerable number of similar sets will be brought into use within the next two or three years. The outstanding feature of this system of multiplex working is that it is possible to provide two metallic circuits on the less heavily loaded lines, whereas duplex and quadruplex working is not justified, with considerable decrease in line mileage. For instance, it was formerly necessary to maintain two circuits between Manchester and Newcastle-on-Tyne, two between Manchester and Leeds, and two between Leeds and Newcastle-on-Tyne. The whole of the traffic between these three offices is now disposed of over one line, with Leeds intermediate. Another important feature of this type of multiplex working is that the facilities between the offices on a circuit can be varied where necessary by means of a switch at the intermediate office, to give an additional channel between any two stations.

At the present time about 35 per cent. of the total traffic (some 37,000,000 telegrams per annum) at the Central Telegraph Office, St. Martins-le-Grand, is dealt with by multiplex arrangements, and that figure will be increased to upwards of 50 per cent. when the 1922-23 programme of new installations is completed. It is expected that ultimately 75 per cent. of the traffic at the larger offices will be dealt with by some form of machine telegraph apparatus.

An automatic telegraph concentrator switch is being constructed, and will be tried experimentally. By this system a number of circuits are grouped at one point to facilitate manipulation at periods when the traffic is relatively light, and the circuits are thus brought under observation of the available operators. The use of the switch will simplify the work at the out-stations no less than at the switch office.

It is generally known that the British Government acquired in 1917 a cable to Canada, known as the "Imperial" cable, and its use has considerably improved the communication between the mother country, Canada, and Australasia. The recent purchase of a second cable to Canada places the Post Office in a position to give an excellent service to the Colonies mentioned, as well as to the United States, Central America, the West Indies, and the Northern portion of South America.

Wireless Telegraphy.—On June 20th, 1922, at the Engineering Societies Building, N.Y., before a joint meeting of the Institute of Radio Engineers and the N.Y. section of the A.I.E.E., Senatore Guglielmo Marconi, honorary member of the A.I.E.E., presented a paper on "Radio Telegraphy," which called attention to new developments in the radio field, and Senatore Marconi demonstrated on a miniature set, before the audience of over 1,100 engineers, the possibility of directing wireless waves to any point desired. The Institute of Radio Engineers presented Senatore Marconi with its Medal of Honour, awarded by the Board of Direction to a pioneer of pre-eminent standing in the radio field, whose contributions to the field have added substantially to its development. The author first deals briefly with the early history of long-distance radio communication. The work carried out by the engineers and experts of the Marconi Co. in England with electron tubes or triode valves shows that, according to their experience, greater efficiency can be obtained at present by a number of bulbs used in parallel than by the employment of large single-unit tubes. Information is given in a general way with regard to recent practice in the design and construction of receivers with the object especially of improving selectivity, reducing interference, and concerning the possible speed of working. The lecture also deals briefly with results obtained at receiving observation stations situated in various far distant parts of the world, where it has been ascertained that radio signals arriving from high-power stations situated at or near the antipodes of the observation stations, reach the receivers by various ways around the earth, not always following the shortest great circle route, and also that at such places the electric waves coming round by different ways do in certain cases increase this effect on the receivers whilst in others interfere with each other. Apparently transmission is easier from west to east than from east to west, and it may be necessary to modify somewhat the transmission formula for long distances. It has also been ascertained that the most troublesome atmospheric disturbances or static usually come from the continents, and not from the oceans. The lecture further deals with a study of short electrical waves, and the results which have been obtained with waves of a length of from 1 to 20 metres, and shows that electric waves of under 20 metres in length, used in connection with suitable reflectors, are quite capable of providing a good and reliable point-to-point, unidirectional system over quite considerable distances. The application of this system as a directed finder in aid of navigation and as a method for preventing collisions at sea, is also dealt with.—A.I.E.E. *Journal*.

Suction Ash Plant at Runcorn.—One of the latest installations of Bennis ash handling plant has recently been completed at the boiler-house of the Mersey Co.'s generating station at Runcorn, which was described in our pages some time ago, for the disposal of red-hot ashes, as discharged from twelve chain-grate stokers, and delivery by suction pressure to an overhead ash-receiving tank outside the boiler-house. As the ashes fall over the end of the chain grates they drop into small hoppers located beneath the back of the grates, from which they are released periodically into the suction plant by opening a valve. Since it is necessary to break up the ashes to a suitable and uniform size an electrically-operated ash-breaker has been provided, which—being mounted on rails—can be placed between the outlet of any of the afore-mentioned hoppers and the corresponding inlet to the pipe system of the suction plant, which are plumb

above each other. An exhauster of the Root's blower type and a foul-air filter are employed. The exhauster is driven through machine-cut spur gearing by a 110 b.h.p. electric motor. The exhauster is connected to the overhead receiving tank through the intervention of the filter. After the suction main has deposited the ashes in the receiver the foul air is freed from the bulk of the fine dust, which is held in suspension in the foul air in its passage through the filter. The latter consists of a casing in which water sprays meet and purify the air and deposit the impurities in a sludge tank, so that the air passes to the exhauster in a state which does not injure the latter. The contents of the sludge tank are periodically removed, together with the ashes from the receiver, by gravity in railway trucks. A special shute is also provided to alternately deliver the ashes on to the ground or into barrows or small trucks, if this should be desirable. A hand-operated cat-head crane is provided over the top of the receiver to facilitate the renewal of any parts which may be required in course of time. A water service is provided at the inlet to the ash receiver to quench the ashes, and another at the top of the filter. The water is supplied by an electrically-driven centrifugal pump. The supply is automatically controlled by a valve device, designed by Messrs. Bennis, which controls the amount of water according to the volume of ash-laden air passing through the suction mains in such a manner that when but little ash is being carried along the pipes the water supply is checked, and when ash is passing more plentifully the flow of water increases. Several safety devices are also provided for. For instance, a relief valve is located in the pipe line close to the exhauster, which automatically admits air to the latter in the event of any choke in the pipe or of a similar emergency. Other provisions guard against the ill effects caused by explosions, which are always possible with such plant if, through lack of knowledge or inattention, small quantities of unburnt fuel pass into the pipes along with the ashes. When such fuel comes in contact with the red-hot ashes and water in the receiver an explosive gas may be produced, and when this accumulates and ignites considerable damage occurs through explosions. The Runcorn plant is said to be immune from such damage, since sufficient communication is automatically established with the outer atmosphere through the water seal at the bottom of the filter. Also, should an explosion occur, all that could happen would be the automatic opening of the explosion doors and the blowing out of the water from the water seal. In the Bennis type of plant, since the ashes entering the vessel vertically at the top fall direct on to ashes already in the receiver, no wear takes place.

Wireless Developments.—According to the *Daily Mail*, the need for meting out special wave-lengths for different branches of wireless is made clear by a recent expert statement which shows that with the best transmitting or receiving instrument to-day one particular wave-length cannot be isolated; a number of closely allied waves are always transmitted or received. A difference in frequency of at least 10,000 waves a second is necessary for two near-by transmitting stations not to cause interference or "jamming."

Locating thunderstorms by wireless is one of the remarkable operations carried out at the Croydon aerodrome meteorological station. A frame aerial is employed and a wave-length of 30,000 metres; a count is made of the number of atmospherics or static discharges in different directions during a period of 15 seconds. The position of a thunderstorm can be located by finding the direction in which the atmospheric disturbances took place.

A new method of sending photographs by wireless has been recently tried out in Italy, the invention of Prof. Korn. The system depends on the old idea of telegraphing code letters, each representing the size of the successive dots that go to make up a newspaper illustration. Prof. Korn has invented a special form of typewriter for building up the code telegraph into a new picture.

According to the *Daily Express*, a new system for the clarification of wireless messages has been invented by Mr. A. F. R. Cotton and Mr. E. W. Russell, two Cambridge undergraduates. They are able, by the use of artificial crystals, which exhibit a piezo-electric effect, to produce perfect articulation of the human voice and reproduction of all musical sounds, and the inventors of the Cotrus system claim that they can entirely eliminate buzzing. The invention may be adapted to a gramophone.

British Empire Patents.—The report of the conference which was held at the Patent Office, London, in June last, has been issued (H.M. Stationery Office, price 1s. net). The conference was attended by representatives of the self-governing Dominions and India, Mr. W. Temple Franks, C.B., presiding, and ten meetings were held, but no witnesses were called.

The report states that under the existing conditions, in order to obtain patent protection throughout the Empire, at least 46 separate applications have to be made, the initial payments amounting to £237, and the renewal fees to about £1,210. The position is considered by no means satisfactory; in addition to the great expense entailed, there are considerable divergences of practice and procedure, and a lack of certainty that an invention patented in one part of the Empire will necessarily receive the same protection in another.

A resolution of the conference unanimously approving of the institution of a "British Empire Patent" is recorded, and particulars are given of a number of schemes put out for this purpose, but rejected by the Conference on various grounds. It was decided to recommend a scheme which would preserve in full the existing rights of the United Kingdom, the self-governing Dominions, and India to grant patents within their own borders, but would allow of the establishment of a Central Patent Office for the grant of patents which should extend to any of those areas on registration therein; the scheme would also apply to all the Colonies and Protectorates, and the registration fees would be of such amount as would result in a considerable reduction in the total cost of patents throughout the Empire. One application and one specification would then suffice for the whole Empire, there would be only one examination into novelty, &c., the cost of the procedure—and probably of agents' fees—would be greatly reduced, and the patent would have a greater commercial value owing to the wider search made in the Central Office. Overlapping of functions in the various offices would be reduced, applications would be encouraged, and the system would create a further bond of union between the various parts of the British Empire. By selecting an existing office for the purpose, the cost of establishment would be diminished.

The report states that the Conference held that to undertake a really efficient universal search, such as was "professed to be undertaken by the Patent Offices of Germany and the United States," was impracticable, but that the question might be reconsidered later.

In view of the difficulty of carrying out the foregoing scheme, it was proposed, as a temporary measure, that subject to the right of the Dominions to object before registration of a patent, patents as at present granted by the Patent Office of the United Kingdom should be accepted for registration throughout the Empire, and this provisional scheme was adopted. Outlines of procedure were formulated, according to which, application for registration in a self-governing Dominion or India must be made within one year from the issue of the patent and accompanied by certified copies of the U.K. specification, the privileges, if registration is granted, to date from the date of the patent in the United Kingdom; in the cases of Colonies and Protectorates, application must be made within three years, the registration fee would be £1, and no renewal fees would be payable.

Much importance was attached by the Conference to the provision that certified copies of the specification of the U.K. patent should be accepted as complying with all the provisions of the local law as to lodgment of specifications and as to sufficiency of description and claims, this being regarded as a great step in advance.

The Conference expressed the opinion that it was of the highest importance that the procedure and practice in respect of the grant of patents should be uniform throughout the Empire. In order to guard against non-working, the compulsory licence system was recommended, on the lines of the U.K. Act of 1919. The duration of the Empire patent, it was thought, should be 16 years.

Appointments Vacant.—Constructional engineer (£600), for the Yorkshire Electric Power Co.; teacher in technical electricity, for the Wimbledon Technical Institute; assistant in the sales department (£400), for the Yorkshire Electric Power Co.

Fatalities.—An inquest was held on August 15th into the death of Reginald Hardman, an engineer employed by the British Thomson-Houston Co., Ltd., upon the construction of the Barton, Manchester power station. A witness stated that Hardman and another employé were carrying a steel door weighing about 100 lb. The other man lowered his end and it cut through an electric cable. Both men received a shock at 240 V, but while Hardman was killed the other man escaped death. A verdict of "Accidental death" was returned.

An inquest was held at Sheffield on August 18th upon the body of William Gandy (14) who died from tetanus following upon extensive burns on the left hand, caused by electricity. The mother of the deceased stated that she found her son, on August 5th, lying on his stomach with a toy electric motor clasped in his left hand. A wire from a plug adapter in a lamp socket was attached to the motor, and the current had to be switched off before the boy could be picked up. The burns were dressed, but on August 11th he complained of a sore throat and tightness of the jaws, and the following day he died. Mr. Yerbury, deputy general manager of the Sheffield Electricity Department, who was called to give expert evidence, said that the motor was not designed for a 200 V circuit, and consequently it was burned out when the current was switched on. Witness said that the department had no definite regulation to prevent people connecting apparatus in this way, and he emphasised how dangerous it was for people unacquainted with electrical devices to experiment in this manner. The coroner returned a verdict of "Accidental death."

OUR PERSONAL COLUMN

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The Dundee Corporation Electricity Committee last week considered the appointment of a successor to Mr. Richardson, the manager and engineer to the department. It will be remembered (ELEC. REV., July 21st, p. 96) that Mr. Douglas H. Bishop, who had charge of the generating station at Carolina Port, was recommended for the position at £800, rising by £50 per annum to £1,000, the salary of Mr. Richardson. Mr. Bishop, however, declined to be a candidate for the post unless a commencing salary of £1,000 was guaranteed. It was decided to advertise the appointment at £800, rising to £1,000, though it was pointed out that the basic rate under the Schedule of the Association of Municipal Electrical Engineers, was £1,500. As the result of the advertisement 86 applications were received and a short list of seven was selected (including Mr. Bishop). This was subsequently increased to nine, and last week the committee vote resulted as follows: for Mr. Bishop, 7; for Mr. Lamb (also of Dundee), 5; for Mr. McInnes (of Gravesend), 3. These figures were to be placed before the next meeting of the Council.

On the same day the Dundee Council Wages and Conditions of Service Committee had before it an application from the tramway manager (Mr. W. T. YOUNG) for an increase of salary (at present £600). A proposal by the Lord Provost that an increase to £700 be given was discussed, and an amendment for no increase was moved, but the advance was carried by 6 votes to 5. The *Scotsman* reports that after discussion the Committee unanimously decided to reduce practically all the officials' salaries by one-third of the bonus, it being provided that officials considering themselves aggrieved could make application for adjustment.

On July 10th, at Johannesburg, Mr. D. P. REID, A.M.I.E.E., M.(S.A.)I.E.E., chief mechanician of the Union Postal Telegraph and Telephone Department, was presented by his colleagues with handsome easy chairs and a teak table on his taking six months' leave prior to his retirement. In making the presentation, Mr. J. E. Williams, divisional plant superintendent, referred to his long acquaintance with Mr. Reid, who had entered the Home service in 1883; since then he had gained experience in the Federated Malay States, Australia, Norway, and Natal, before accepting his present post. Mr. Reid, who is widely known in both technical and musical circles in South Africa, is also interested in agriculture, and is taking up farming in Natal.

Mr. JOHN R. STRUTHERS, assistant resident engineer at the Dalmarnock Generating Station of the Glasgow Corporation Electricity Department, has been appointed chief assistant engineer of the Corporation Electricity Department, Belfast, and takes up his new duties about the middle of September.

Mr. H. W. WOLTON, A.M.I.E.E., has joined the board of Mayall & Co., Ltd., electrical and mechanical engineers' merchants, Birmingham.

The *Industrial Australian and Mining Standard* states that Mr. J. E. SCHURMAN, principal technical director of Brown, Boveri & Co., Switzerland, was due to arrive in Australia by the s.s. *Makura* in August. "Mr. Schurman's main object is to inquire into trade possibilities in this country, with special reference to the advisability of manufacturing locally."

MESSRS. WALLIS-JONES & DENT, consulting engineers (Reginald J. Wallis-Jones, O.B.E., M.Inst.C.E., M.I.E.E.) have removed their office from 23, Old Queen Street, S.W.1, to 50, Queen Anne's Gate, Westminster, S.W.1, (*i.e.*, their pre-war address). Telephone: "8070, Victoria."

Mr. PERCY DUNBABIN, a member of the staff of the British Insulated and Helsby Cables, Ltd., last week received a case of cutlery from his colleagues on the occasion of his marriage. Mr. George Seddon made the presentation.

At a luncheon held last week Mr. C. E. TOWN was presented with a massive silver salver and an illuminated address by the representatives of the commercial schools in London on the occasion of his retirement from the assistant secretaryship of the London Chamber of Commerce and the secretaryship of Commercial Education of the Chamber. The presentation was in recognition of the services rendered by him to the cause of commercial education during the past 25 years.

Obituary.—Mr. [illegible] W. BIRKETT. The death took place on August 17th, at the age of 75 years, of Mr. Francis W. Birkett, head of the firm of F. W. Birkett & Sons, Ltd., electrical contractors, brass founders and finishers, at Northgate, Cleckheaton.

Will.—MR. C. A. HOUFTON, chairman of the Mansfield Engineering Co., Ltd., mechanical and electrical engineers, left £23,845 gross personalty.

NEW COMPANIES REGISTERED.

Robins Electrical and Wireless Depôt and Institute, Ltd. (183,800.—Private company. Registered August 14th. Capital, £1,000 in £1 shares. To carry on the business of an electric, land wireless depot and institute, &c. The subscribers (each with one share) are: R. W. Robins, Wallbrook, Cwm Coed, Penylan, Cardiff, consulting engineer; Gladys Jones, 31, Morlais Street, Roath Park, Cardiff, clerk. The subscribers are to appoint the first directors. Remuneration as fixed by the company. Solicitors: Phœnix and Lewinson, Dumfries Chambers, Dumfries Place, Cardiff.

T. F. Collier & Co., Ltd. (183,805).—Private company. Registered August 16th. Capital, £1,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers, founders, iron and steel workers, &c. The first directors are: T. F. Collier, 352, Manchester Street, Oldham; Mrs. M. A. Collier, 64, Union Street West, Oldham. Qualification, £1. Remuneration (except managing director) as fixed by the company. Registered office: 352, Manchester Street, Oldham.

Unotis, Ltd. (183,835).—Private company. Registered August 17th. Capital, £2,000 in 1,800 preference shares of £1 each and 4,000 ordinary shares of 1s. each. To carry on the business of advertising and general publicity contractors and agents, electrical contractors, sign dealers, dealers in electrical fittings, manufacturers of and dealers in apparatus and appliances, employed by advertising contractors, &c. The subscribers (each with one preference share) are: L. W. Davies, 143, Pearl Street, Cardiff, engineer; G. E. Smith, 221, Gladstone Road, Barry, accountant and auditor. The subscribers are to appoint the first directors. Secretary, G. E. Smith. Registered office: 9, Park Place, Cardiff.

British Radio Sales Co., Ltd. (183,761).—Registered August 14th. Capital, £10,000 in 1s. shares. To carry on the business of mechanical and electrical engineers, manufacturers of and dealers in all apparatus and devices used in connection with telegraphy and telephony, with or without wires, signalling apparatus, &c. The first directors are: Ella M. Kentish, 64, Bishop's Road, Fulham, private secretary; H. Spratt, 44, Margery Park Road, Forest Gate, E., engineer; C. Sommers, 40, Rosewell Road, Shepherd's Bush, W., accountant; A. S. Brereton, Feiden Lodge, Boxmoor, Herts., wireless engineer; J. A. Carter, 11, Bennetts Castle Lane, Chadwell Heath, telephone engineer; J. S. Hogg, 3 and 4, Suffolk Place, Pall Mall, S.W., solicitor; E. L. Chasteauneuf, 32a, Kettering Street, Streatham, S.W., clerk. Remuneration: £150 each per annum (chairman, £200), free of income tax. Registered office: 62, Oxford Street, W.

Radio Service, Ltd. (183,774).—Private company. Registered August 5th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of wireless instruments (complete and otherwise), and accessories, vacuum valves, &c. The first directors are: Wolfie Grossman, 6, Park Crescent, Clissold Park, N.; Mrs. Leah Grossman, 6, Park Crescent, Clissold Park, N. Qualification: 3 shares. Remuneration as fixed by the company. Registered office: Evelyn House, 62, Oxford Street, W.1.

"All British" Wireless Manufactures Co., Ltd. (183,755).—Private company. Registered August 15th. Capital, £500 in £1 shares. To take over the business of wireless apparatus manufacturers and agents carried on by C. Hodgson and K. Lockwood at 70, Central Buildings, 41, North John Street, Liverpool, as the "All British" Wireless Manufactures Co. The permanent directors are: C. Hodgson, 37, Milton Road, Waterloo, Liverpool; K. Lockwood, 103, Breck Road, Anfield, Liverpool. Secretary: L. Jones. Registered office: 70, Central Buildings, 41, North John Street, Liverpool.

Alpha Electric and Oxy Acetylene Welding Co., Ltd. (183,727).—Private company. Registered August 14th. Capital, £2,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are: J. F. Gumm, 30, Romilly Road, Cardiff, clerk; Gladys Jones, 31, Morlais Street, Cardiff, clerk. The subscribers are to appoint the first directors. Remuneration as fixed by the company. Solicitors: Phœnix and Lewinson, Dumfries Chambers, 8, Dumfries Place, Cardiff.

Margate and District Electrical Co., Ltd. (183,719).—Private company. Registered August 12th. Capital, £3,000 in £1 shares. To carry on the business of electrical and general engineers, makers of and dealers in apparatus and machinery, &c. The first directors are: T. D. Wood, 1, Ethelbert Terrace, Margate; V. J. Woolls, 63, Cornwall Gardens, Margate, chemist. Qualification, £5. Remuneration as fixed by the company. Secretary: T. D. Wood. Registered office: 262, Northdown Road, Margate.

Excelsior Magnetic and Ignition Co., Ltd. (183,735).—Private company. Registered August 14th. Capital, £1,000 in £1 shares. To carry on the business of engineers, founders, smiths, machinists, manufacturers and patentees of a new type of "commutator" for Ford cars, manufacturers and repairers of all kinds of magnetos and ignition apparatus, electrical machinery, &c. The first directors are: J. Judge, 109, Chapman Street, Oldham Road, Manchester; J. T. Reid, 181, North Road, Clayton, Manchester; J. Valentine, 227, Pendlebury Road, Manchester; H. Shaw, 58, Craven Street, Hightown, Manchester; W. Judge, 109, Chapman Street, Oldham Road, Manchester. Qualification: 75 shares. Secretary: W. Judge. Registered office: 55, Cannon Street, Manchester.

Manchester Radio Co., Ltd. (183,746).—Private company. Registered August 14th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are: F. H. McCrea, 10, Mauldeth Road West, Withington, Manchester, mechanical engineer; J. H. McCrea, 10, Mauldeth Road West, Withington, Manchester, sanitary engineer. F. H. McCrea is first director and chairman. Qualification: £50. Registered office: 155, Oxford Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Eagle Electric Light and Power Co., Ltd.—Particulars of £750, authorised March 31st, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

H. Arrowsmith & Co., Ltd.—Debenture dated August 9th, 1922, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: R. C. Haworth, 56, Mosley Street, Manchester.

Hong-Kong Tramway Co., Ltd. (75,486).—Return dated April 27th, 1922 (filed July 27th). Capital, £81,250 in 5s. shares. All shares taken up. £81,250 considered as paid. Mortgages and charges (at date of return), $700,000 (£90,416 13s. 4d. at exchange, 2s. 7d. per dollar)—discharged on June 30th, 1922.

Satisfaction in full on June 30th, 1922, of charge dated May 31st, 1919, and supplemental equitable charge dated May 30th, 1921, securing $700,000.

Sloan Electrical Co., Ltd. (61,528).—Return dated July 5th, 1922. Capital, £60,000 in £1 shares (10,000 preference and 50,000 ordinary). 5,000 preference and 40,000 ordinary shares taken up. £38,500 paid. £6,500 considered as paid. Mortgages and charges, nil.

Rangoon Electric Tramway & Supply Co., Ltd. (86,932).—Return dated May 4th, 1922 (filed June 14th). Capital, £800,000 in 50,000 preference shares of £5 each and 550,000 ordinary shares of £1 each. 50,000 preference and 250,000 ordinary shares taken up. £435,000 paid, being £5 per share on the preference and £1 per share on 185,000 ordinary. £65,000 considered as paid on 65,000 ordinary shares. Mortgages and charges, £231,587.

CITY NOTES.

Indo-European Telegraph Co., Ltd.

The accounts for the year 1921 have now been issued, and they will be submitted for confirmation at the next general meeting. At the meeting held in April last the shareholders were informed of the only salient feature, namely, the expenditure necessary on the reconstruction of the line in Russia and Poland. Mr. C. H. Tritton, son of the chairman, has been elected a director in the place of the late Mr. Chas. Holland. The accounts show a balance carried to profit and loss account of £38,675. To this is added £16,620 brought forward from 1920, and corporation profits tax and income tax amounting to £7,554 are deducted, leaving £47,742. The total dividend of 7 per cent. for the year free of income tax required £29,750, and the balance carried forward is £17,992.

Singapore Electric Tramways Co., Ltd.

The directors announce that, owing to the urgency of the matter, it has not been found practicable to carry out the authority given by the debenture holders at the meeting on July 26th, as it is found that the creation of an effective security, to be given to the Shanghai Electric Construction Co., would involve a serious delay in consequence of the necessity of such security being registered in Singapore. With a view, therefore, to minimising delay and as a precautionary measure, it was decided to apply to the Court forthwith for the appointment of a receiver for the debenture holders, and on August 3rd an order was made appointing Sir William Plender, G.B.E., receiver and manager. Money may be borrowed by the receiver without the necessity of registering a new security in Singapore, and in this way effect will be given, although in a different form, to the course of action sanctioned by the debenture holders.—*Financial Times.*

West India and Panama Telegraph Co., Ltd.

The report for the year to December 31st, 1921, states that the amount to credit of revenue was £93,970, and the expenses totalled £95,490, resulting in a loss on the year's working of £1,519. The debit balance of the revenue account is now £77,911. Had it not been for the fact that £21,991 was earned in 1921 by the hiring of the company's cable ship and by the sale of several years' accumulations of old materials, the total debit balance would have reached nearly £100,000. The hope of improved business in 1921, which the directors entertained, had unfortunately not been realised. Trade in the British West Indies continues stagnant, and there seems little prospect of early revival, and in the American island of Porto Rico, where business is more active, the company has now to meet the competition not only of a French company, but also of an American company. The company's investments having been practically exhausted owing to the long detention of the cable ship at the Trinidad Government dock, the directors recognised that it would not be possible to continue working at a loss, and they considered it imperative to place the serious position of the company before the Treasury and the Colonial Office. The directors pointed out the inconvenience which would result to the British Isles if the telegraph service had to be suspended, and they asked for Government assistance. At present no relief has been offered to the company; there has, indeed, been a definite refusal of direct financial help, but the directors have submitted another proposal, which is now under the consideration of the Government.

French Companies.

The *Ateliers de Constructions Electriques*, of Metz, report a decline in the profits from 405,000 fr. in 1920 to 133,000 fr. last year. Excepting a small sum carried forward, the balance has been devoted to depreciation and reserve fund.

The *Société Francaise Radio-Electrique* reports that the development of the undertaking necessitates the raising of new capital, there being a great disproportion between the latter and the importance of the company. Thus the Levallois works alone has involved an expenditure in excess of the share capital, and the orders executed in 1921 were of the value of nearly five times the amount of the capital. In the circumstances it has been decided to issue 50,000 new shares, and thereby increase the share capital to 12,000,000 fr.

Petters, Ltd.—The report for the year ended March 31st states that after providing for depreciation and bad and doubtful debts, and after the transfer from reserve fund of £25,000 to meet losses on stocks, there is a balance of £10,918. The directors recommend that this balance be carried forward. The financial position does not warrant the payment of any dividend at present.

German Capital Increase.—The Continental Company for Electrical Undertakings, of Nuremberg, has decided to increase the share capital by 2,000,000 marks to 34,000,000 marks by the issue of 6 per cent. preference shares having multiple voting powers. The shares will be taken over by the Schuckert Electricity Company, of Nuremberg, which already holds 75 per cent. of the capital in the other company.

British Columbia Electric Railway Co., Ltd.—Dividends of 3½ per cent., free of income tax, both on the preferred and deferred ordinary stocks, in respect of the year ended June 30th, 1922.

Fairbairn Lawson Combe Barbour, Ltd.—Interim dividend on the preference shares at the rate of 5 per cent. and on the ordinary shares at the rate of 5 per cent. per annum for the six months.

Charles Clifford & Son, Ltd.—Interim dividends for the half-year on the preference shares at the rate of 6 per cent. per annum, less tax, and on the ordinary shares at the rate of 10 per cent. per annum, free of tax.

Stock Exchange Notice.—The undermentioned has been ordered to be officially quoted:

North Metropolitan Electric Power Supply, 15,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 305,001 to 320,000).

Aberdeen Suburban Tramways Co., Ltd.—Dividend at the rate of 7 per cent. for year, carrying forward £2,027.

Electro Bleach and By-Products, Ltd.—Interim dividend of 3½ per cent., less tax, on the preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The principal activity of the Stock Exchange markets at the present time is that shown in South African mining shares. Outside this particular department, business is quiet, with the War Loan and other similar investment stocks inclined to give way a little owing to the uncertainty of the political developments in connection with Reparations and debt cancellation. For these causes the War Loan has dwindled to the near neighbourhood of 100, but such heaviness has not extended beyond what is called the Consol market. It does not affect, for instance, the strength of industrial debentures and preference issues. The electricity supply list displays all its accustomed firmness. The new County of London ordinary, after being 3s. 9d. premium, eased off to 3s. 3d. premium, which is equal to 25s. 9d. for the fully-paid shares, while the 6 per cent. preference, after touching 2s. premium, are but a few pence less at the present time. Calcutta Tramway Second Debentures have risen to 2½ premium, though the other Indian Electric new issues are inclined to be dull, Madras being back to the subscription price.

The Home Railway list in the Underground group is distinctly strong. Metropolitan Consolidated took the lead. Rumour links, for the *n*th time in twenty years, the Metropolitan with the Great Western Railway, and the price is up to 54. Districts are good, at close upon 40. Underground Electric ordinary, after touching 2⅝, went back again to 2½, and the Income Bonds are 1 up at 84¼. For the two recently issued 4½ per cent. Debenture Government-guaranteed stocks of the City and South London and the London Electric companies, demand keeps the price steady at 95¾. In both these cases, buyers can obtain bearer scrip for level amounts of £100 stock. This means that purchasers can escape the heavy 1 per cent. *ad valorem* stamp duty, but, of course, when the stock becomes registered, the stamp will be payable by the buyer.

Some of those interested in electricity supply shares have received copies of the leaflet issued by the "Conference of Local Authorities Owning Electricity Undertakings in London and Home Counties," which leaflet declares that the average selling price from municipal stations is approximately one-third less than the average price charged for supplies from stations that are not municipal stations. Doubtless the informed have means for checking what to the outsider appears a somewhat bold assertion, but obviously the companies are not disturbed by the comparison which is drawn. Westminsters are 5s. better at 7⅞, and Kensington at 7⅞. Metropolitan ordinary, County ordinary, Chelseas and several preferences are up on the week.

Brush ordinary receded to 25s. 9d., and British Electric Traction, after hardening to 62 went back to 59½. Edison Swan at 3s. 3d. have regained the few pence they lost last week. General Electric ordinary stiffened to 18s. 9d. Metropolitan-Vickers preference at 2½ are 1/16 higher. India Rubber 5 per cent. debentures of 1926 improved to 96. Falkestone Electrics at 3½ are ¼ up, and rises have occurred in Adelaides at 18s. 9d., Urbans 17s. 6d., and a few other shares of this kind. The Eastern Telegraph group has rallied from the slight heaviness which overtook prices last week. Eastern Extensions stand higher at 18¼, Eastern ordinary at 18¾ is 1½ to the good, and Globe preference improved to 11½. Great Northerns are a little better at 29¼. Anglo-American preferred at 10½ is 1½ up. The West India & Panama Co. publishes another melancholy report, but the price of the ordinary shares remains about 5s.; more or less nominal.

The effect of the chairman's cheerful speech at the Marconi meeting is making itself felt. The parent shares are 3 better at 2⅞. It is said in the market that a good many shares have

recently been pressed for sale and that these have found a home. More yet, when "broadcasting" begins in earnest the company is expected to benefit substantially from the orders which will pour in for sets ranging from £6 to £50. Radio Communication during the last few days have gone up a couple of shillings to 23s. The preferred advanced more quietly, to 14s. 9d., Canadian Marconis are a trifle firmer at 10s. 6d. bid and the Marconi market, as a whole, looks better than it has done for some time past.

Hemerys have strengthened to 45s. 9d. Callenders rose to 2£, and this particular group shows marked strength. London and Suburban Traction preference are slightly harder at 10s., the ordinary remaining about 1s. 9d. Babcock & Wilcox eased off to 2¾. The iron and steel market is somewhat heavy, owing to the issue of one or two bad reports during this month.

British Columbia Electric stocks are good, with rises in the preferred and deferred. Mexico Tramways 5 per cent. bonds at 73½ are one higher. Mexican Light & Power fives at 63½ have shed a couple of points. Except for these changes, the foreign list is uninteresting. There is nothing much doing in the rubber market. The price of the material has dwindled below 7d. per lb., but holders of rubber shares are evidently prepared to "see the thing through," and the air is thick with vague talk of certain new developments that are declared to be pending in connection with American demand. These anticipations are too nebulous to provoke any particular buying of shares so long as rubber remains at anything like the present unprofitable level. The armament group of shares is disposed to sympathise with the dulness in the iron and steel division.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Aug. 22, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7⅝	—	£8 0 0
Charing Cross Ordinary	8	9	7½	—	5 17 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6¼	+ ¼	4 18 0
City of London	14	14	2½	—	6 18 0
do. do. 6 per cent. Pref.	6	6	23/-	- 6d.	5 4 4
County of London	8	8	1⅝	+ ⅛	5 11 4
do. do. 6 per cent. Pref.	6	6	23/-	+6d.	5 4 4
Kensington Ordinary	9	10	7¼	+ ¼	6 15 7
London Electric	3½	4	2¼	—	6 18 0
do. do. 6 per cent. Pref.	6	6	5¼	+ ¼	5 17 1
Metropolitan	7	7	5⅝	+ ⅛	6 4 5
do. 4½ per cent. Pref.	4½	4½	4		5 12 6
St. James' and Pall Mall	12	12	8¾	—	6 17 2
South London	7	7	8½	—	8 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅜	+ ¼	6 11 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104½	+1½	5 14 8
do. Def.	1½	84/6	23½	—	7 9 0
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8¾	— ¼	8 9 8
Eastern Extension	10	10	13⅜	+ ⅜	5 6 8
Eastern Tel. Ord.	10	10	180⅝	+1½	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 8 5
do. do. Pref.	6	6	11⅝	+ ⅛	5 4 4
Great Northern Tel.	24	22	20½	+ ½	7 10 6
Indo-European	10	10	26	— ½	6 19 0
Marconi	25	15	2⅝	+ ⅛	6 6 4
Oriental Telephone Ord.	12	12	23	—	*5 1 1
United K. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 3
Home Rails.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2¼	55½	+1	4 2 7
do District	Nil	1	8⅝	—	2 11 6
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	84½	+1	*4 14 7
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	83	—	7 17 2
do. do. 2nd Pref.	Nil	5½	84½	-	7 0 9
do. do. 5 per cent. Deb.	5	5	82	—	6 2 0
Brazil Tractions	Nil	Nil	49⅜	-	8 1 0
British Columbia Elec. Rly. Pcc.	5	5	70½	—	6 9 9
do. do. Preferred	5	9/-	60½	+1	*6 13 6
do. do. Deferred	3	12/-	76½	+2	*8 2 4
do. do. Deb.	4½	4½	76	—	5 11 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	73½	+1	—
do. do. 6 per cent. Bonds	Nil	Nil	45½	—	Nil
Mexican Light & Common	Nil	Nil	22½		Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	5	63½	—2	7 17 6
Manufacturing Companies.					
Babcock & Wilcox	15	16	2⅝	— ⅛	5 11 4
British Aluminium Ord.	10	10	18/8	—	—
British Insulated Ord.	15	15	2¼	+ ⅛	7 1 2
Callenders	15	15	2⅛	—	7 1 2
do. 6% Pref.	6¾	6¾	1⅛	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 18 4
Edison-Swan	10	Nil	3/8	+9d.	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1¼	—	8 0 0
English Electric	8	5	17/6	—	5 14 8
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6¾	6¾	22/-	—	5 18 2
do. Ord.	10	5	18/9	+6d.	5 6 8
Henley	15	15	2	+ ⅛	6 11 6
do. 4½ Pref.	1½	1½	4⅜	—	5 2 10
India-Rubber	10	—	4½	—	—
Met.-Vickers Pref.	8	8	2⅞	+ ⅛	6 — 0
Siemens Ord.	10	10	27/-	—	*7 8 2
Telegraph Con.	20	[redacted]	26	—	*4 19 2

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 23rd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	7½d.	½d. dec.
a Ammoniac, Sal ... per ton	£63	...
a Ammonia, Muriate (large crystal) ...	£48	...
a Bisulphide of Carbon ...	...	...
a Borax ... per ton	£30	...
a Copper Sulphate ...	£26 10s.	...
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a ,, Perchlorate ...	7½d.	...
a Shellac ... per cwt.	£16 15s.	...
a Sulphur, Sublimed Flowers ...	£11 10s.	...
a ,, Lump ...	£11	...
a Soda, Chlorate ... per lb.	3½d.	...
a ,, Crystals ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£120	...
b ,, Wire ... per lb.	1/9 to 2/6	...
b ,, Sheet ...	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£150	...
Grade II ... ,, ,,	£108	...
Grade III ... ,, ,,	£62	...
c Brass (rolled metal 2' to 12' basis) per lb.	9½d.	½d. inc.
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£94	...
c ,, Sheet ... ,,	£94	...
c ,, Rod ... ,,	£94	...
d ,, (Electrolytic) Bars ... ,,	£71	£1 dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£81	£1 dec.
d ,, ,, H.C. Wire per lb.	10¾d.	¼ dec.
f Ebonite Rod ... ,,	3/6	...
f ,, Sheet ... ,,	3/-	...
g German Silver Wire ... ,,	2/6	...
h Gutta-percha, fine ... ,,	12/6	...
h India-rubber, Para fine ... ,,	10½d.	1d. inc.
i Iron Pig (Cleveland Warrants) ... per ton	90/-	...
j ,, Wire, galv. No. 8, P.O. qual. ,,	£24	£1 dec.
g Lead, English Pig ... ,,	£26	10s. dec.
g Mercury ... per bot.	£11 15s.	...
c Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ... ,,	1/1	...
p ,, drawn bars and rods ,,	1/3	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ,,	1/3½	...
o Platinum ... per oz.	£19 10s.	...
d Silicium Bronze Wire ... per lb.	1/-	...
r Steel, Magnet, in bars ... ,,	1/-	...
n Tin, Block (English) ... per ton	£159 10s. to £160	40/- to 50/- dec.
n ,, Wire, Nos. 1 to 16 ... per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Electric Heating Increases Oil Output.—Production from low-gravity oil wells can be increased 100 per cent. through the application of electric heat, says the *Journal of Electricity and Western Industry*. A recent test at one of the Californian oil fields in the case of a low-gravity or "head" well demonstrated the feasibility of the scheme. A 5-kW heater consisting of four sections was placed around the well casing before the pumping commenced. Actual measurement showed an increased production of from 50 to 75 per cent. In the case of a 10-kW heater production was increased 100 per cent. It was determined that the cost of operating such a heater averaged $20 per month per well. Low-gravity or "head" wells can only be pumped approximately eight hours out of twenty-four. The application of the electric heater greatly increased the pumping period. It is believed that there are unlimited possibilities in the application of electric heat to oil production in low-gravity districts, not only in pumping from the wells, but also in transporting the oil from the field to the refinery or to the shipping point.

International Tramway Congress.—The *Electric Railway and Tramway Journal* announces that the first post-war Congress of the Union Internationale de Tramways, de Chemins de Fer d'intérêt local, et de Transports Publics Automobiles is to take place in Brussels from October 2nd to 7th.

Among the subjects which are being discussed are: The type of current for light railways; the use of the mercury vapour rectifier for tramway systems; one-man cars; automatic sub-stations; the repair of tracks by electric welding, &c.; and modern improvements in tramway rolling stock.

FALSE MARKING AND DESCRIPTION OF GOODS WITH SPECIAL REFERENCE TO ORIGIN.

By THEODORE RICH.

Part IV.—A World-Wide Problem.

During the last century England gradually became the leading country of the world regarding the encouragement of business honesty, an important factor being the mercantile law. Steps taken in this country were to a material extent copied in the Dominions and Colonies, and had their reflection in the measures of many other countries.

It was pointed out truly by the 1920 Committee that a British manufacturer cannot protest when he finds that imitations of his goods are being manufactured or sold in some foreign country, and that the local legislation and the practical application of it are inadequate to safeguard his interests, if he lives at home in a glass house where, owing to the state of the law, enormous quantities of goods are sold with impunity with deliberately false marking, "get up," or trade description. It is difficult to expect consuls, diplomats and commercial attachés to take much more than a languid interest in such subjects if people at home refuse to take energetic steps to put their own house in order.

The law in most countries regarding these matters is unsatisfactory and uncertain, and in England exceedingly slow and expensive. In many cases manufacturers hesitate, therefore, to act where their own interests are involved, and only very rarely can be persuaded to move where it is a matter affecting the whole trade.

The alternatives to action by individuals is action by manufacturers' associations, Chambers of Commerce, or by Government departments.

The attitude of the Government always has been that individual concerns, especially if they are of some magnitude, should protect themselves on the assumption that those who pay taxes, and especially those who pay supertax, have no right to expect Government departments to show any direct return for money spent in the way of assistance or actions in law.

Employers who are bothered by overlapping officials whose time is taken up by futile returns, must not expect assistance; the policy adopted regarding the Department of Overseas Trade shows the mentality of the day.

Many Chambers of Commerce are falling under the suspicion of being dominated by alien interests, and too often associations, frightened by the futility and expense of efforts in the past, are slow to act; there are, however, exceptions.

The Case for Government Action.

In the 1890 inquiry the case for Government action was put clearly by Mr. S. G. Richardson, then Master Cutler of Sheffield. *Question:* "In the case of a distinct violation of a trade description, a false description, do you not think that the prosecution should rather be undertaken by the person aggrieved than by the Public Prosecutor?—No, I think not; I think that the Merchandise Marks Act was intended as a benefit to the whole community, and that the expense of prosecuting, and the onus of prosecuting, should fall upon the community."

The same witness admitted that "if the Government undertook the duty and prosecuted, the effect of Government prosecutions would be so striking upon public opinion that there would be a great hesitation before anybody resorted to fraud."

Ever since the original Act was passed there have been continuous demands on the part of a material section of the manufacturers of this country for prosecutions to be undertaken by Government departments. In compliance with these demands, the 1891 short amending Act was passed, which empowered the Board of Trade to act "in cases appearing to the Board to affect the general interests of the country, or of a section of the community, or of a trade" (Section 2).

This amending Act, as far as false descriptions of origin are concerned, has remained almost a dead letter; cases galore have been put before the Board, as blue-book evidence shows. There are more votes and popularity to be got by hauling a manufacturer (the popular Aunt Sally) before a local bench for petty infractions of busybody legislation, and for not paying Trade Board wages that his trade cannot stand, than by prosecuting those who obtain extra profits by "free fraud."

In recent years also, in Government Departments officials have begun to realise that the road to promotion is not facilitated by hostility to the Anglo-German element in our midst and in high places. More than that, knowing the number of men now in Government offices who have only the flimsiest ties to this country, some people are afraid that information they may give may get round much too quickly to rivals in Central Europe and to their agents and allies at home.

If it is right for the Government, by legislation, to protect the worker during his employment, and to safeguard his interest when he pays for his housing, when he buys milk or butter, and to protect the collier by a checkweighman, and the coal consumer from short weight, it is equally just to protect the manufacturer, who risks his capital when providing employment and pays a very high proportion of the local and national taxes, from unfair competition, through non-marking or trade innuendoes, and at the same time to limit the activities of those who rob the ultimate purchaser by making much more profit than they otherwise would but for such deception.

Complaints have been made again and again since 1890 that the Board of Trade keeps no staff of inspectors, no detectives to see that the Act is carried out, to prevent the public being defrauded; although, naturally, money can be found for Labour Exchange officials and continuation-school inspectors, and many thousands of pounds can be voted for almost worthless trade statistics.

The 1894 Merchandise Marks (Prosecutions) Act empowered the Ministry of Agriculture to prosecute in cases relating to agricultural and horticultural produce. Quite apart from prosecutions, complaints by inspectors appointed by this Ministry have led in many cases to the discontinuance of deceptive labels. Traders fear prosecutions and exposure, especially where Government Departments are concerned; the moral effect is very great.

There is little doubt that some of the hundreds of inspectors of both sexes who badger working-class families nowadays could be put on more useful work to promote honest trading.

We have been termed a race of shopkeepers. This country has to stand or fall by its manufacturing and producing stability, not by the least honest section of our merchants and middlemen.

There is, on the other hand, a very strong feeling that if the Government piles burdens in the form of innumerable regulations on to the back of a manufacturer (and while a certain proportion of these benefit the manufacturer in the long run through increased efficiency, yet a material proportion of them, put on as a sop to inspired popular clamour, must react on the minimum price at which he can sell his goods), then it is the duty of the Government to see that a purchaser has reasonable opportunity of judging whether the goods he buys have been made at home under special regulations or in some country where conditions are better or worse.

As far as trade is concerned, the old principle of our law that "a private injury is a public wrong" is, to a large extent, dead; taxpayers expect more obstruction

than assistance from Government Departments, and fair trade has now become a question not of morality, but of political intrigue.

There is the fear, however, nowadays that if the Board of Trade started to create a department to handle inquiries, a new hotbed of officialdom would result, that four-figure jobs would be handed round in return for political services rendered, and that more time would be spent on form-filling and departmental minutes than in useful work.

There is also the danger that, as with the Business Names Act, respectable people would be harried to create prejudice to the law. Legislation passed to comply with a legitimate demand can quickly be turned into a farce if it happens to be inconvenient to friends of the "powers that be." Years ago, before the days of ultra-professional politics with its appropriate influences, Government Departments were to a large extent trusted by the manufacturing community, as witness remarks in the 1890 Report. Things are different to-day in some cases, it seems.

Board of Trade Inactivity.

The evidence of Mr. H. Fountain, Assistant Secretary of the Board of Trade, before the 1920 Committee, is of considerable interest. He said there had only been a few prosecutions regarding false indications of origin. When a buyer who is not in the trade, and therefore not a specialist, sees a name with an English address on an article he naturally thinks that it is English, but, conveniently for those intending to deceive, the Board of Trade has "felt it impossible to prosecute where a firm in this country simply put their name on goods, unless the firm represent themselves as manufacturers." (Paragraphs 9 and 17.)

There is no obligation on the Customs to notify the Board of Trade when suspicious goods are passed; they often, however, do so. It is exceedingly difficult once goods are in circulation to prove legally that they are foreign and not British, and cases fall at times between two stools.

Mr. Fountain said that his Board had prosecuted in cases where foreign goods have been described in catalogues or advertisements; he did not say whether the words "Works so-and-so," had been used in these cases.

The following questions by Mr. Kerly, K.C., and answers given in the 1920 inquiry by Mr. Fountain, of the Board of Trade, show the mentality of Government Departments. In reply to a question regarding the results obtained, Mr. Fountain said:

"I do argue undoubtedly that the effect of a Board of Trade prosecution is to prevent a large number of other people who were sailing rather close to the wind from doing things which otherwise they would have done, for fear of having a prosecution of that character."

Mr. Kerly, who had had, as he stated, some professional acquaintance with the prosecution of a number of small grocers for selling washing soda as sulphate of soda, said that "after these prosecutions had been going on for a number of years at the expense of Messrs. Brunner Mond, the Board of Trade were persuaded to prosecute themselves, and they secured a conviction. *Answer*.—"I remember such a case."

Mr. Kerly: "After that the misdescriptions continued for years, and the Board of Trade would never prosecute again."

"I suggest to you that the view exists that the Board of Trade has been much too reluctant in plain cases, that it has taken months and months, and sometimes years, to persuade them to move, and that when they have prosecuted they have become so exhausted that it has taken them a long time to recover." *Answer*.—"I do not think I can answer that question."

Firms like Brunner Mond pay many thousands a year in State taxes; they must not expect State officials, whose pay comes from the taxpayer, to stir themselves, except perhaps when the monthly departmental cheque comes to hand; there is then little reluctance and no question of months or years before it is cashed.

Difficulties Regarding the Act.

Ever since the original Merchandise Marks Act was passed, certain glaring defects have been pointed out, and although certain minor amending Acts have been passed, nothing has been done to amend the defective clauses.

One great difficulty is that prosecutions under the Act take place before a Court of Summary Jurisdiction, that is to say, a stipendiary magistrate or local bench, and although the Act allows of an indictment, that is to say, action before a High Court, such facilities have for some reason been rendered nugatory.

It has been pointed out that Merchandise Marks Act cases have to be taken as and when convenient between "drunks" and "black eyes"; the cases sometimes hang on adjourned for months; the celebrated "sardine" case took nearly four years, and when some important point has been thrashed out at endless expense, it carries no material weight, as the proceedings have taken place in an inferior Court.

The case, if the result is disputed, will go to Quarter Sessions, and then perhaps to the High Court.

The case is of a criminal character, and therefore it is often difficult to get sufficient evidence to secure a conviction. "It is extremely difficult, once the goods have got into circulation (that is to say, cleared from the Customs), to prove that they were foreign goods." (1920 Committee, paragraph 19.)

In trade mark cases the matter goes straight to the High Court before a judge who usually has considerable experience in such matters, and therefore the matter goes through more expeditiously; and, further, in all such cases, there is the incentive of a definite injury to a definite party.

Like so many other pieces of legislation, the Act was well meant but badly framed.

An enormous amount of fraud has taken place with the aid of "verbal descriptions"; in a few cases fines have been inflicted; in a number of cases, however, the bench has refused to act. Some people are afraid that the inclusion of verbal misdescriptions might lead to a good deal of perjury, although they apply to the Food and Drugs Act, and those who sail close to the wind are not anxious to put anything in writing.

Those who have wasted a large amount of time and money are loth to spend more in taking a matter to a High Court on appeal, and it is only when the High Court has decided a particular point of law that any point can be said to be definitely decided. The difficulty is not so much the wording of the Act proper as the great inconvenience involved in putting the Act in motion and the dead wall of departmental procrastination and obstruction.

If a manufacturer prosecutes successfully he may get a few guineas costs allowed by the Bench where the actual cost has run into hundreds of pounds, and although under the Act costs allowed are not limited, and in one case in London £500 was allowed, yet as a rule costs are so heavy that even after a successful prosecution a delinquent may be tempted to go on doing the same thing elsewhere, knowing that unless a complaining party is backed by a powerful trade association he will soon get tired of spending money to little effect.

There is also the disadvantage of having trade matters decided by a local Bench, as the Bench may be influenced by personal interests. Merchants and middlemen generally object to the public knowing what they are buying.

A Narrow Escape.—A party of three in a motor-cycle combination narrowly escaped a fatal electric shock on August 16th. While passing through Crayford the side-car passed over a fallen trolley wire, causing a shower of sparks. Tramway workers immediately drew the wire away and the party was unhurt. It is thought that the insulation afforded by the rubber tires prevented a serious accident.

SÖDERBERG ELECTRIC FURNACE ELECTRODES.

Self-Baking Continuous Type.

The Söderberg self-baking electric furnace electrode is a continuous one that is built, baked, and renewed *in situ* on the furnace of which it is a part. It is claimed to be an everlasting electrode which, once installed with the furnace, will continue to work without it being necessary to change it year after year throughout the whole lifetime of the furnace.

The principal way of making the electrode is described by Messrs. C. W. Söderberg and M. Sem, of Det norske Aktieselskab for Elektrokemisk Industri, Christiania, Norway, in *Chemical and Metallurgical Engineering*, from which the following particulars are abstracted. The process is illustrated in fig. 1, from which it will be gathered that the electrode consists of a casing of small-gauge sheet metal (usually iron)) into which ordinary electrode mixture is tamped. The casing serves to give the electrode the right shape while tamping, to reinforce the unbaked part, and to help carry the current from the electrode holder to the baked part of the electrode; it further serves to protect the electrode against air corrosion. In order to give the casing a sufficiently good mechanical and electrical contact with the electrode carbon the casing is provided with ribs extending radially into the electrode. The electrode is suspended in the furnace by means of a clasp holder that can easily be moved along the electrode. The electrode is very long, and its upper part is surrounded by a platform, where the lengthening of

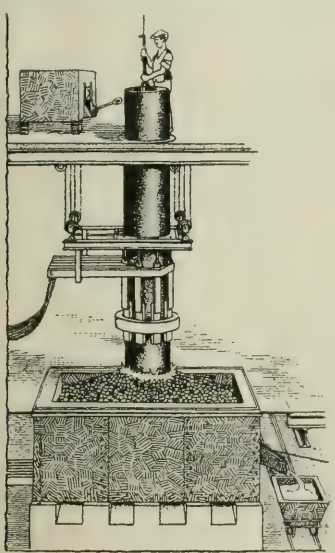


Fig. 1.—Method of Making Söderberg Electrode.

the casing and the tamping in of new electrode mixture may be carried out as often as necessary, without the workmen being exposed to the heat from the furnace. The tamping is usually done by pneumatic rammers.

The lower end of the electrode is placed in the smelting furnace, where it is baked by means of the heat from the furnace crater and by heat developed in the electrode itself by the electric current. The electrode will, therefore, consist of a lower (or internal) fully baked part, and an upper (or external) raw and unbaked part. The electrode holder is ordinarily placed on the lower baked part of the electrode, but may be placed anywhere if the cross-section of the iron casing is sufficient to conduct the current from the holder to the baked part of the electrode. Moving the electrode in the holder is done at full current load, with no interruption in the working of the electrode, the current being always maintained by means of the sliding contact between the electrode holder and the electrode.

When the electrode begins to get too short a new section of iron casing is welded to its upper end and warm electrode mixture is tamped in. The old mixture is still soft, and will mix completely with the new mixture, making the electrode absolutely uniform and with no joints; it will be obvious that the Söderberg electrode has a great advantage over ordinary electrodes in this respect. As in all open furnaces, the electrode holder is water-cooled, and is suspended in a frame that may be moved up and down.

The first Söderberg electrode was used in connection with a ferrosilicon furnace which was put in operation by the A/S Fiskaa Verk per Kristianssand S., Norway, in November, 1918. In July, 1919, it was replaced by a 850-mm. diameter electrode, and this electrode has been working continuously ever since without a single shut down due to the electrode and without any electrode breakage—results which have hitherto been unobtainable. Electrode consumption is considerably reduced, and air corrosion is eliminated to a very great extent, due to the good protection afforded by the iron casing and the electrode holder. The baked electrode is equal in quality to the best ordinary electrodes. The cost of manufacture is relatively very low. In May, 1921, a second electrode (rectangular, 1,150 x 500 mm.) was placed in the furnace (load about 2,000 kVA) and has also worked very well with about the same efficiency and electrode consumption as the round electrode; the furnace operates on three-phase current, Scott-connected.

Important and interesting details in connection with the manufacture and operation of the Söderberg electrode may be found in *Teknisk Ukeblad*, Christiania, 1920, No. 25. See further J. W. Richards, *Trans.*, Am. Electrochem. Soc., 1920, p. 169. The electrode works exactly as an ordinary carbon electrode, and needs no special attention of any kind. It looks like and has the properties of ordinary electrodes, and differs in no way from them either with regard to specific gravity, electrical conductivity, or mechanical strength. The electric resistance of the hot electrodes (1,000 to 2,000 deg. C.) is about 0.003 ohm per cu. cm. It is therefore possible to operate them at a higher current density than ordinary electrodes, and it is further possible to regulate the electrical conductivity to a great extent by the weight of the iron casing in relation to the weight of the baked carbon. In November, 1920, a 400-mm. rectangular electrode was operated continuously at a current density of 10 amp. per sq. cm. At intervals the current load was increased for a short period up to 18 amp. per sq. cm. Due to the good electrical conductivity of the electrode and the short distance from the holder to its lower end, the voltage drop in the electrode is relatively low. At Fiskaa it is ordinarily between 1.3 and 1.9 volts. The heat loss in the cooling water is between 5 and 7 per cent. of the energy consumed in the furnace.

Söderberg electrodes have since been installed in furnaces all over the world. In September, 1920, an installation at A/S. Arendal Smelteverk, Eydehavn, Norway, was put into operation. It consists of two electrodes each 950 mm. in diameter in a two-phase 4,000-kW furnace with two furnace craters running on ferrosilicon (50 and 75 per cent. Si). The electrodes proved to be very much superior to ordinary electrodes with regard to both electrode consumption and furnace output. The consumption of Söderberg electrodes is about one-half that of ordinary electrodes, working on the same alloy in the same furnace. The direct savings obtained are so important that the total cost of the installation will be saved by less than one year's continuous running. While the electrodes in the Arendal plant are 40 per cent. greater in cross-section than the largest ordinary single electrodes, there is no doubt that electrodes of still larger size can be made.

Calcium carbide furnaces are also using Söderberg electrodes with excellent results. The latest installation is in a 6,000-kW. three-phase carbide furnace in the Knapsack plant of the A/G. für Stickstoffdünger at Cologne, Germany. This furnace is provided with three 950-mm. (39-in.) electrodes, and was put into operation in August, 1921. The electrodes are about 7 metres long, and the tamping house (4.5 metres above the platform of the furnace) concrete floor is reinforced by iron tubes for water-cooling. The average results of three months' running show a reduction in the electrode consumption of about one-third. At the same time the output of the furnace per kilowatt-hour was raised considerably. At present the whole plant, consiting of nine furnaces, each rated at about 6,000 kW, is to be provided with Söderberg electrodes, and some of the furnaces are already being rebuilt.

It may be of interest to note that some carbide producers have referred to the fact that part of the iron from the iron casing of the electrode will pass into the carbide and reduce the quality of the product. However, calculation shows that only from 0.1 to 0.2 per cent. of iron can be transferred to the carbide from this source, while ordinary carbide always contains about ten times as much iron. The amount in question is thus of no importance whatever.

Besides the installations described, Söderberg electrodes are at present installed or in course of installation in ferro-alloy and carbide furnaces in Sweden, Italy, France, Germany, and South Africa. Also in closed furnaces the new electrodes have been brought into permanent industrial use. In September, 1920, a 500-mm. (20-in.) Söderberg electrode was installed in a 7-ton Heroult steel furnace of the Stavanger Electro Staalverk A.S. Jörpeland per Stavanger, Norway, and the results were so good that a permanent installation was

made. In order to get comparative results the electrode was then run together with German electrodes of the best steel-furnace quality and better ordinary electrodes. The 1921 electrode consumption for the Söderberg electrodes was only 58 per cent. of that for the German electrodes used in the same furnace, although the Söderberg electrodes were made of very poor raw materials, so that the ash content was about 15 per cent. The electrodes may be lengthened outside the furnace easily when using small Söderberg electrodes. When using big electrodes, however, it may be more practical to provide a tamping platform which will tilt with the furnace, and which may be removed from the furnace by means of a crane when the roof of the furnace has to be renewed. It may also be possible to arrange the platform fixed to the wall, and constructed in such a way as to permit the electrodes to be tilted with the furnace. Further installations in steel furnaces are at present being made in Germany, and others are under consideration in England, France, and Italy. Another step is the installation of two 700-mm. (29-in.) electrodes in an electric pig-iron furnace of the Elektrometall type in Domnarfvet, Sweden.

It is therefore obvious that the utilisation of Söderberg electrodes shows very great advantages. It is now possible to increase the size of the furnaces without increasing the number of the electrodes. This fact is thought to be of special importance in developing types of closed furnaces for the manufacture of calcium carbide and ferro-alloys.

Operating data on Söderberg electrodes indicate the following advantages:—

1. The cost of the electrodes is reduced very much.
2. The cost of special mounting and protecting the electrodes against air corrosion is avoided.
3. The baking is done without cost by waste heat from the furnace crater. (The heat loss through the electrode is, in fact, less than for ordinary carbon electrodes.)
4. The electrode consumption is reduced: (*a*) Because the Söderberg electrodes have no electrode butts. (*b*) Because the air corrosion is very small. (*c*) Because fractures do not occur.
5. The running of the furnace is more regular because there are no stops due to change of electrodes and other troubles experienced with ordinary electrodes.
6. Every individual plant will be independent of electrode factories and will be able to make its own electrodes of the quality and shape most suitable.
7. The number of labourers can generally be reduced and their working conditions are improved, as they are not so much exposed to heat.
8. It is possible to make new furnace constructions, which opens up possibilities for further development of the smelting industry.

The electrodes can be installed in most electric melting and smelting furnaces, and can be built in all shapes and sizes, both round and rectangular. The cost of installation is relatively low—for two electrodes in a 2,000-kW ferrosilicon furnace it would be about $6,000, and the time required would be from one to two months. The cost of electrodes mounted in the furnace and ready for use is estimated at from 2 to 3 c. per lb., including amortisation and interest. This depends upon the prevailing prices of anthracite, coke, tar, pitch, and labour.

The above price is for electrodes of about 34-in. diameter. They may be produced still more cheaply if no anthracite is used in the paste, substituting foundry coke, together with retort carbon or similar material. Such electrodes have been used with very good results in the Fiskaa Verk for several months.

In most open furnaces now with 25 per cent. of electrode butts the electrode consumption will be reduced at least 35 per cent., in which case 10 per cent. of the reduction is due to less air corrosion of the Söderberg electrodes. If ordinary electrodes cost 4 c. per lb. the saving will be as follows:—

Price of ordinary electrodes per 2,000 lb.	$80.00
Cost of mounting and protection against air ...	10.00
	$90.00
500 lb. of electrode butts obtained worth $10 per 2,000 lb.	2.50
Cost of 1,300 lb. electrodes consumed in furnace ...	$87.50
Cost per 2,000 lb. consumed electrodes	$135.00
Cost of 2,000 lb. Söderberg electrodes	40.00
Direct saving	$95.00

To this should be added the indirect savings due to the elimination of electrode changing; less repair on contacts, cables, &c.; more regular running; easier operation of the furnaces; higher output, &c.

In trying to picture the possibilities of development which the new electrode embodies the most prominent is that they are not limited in length or section. Accumulated data all seem to indicate that electrodes are more steady and satisfactory in operation the larger they are. If there are no limits to the size of the electrodes there will be no limits to the size of the furnaces either. When alternating currents are used for smelting there is certainly a limitation to the size of the electrodes, or rather to the number of amperes, owing to the phase-displacement and the skin-effect, which will be quite noticeable at very high current load. Thorough investigations show, however, that when using a 50-cycle current, it is possible to make round electrodes of 1.75-metre (71-in.) diameter, if the current density in the central part is permitted to be 50 per cent. less than at the surface. A 39 in. electrode would show a divergence of 10 per cent. By using 25 or 15-cycle current and allowing a divergence in the current density of 50 per cent. it is possible to make electrodes of 2.2 metres (100 in.), or 3.20 metres (130 in.) respectively. The latter will, at a current density of 3 amp. per sq. cm. (20 amp. per sq. in.) conduct a current of 240,000 amp., which at a voltage of 60, would develop—by means of a single electrode—14,400 kVA.

With this last figure the ultimate limit is not by any means reached. It will be possible to reduce the number of cycles still more, or even to work with direct current. Besides, the electrodes may be given such shapes that the skin-effect will be less, and to meet the requirements of each special process. The electrodes may thus be provided with channels running throughout their whole length, serving, for example, for drawing off the furnace gases or for charging the furnace. The Söderberg electrode may open up a new field of modern electro-thermic industry.

ELECTRIC VEHICLES FOR MUNICIPAL WORK.

A paper was presented at the 49th annual general meeting and Conference of the Institution of Municipal and County Engineers, at Cardiff, in June, by Mr. R. B. Mitchell, M.I.E.E., the engineer and manager of the Glasgow Corporation electricity undertaking, in which is outlined the experience gained in Glasgow with electric vehicles on various municipal services, in the hope that it may help to drive home the fact that battery vehicles can be operated economically, even under very difficult conditions.

The paper explains, inter alia, that the road surfaces in Glasgow are mainly cobbled, and there are many stiff hills, so that the conditions cannot be considered favourable for economical working. The nature of the work on which the cars are employed is very varied, and comprises general cartage for the [illegible] of the Electricity Department, ash disposal from the power stations, and cable haulage. A tractor is employed for hauling heavy pieces of [illegible] while a small and speedy three-wheeled van is used for [illegible] services.

The [illegible] has provided very valuable experience in all [illegible] electric vehicle running, and it is realised that the scope of the battery vehicle lies in the sphere of motive power between that of horse haulage and petrol [illegible].

The electric vehicle is used in Glasgow for:—(*a*) General cartage and ash disposal in the Electricity Department (21 machines). (*b*) Refuse collection in Cleansing Department (22 machines). (*c*) Ash disposal in Tramways Department (2 machines). In addition three privately owned machines are garaged in the service station of the electricity department, and four firms have private charging stations. Practically every type of electric vehicle procurable in Britain is represented.

The types of cars used in Glasgow may be divided, roughly, as follows:—American single motor cars with chain transmission, American single motor cars with balanced drive totally enclosed, English single motor cars with chain transmission, and English 2 and 4 motor cars with gear transmission. The early American cars bought in 1912-1915 were exceedingly satisfactory in most respects, the mechanical design, however, left much to be desired. Accordingly, the costs and maintenance of the chassis, brakes, steering gear and body were excessive. The English-built cars, with one or two exceptions, were sound mechanically, but the electrical parts gave an immense amount of trouble as compared with the American machines, the batteries, controllers and motors being all definitely inferior to those of their American rivals. Other English efforts were so bad, both mechanically and electrically, that they must have done an immense amount of harm to the battery vehicle industry generally.

The most important deduction to be made from the author's table of the costs of replacement parts for cars is the enor-

mous preponderance of mechanical replacement costs as compared with electrical ones, even including the battery. The 10 per cent. depreciation claimed as compared with the 15 per cent. in the case of petrol cars, is amply justified.

In the Glasgow Electricity Department the present contract rates for cartage and running costs of electric vehicles are such that one electric vehicle must do the work of three horse vehicles in order to justify its existence. The records of work done by horses operated by contractors show that the best result obtained has been 20 miles per day. The average load in this case was ½ ton. A two-ton electric vehicle has done 47 miles in one day with a load of one ton. This is, however, an exceptional performance, and 40 miles per day would be a fairer basis of comparison. This gives a four to one ratio (40 ton miles to 10 ton miles) in favour of the electric, so that there should be no difficulty in obtaining the three to one ratio which is economically necessary. The nature of the work to be done is all-important in comparisons of this kind, and each case must be examined separately.

Standard battery sizes, as recommended by the vehicle makers, have been used so far, but it has been found that much better results can be obtained by the use of larger capacities. This is particularly the case in winter, when the demand on the batteries is often abnormal. The ampere-hour meters installed on all cars have been fairly satisfactory, but they must be overhauled about once a year. This is rather a serious item on the cost sheet, and it is doubtful whether these instruments will be used on future cars. The best types of car have been available for six days per week for two years on end, and one week is amply sufficient for an overhaul which will enable them to go on for a similar period. It is a much less formidable and costly job to make a complete overhaul of an electrical vehicle than of a petrol or steam car. The best battery result attained in Glasgow has been a total life of three years. The practice of fitting a small battery, and giving it boosting charges, is far from satisfactory in most respects. The question of battery rating deserves close study, and, in the first instance, the author recommends that a guarantee of the number of cycles of charge and discharge should be given in all batteries in addition to the ordinary duration guarantee.

Nickel batteries are practically perfect mechanically, but their high internal resistance, low watt-hour efficiency and voltage are decided disadvantages, especially in hilly towns. The cost of these batteries is also almost prohibitive at present. Lead batteries of the Ironclad Exide type have, in general, given good satisfaction, and their guarantee period of two years can be exceeded very easily in most cases. Flat-plate batteries have not been in use long enough to enable a final pronouncement on their qualities to be made, but there is every possibility that those on trial will prove successful. The figure of 3.45d. per mile for battery renewals cannot readily be reduced, and it lies with the battery makers to devise something more economical.

A good tool equipment is essential for the maintenance of the mechanical parts of the cars. The staff should also get a careful elementary training in the underlying principles of the electric circuit if the best results are to be obtained.

Most of the electrical troubles experienced in Glasgow have been with the multi-motor vehicles. However, recent results with cars of this class have been entirely satisfactory, so that the writer cannot join in the wholesale condemnation of the type which is commonly indulged in. Users should endeavour to find out accurately whether the extra complication of the single-motor type is justified by the higher efficiency claimed for it. The best types of motors are so satisfactory that they require practically no attention. The only improvement which can be looked for in this direction is some very slight increase in efficiency and possibly the introduction of regenerative braking. Combined gear and chain transmission systems have given very good results, but by far the most satisfactory of all has been the balanced drive with one motor and totally enclosed gears.

The only item of the electrical equipment which gives rise to any appreciable trouble is the controller. The plain drum type has proved most satisfactory so far, but there is still scope for improvement, even in the best types covered by Glasgow experience.

The ten years' experience of battery vehicles in Glasgow has included periods in which it seemed wholly impossible to compete with other methods of traction. It is now felt, however, that the worst is definitely past, and that it will be possible to run a wholly electric transport system for the Electricity Department, at least, which will be both reliable and economical.

Those who are contemplating using electric vehicles can rest assured that excellent service can be obtained from them, and the only word of advice offered is the commonplace one: "Settle definitely the best type of car for your own purpose and stick to it."

Discussion.

The paper was not read until the end of the week, and unfortunately Mr. Mitchell was unable to be present to reply to questions raised in the discussion, which was of an interesting character. The President (Mr. E. J. Elford), however, read a letter in which Mr. Mitchell said that, though he could not attend the conference, he would be pleased to supply members with any information they might require on the subject.

Mr. W. J. Steele (Newcastle), opened the discussion, and remarked that in certain districts electric vehicles had proved the best. He had made an experiment extending over six months, but found that when it came to long distances electric vehicles were not so useful, and that steam haulage was slightly cheaper than petrol. He thought all tests based upon so many tons were quite wrong; they should be based upon the cost of the work to be carried out.

Interesting particulars of the comparative costs of electric and horse-drawn vehicles for refuse collection were given by Mr. H. G. Whyatt, whose experience in Grimsby was that they were saving 2s. 7d. per ton by the use of electric vehicles. Their vehicles were bought about 18 months ago, at a costly time, and they cost £1,489 apiece. They had now been in use about fifteen months, and the total cost of collecting by them was 8s. 11¾d. per ton. With horse-haulage it cost them 11s. 6¾d. per ton, whilst by horses which they hired in addition to their own the cost was 6¾d. more. Some members of his Council might think that they had sufficient electric vehicles, whilst others thought they ought to have more for the highways, and additional ones for the household scavenging, but there could be no doubt that for his district the electric vehicle had proved less costly than the horse-drawn one.

Mr. J. A. Dawes (Inspector of Cleansing, Ministry of Health), informed the conference that from data which had come into his possession he found that up to a mile the horse was going quite well at the moment, but on mixed refuse (that was to say, where they were removing from ashpits, as distinct from ashbins) the motor came in earlier. Then, after the mile, the electric vehicle came in, especially in cases where they had what was known as kerb collections. But the further they got away, the heavier the machine, until when they got to three miles he found from the data that steam haulage came into its own.

Mr. Whyatt here interposed the information that an electric vehicle displaced two and a-half horses.

Mr. A. J. Brodie (City Engineer, Liverpool) remarked that there were some people who said that the petrol vehicle was the only vehicle. That was all a mistake, and those people would live to learn differently. He agreed as to its utility over longish distances, but there was still room for the horse in certain districts, for the electric vehicle under certain conditions, and also for the steam vehicle, whilst there was more room for the petrol vehicle if they had a fair distance to go.

In closing the discussion the President pointed out that by putting one vehicle on a long haulage, and another on a short one, with a different kind of refuse, he did not think they could get at a proper basis of comparison. The loading height was a very important question, and he felt that the standard vehicle of many manufacturers was a good deal higher than it need be. They seemed to waste an enormous amount of room.

During the week's conference an exhibition of electrical and other appliances for use in municipal work was held, and the members displayed a keen interest in the various tests.

The Radio-Telephone Fire "Hazard."—The Canadian Dominion Fire Commissioner informs the *Electrical News* that new fire risks have been introduced consequent upon the growth of wireless telephony among amateurs. Fires are caused by lightning, and by the use of lighting circuits in connection with the system. Accordingly, a set of rules has been drawn up to guard against the fire "hazard." Among these regulations is one forbidding the erection of antennæ over any other circuits operating at 600 V or above. Leading-in wires must be of a non-corrosive metal, and in no case smaller than No. 14 B. and S. gauge; these wires must not come within four inches of electric light or power wires unless separated by adequate insulation. Each leading in wire must be provided with a protective device, which will operate at 500 V or less. Details as to earthing and earthing wires follow the usual lines. Wires inside buildings must not be placed within two inches of lighting or power wires unless separated by insulation, such as porcelain tubing. The Committee which drew up the regulations expressed the opinion that there was no danger of fire in installations employing indoor antennæ.

New German Cable Ship.—According to the *Taegliche Rundschau*, the trial trip of the new German cable steamer *Norderney* took place on August 17th at Wilhelmshaven. The vessel's displacement is about 2,000 tons, her speed 10 knots, and she is capable of carrying 1,100 tons of cable. In addition to wireless, the *Norderney* is also fitted with submarine signal apparatus. The new vessel services the cable steamer *Grand Duke of Oldenburg*, which was surrendered to the Allies. *Reuter.*

ELECTRIC LOCOMOTIVES.

By Sir V. L. RAVEN, K.B.E.

(*Abstract of paper read at the* Institution of Mechanical Engineers' Summer Meeting *at Paris and Liége.*)

The paper does not discuss the many points of mechanical and electrical design of electric locomotives, but deals rather with the more general questions of the requirements which any locomotive must be designed for; the various designs which have been worked out to meet these requirements in the various countries, and the advantages and disadvantages of the various designs which have been completed.

There are broadly three classes into which locomotives on most railways may be divided, namely:—

Shunting Locomotives.—For locomotives of this class a maximum speed of 25 miles per hour will be ample. They should, however, be suitable for moving the heaviest trains in use. On British railways it is not possible to go much higher than 30,000 lb. drawbar pull and an adhesive weight of from 60 to 65 tons should be sufficient. Compared with steam locomotives usually employed in goods-yards this is a substantial increase. The design should be as simple as possible and, if practicable, the whole weight of the locomotive should be on the driving wheels. For anything in the neighbourhood of 60 tons it is necessary to divide the weight between four axles, in order not to exceed the permissible axle loading.

The simplest arrangement is undoubtedly the double bogie design, each bogie carrying a pair of geared motors. This construction is cheap, and the maintenance easy, due to the facility with which a bogie can be removed for overhaul or repair of the motors and a spare bogie substituted. The author sees no reason why this general design should not be regarded as standard for this class of locomotive.

The North-Eastern Railway has had in use on the Quayside line at Newcastle for seventeen years two shunting locomotives which have given extraordinarily good results. Each is capable of hauling 335 tons on the level at 14 m.p.h., and of starting up a gradient of 1 in 25 with a trailing load of 166 tons, and of hauling this load up the same gradient at 9.5 m.p.h. They have only been in the shops three times for thorough overhaul. Their daily service occupies about eighteen hours, and, if required, they could do more. For the whole of the year 1921 the average cost per engine for repairs, inspection, preparing, cleaning, &c., was £103. This figure is rather high, as it included some special repairs to one of the locomotives which would not be required in an ordinary year. The corresponding figure for steam locomotives doing the same class of work for the year 1921 would be about £610.

Freight or Goods Locomotives.—On British railways it is useless to design a locomotive for more than about 30,000 lb. tractive effort. One of the great advantages of electrification on a railway is the possibility it affords of speeding up the slow-moving traffic. When a line reaches the point of congestion the capacity can be increased by quadrupling or by electrification. The former is a very costly matter, and even if the congestion is relieved in this way the many advantages obtainable by electrification are not secured. It is important, therefore, that the speed of goods trains should be raised as much as is practicable. On the British railways, due to the absence of power-brakes on the wagons, the speed on the level must not exceed about 35 miles per hour, and must be less than this on falling gradients, in order that the train may be sufficiently under control to stop when required by signal. The only practicable way, therefore, to effect any substantial increase in the average speed is to increase the speed up the gradients. This can easily be done by providing a sufficiently powerful locomotive and designing it for the speed required.

The author considers that the standard freight locomotive should be capable of taking a normal train up the ruling gradient on any ordinary line in Great Britain at about 25 miles per hour. This should enable an average speed of 30 miles per hour to be maintained, which approximates to the speed of the local passenger trains. All trains, except the few passenger expresses, would then travel at approximately the same speed, and the traffic delays would thereby be cut down to the minimum. The North-Eastern Railway in 1914 built ten freight engines for working the mineral traffic on the Shildon-Newport branch line. Five electric engines are capable of doing the work formerly done by thirteen steam engines. In 1920, which may be considered a fairly normal year, the total cost for repairs, inspection, preparation, cleaning, &c., came to 1¼d. per engine mile, of which repairs amounted to a little more than 1d. and shed charges a little less than ¼d. Corresponding figures for the same year for steam engines doing similar work are about 11¼d. per engine-mile total, of which the repairs alone would cost about 8d., and the shed charges about 3¼d. The author estimates that at the present time the corresponding figures for repairs, shed charges, &c., would be about 30 per cent. lower.

Many different designs of electric freight locomotives have been worked out on the Continent and in the U.S.A., but it is not possible to refer to all of them. There seem to be no signs, however, that any standard design of electric freight engine is being evolved as representing the general consensus of opinion of Continental engineers.

In comparing these various designs, the first point to be considered is whether the motors drive directly or through gearing. The cost of the motors alone is something like 30 to 40 per cent. of the total cost of the locomotive. Any design, therefore, which leads to an unnecessarily large and costly motor is at a disadvantage. In the author's opinion the employment of gearing, which is now highly efficient and has a long life, is an essential feature of a satisfactory design. The use of cranks and side-rods for a freight locomotive is not a necessity, either for British railways where comparatively light trains have to be hauled, or in other countries, where the stronger drawgear makes it possible to deal with much heavier trains.

The importance of keeping down the dead weight has been overestimated. The track has to withstand the shocks due to the passage of the whole train, not only of the locomotive, and it is difficult to believe that a little extra dead weight on the four axles of the locomotive alone will make any appreciable difference to the wear and tear of the track.

As to the advantage obtainable by the use of one or two large motors, instead of two or four smaller motors, while it is quite true that, other things being equal, the cost per horse-power falls as the size increases, the difference in favour of the larger motor is more than offset by the extra cost of the mechanical parts. Quite apart from the increase in first cost of the locomotive arising from the introduction of cranks, jack-shafts, Scotch yokes and coupling-rods, the maintenance cost is of great importance. The author is definitely of opinion that for the conditions which apply to British railways, the most suitable and satisfactory arrangement for an electric freight locomotive is the double bogie design with two four-wheel bogies articulated together, each bogie containing two motors geared to the two axles without any form of coupling-rod transmission.

Passenger Locomotives.—While it may be possible to go some way in the direction of standardising the design of locomotives intended for freight-work, it is hardly possible to arrive at any definite conclusion with regard to the best design of locomotive for all sorts of passenger traffic. In the first place the weights of trains vary considerably, as also do the speed and the nature of the line, the gradients, &c. Secondly, when running at high speeds, such as those frequently attained on British railways, a locomotive of unsuitable design may start "nosing," and the oscillations may reach such a degree as to injure the track or the locomotive. There is yet no complete understanding as to the origin of the trouble, or agreement as to the best way of guarding against it.

Regarding the requirements for a standard passenger locomotive for the British railways: (1) Is it necessary that there should be more than one class of locomotive for all kinds of passenger traffic? (2) If one class is sufficient, for what tractive effort and speed should the locomotive be designed, and can it be economically used for goods traffic when necessary?

The answer is to use the same engine for all expresses and fast trains running considerable distances without stopping, including all passenger trains which run beyond the limits of any electrified section, and to equip a sufficient number of trains as multiple unit trains without locomotives for the local passenger service. If this is done, the advantages of electrification can be obtained for both classes of passenger traffic economically and conveniently.

As a reply to the second question, some particulars may be given of the capacity of the geared 4—6—4 passenger locomotive with twin motors and quills which has just been completed by the North-Eastern Railway for experimental purposes.* The conditions specified for the electrical equipment are as follows:—

1. The adhesion weight of the locomotive shall be not less than 17 tons per driving axle, and the complete electrical equipment shall be such that the motors can exert sufficient torque to skid the wheels without injury to themselves or to any part of the equipment.

2. The motors shall be able to exert a total average tractive effort of 16,000 lb. at the tread of the driving-wheels when starting under normal conditions on level track.

3. The capacity of the complete equipment shall be sufficient to enable the locomotive when coupled to a train weighing 450 tons to start from rest on a rising gradient of 1 in 78 and accelerate up to the first economical running speed without injury to any part of the equipment.

4. The speed of the motors and gearing shall not exceed the limits of safety when the locomotive is travelling at 90 miles per hour.

*Elec. Rev., December 30th, 1921, and January 6th, 1922.

5. The locomotive shall be capable of hauling a train of fourteen main-line coaches, weighing, with load, 450 tons, at not less than 65 miles per hour on straight level track.

The electrical equipment consists of three pairs of motors, each having a capacity of 300 h.p., so that the total capacity of the locomotive (one hour rating) is 1,800 h.p., measured at the tread of the wheels. The use of three pairs of motors enables a wide range of speed to be obtained by grouping the six motors—(1) all in series; (2) three in series, two in parallel; (3) two in series, three in parallel. With each grouping provision is made in the control equipment for regulating the speed by reducing the excitation of the motor fields. Thus there are for each grouping four different degrees of excitation, namely: full field, 18, 31 and 40 per cent. reductions. With this arrangement twelve different speeds are available for any particular value of the tractive effort. The performance curves, showing the relation between speed

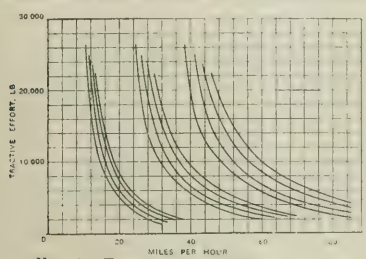


FIG. 1.—TRACTIVE EFFORT—SPEED CURVES.

and tractive effort, as determined by workshop tests, are given in fig. 1. The maximum tractive effort corresponding to a speed of 65 miles per hour is 8,400 lb. or 3¾ tons. The tractive resistance of the locomotive alone at this speed, including that due to windage, should not be more than about 1,600 lb. The drawbar pull would therefore be about 6,800 lb., equivalent to about 15 lb. per ton for a 450-ton train. This should be ample to maintain a speed of 65 miles per hour on the level under any ordinary conditions of weather. A tractive effort of from 8,000 to 10,000 lb. can be obtained at a speed of from 31 to 34 miles per hour. Allowing, say, 900 lb. for the tractive resistance of the locomotive alone, the drawbar pull available at a speed suitable for goods train working is about 7,000 or 9,000 lb. This should be quite sufficient for a train of 600 tons. The speed of such a train up a 1 in 100 gradient would be about 24 miles per hour, which corresponds closely to the conditions of opera-

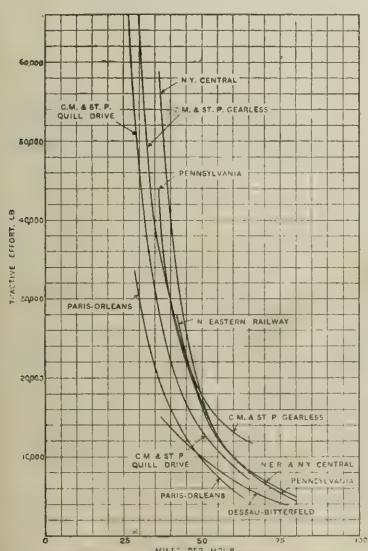


FIG. 2.—TRACTIVE EFFORT—SPEED CURVES.

tion already advocated in connection with the design of a standard freight locomotive. A goods train of 600 tons is a reasonable load for a return trip of a passenger engine on a section in which the ruling gradient is about 1 in 100. It would be hardly worth while, from a traffic point of view, to occupy the line with a smaller train than this, at all events if the line was working anywhere near its full capacity, and it would be better to let the passenger locomotive lie over until required to work a return trip with a passenger train.

A small boiler provides steam to heat the passenger coaches and, so far as is known, it is the first electric boiler used for this purpose in which the heating elements are designed for d.c. at 1,500 volts. To provide the boiler with electricity at a lower pressure would have required a motor generator of 300-kW capacity. The boiler is of the fire-tube type, each tube containing a heating element, consisting of a tube of quartz in the interior of which there is a spiral of high-resistance wire. The boiler contains in all 144 elements, and switchgear is provided, so that the number of elements in circuit can be varied as required.

Three types of locomotives may be mentioned: (*a*) geared with twin motors and quills (American and North-Eastern Railways); (*b*) gearless, with the motor armatures built on the driving axles (American); (*c*) gearless, with transmission by connecting rods (American, Prussian, French, Italian, Swiss, and other railways). To compare the performance curves the author has combined in one diagram, fig. 2, the curves of tractive effort against speed for the maximum condition of output for the locomotives described in his paper, and the comparison shows that the engines differ considerably in their capabilities in respect of both the load to be hauled and the speed at which the trains will travel.

A comparison of the curves shows that the North-Eastern Railway locomotive is well adapted to deal with the loads for which it is intended, and at the speeds at which it is desired to run, without being heavier or more powerful than is necessary for this duty.

While it is clear, therefore, that all these locomotives are not equally well suited to meet the requirements of express passenger traffic on the British railways, it does not follow that a suitable locomotive cannot be designed embodying any one of the systems of drive peculiar to the three general types mentioned above.

So far as the system of driving is concerned, any one of the three general schemes referred to above can be selected. In the author's opinion, however, the choice at present lies between the first two types, namely, the quill-drive and the gearless locomotive, and further experience is necessary before any decisive opinion can be expressed as to which of these two types is to be preferred.

The question as to the most satisfactory mechanical arrangement of an express passenger locomotive for the British railways must be considered with regard to the possibility of oscillations or nosing of the locomotive when running at high speeds. Experience in the United States, we are assured, has proved that an electric locomotive cannot be expected to travel satisfactorily at such speeds as we are considering, say, from 70 to 75 miles per hour, if the wheel arrangement is symmetrical. For example, a 4—6—2 locomotive might, perhaps, be satisfactory, whereas a 4—6—4 locomotive would be unsatisfactory. This is an important point if one bears in mind that one of the advantages of electric working is that there is no necessity for turning the locomotive at the end of each journey. This is only possible if the locomotive can run equally well in both directions. For such speeds as we are considering it is desirable that in whichever direction the locomotive runs there should be a bogie leading. Engineers in the United States recommend one or other of the various designs which are based on the articulation of two locomotives back to back, with the idea that while the locomotive, considered as a whole, is symmetrical, each part of the locomotive is unsymmetrical, and that therefore each part will run satisfactorily without setting up violent oscillations of the locomotive as a whole.

It is difficult to find any satisfactory explanation of the difficulties which have been experienced in the United States in this direction, especially in view of the fact that there are on the British and Continental railways already a fair number of symmetrical locomotives which are capable of running at high speeds. There must be some cause which gives rise to violent oscillations on symmetrical electric locomotives when running in the United States which are absent when symmetrical steam locomotives are run in Europe. It appears to the author that the oscillations can only arise from the fact that there is a periodic disturbance tending to set up horizontal oscillations, the frequency of this disturbance being the same as the natural frequency of the locomotive in oscillating in a horizontal plane. As soon as these two frequencies coincide the oscillations tend to increase until they become dangerous. This natural frequency of the locomotive, however, while it may possibly be slightly changed by an unsymmetrical distribution of the masses on the locomotive superstructure, cannot certainly be eliminated, so that any such distribution might possibly affect the speed at which these violent oscillations occur without in any way eliminating the tendency to oscillate.

There is no doubt a good deal yet to be learned about the behaviour of electric locomotives of a symmetrical arrangement when running at high speeds, but the author suggests that one cause of the trouble experienced in the United States and from which the European railways seem to be free, is that on practically all the railways in the United States the rail joints are staggered, whereas on the British and French railways the rail-joints are opposite to each other. It is hoped that after extended trials of the 4—6—4 locomotive on the North-Eastern Railway the author will be in a position to express a more definite opinion.

REVIEWS.

[illegible] Engineering. Vol. II. *Alternating Currents.* By CHESTER L. DAWES, S.B., M.A.I.E.E., Assistant Professor of Electrical Engineering in the Harvard Engineering School. Pp. xiv+526; figs. 406. London and New York: The McGraw-Hill Book Co. Price 21s. net.

The Principles of Alternating Currents. By R. R. LAWRENCE, M.A.I.E.E., Associate Professor of Electrical Engineering in the Massachusetts Institute of Technology. Pp. xiv+142; figs. 121. London and New York: The McGraw-Hill Book Co. Price 20s. net.

The first of these books, one of several on very similar lines which have emanated from America since the war period, is concerned, for the most part, with a study of the laws governing the flow of alternating currents in circuits and the application of these laws to electrical machines.

In his preface the author describes the work as being of an elementary character, but this term hardly does justice to the contents of the book, which, while not attempting to deal completely with the theory of machines, certainly goes beyond what is usually considered to be an elementary account.

We may say at once that the book is distinctly above the average as regards the quality of the explanations given of alternating current phenomena, and, for a first edition, is remarkably free from errors of any kind.

Following a good preliminary statement as to the sphere and advantages of alternating currents, the earlier chapters, dealing with the flow of currents, are well written, and the treatment of the vector addition of pressures or currents is particularly good, a system of lettering being used (the double subscript system) with a view to preventing the possibility of vectors being accidentally reversed when additions are being made. The application of this method is likely to be particularly useful when dealing with the interconnection of polyphase systems, oftentimes a serious source of trouble with students.

Alternators, transformers, and motors (of the induction, synchronous, and commutator types) are considered in turn, particular attention being paid to both the time and space relations of the quantities concerned. In the chapter on converting plant an account is given of several forms of rectifiers, but chief attention is directed to the rotary converter, which is described in an efficient manner. There is no account of the motor converter, a machine which surely merits inclusion.

Chapter XII. is concerned with a concise description of the appliances used in connection with the transmission line, and would be improved if some account of protective relays for use with oil break switches was included; the oxide type of lightning arrester is also worthy of mention. The final chapter deals with illumination and photometry. It seems to have no direct relationship to the other matter in the book, and would probably be better omitted in a book primarily concerned with alternating current machines.

Minor criticisms may perhaps be made against the use of the term " ohm " in connection with the unit of reactance (it would be better to employ the more usual term " apparent ohm ") and also against the tendency, which seems very usual in books of American origin, to refer to a lamp having a tungsten filament as a " Mazda " lamp.

The printers and publishers are to be congratulated on the general get-up of the book, which can be recommended to students as one from which sound and accurate ideas will be obtained.

The matter in the second of the books mentioned above is practically solely concerned with the problems arising from the flow of alternating currents in circuits, references to machines being of an incidental nature.

The mode of treatment adopted is mathematical, considerable use being made of the method of complex quantities, though other methods are used when desirable, and it is remarkable for the completeness of detail with which the majority of the problems are examined. A fair knowledge of the calculus is necessary in order that certain parts of the work may be followed in a satisfactory manner, but no preliminary knowledge of complex quantities is assumed, the use of these being described in the first chapter.

The more orthodox contents of the book include studies of the effects of capacity and inductance in circuits, power in single and polyphase circuits, and transmission line phenomena. In addition there are a number of chapters dealing with matters of exceptional interest, but which are less commonly considered in text books. Under this category come the effects of harmonics in single and polyphase circuits (a subject whose treatment may be particularly well commended), the application of Kirchhoff's laws to alternating current circuits and the transposition of power lines and telephone lines with a view to the prevention of induction effects in the latter.

When each matter is discussed in such detail it is not easy to criticise, but in connection with this, we suggest that the skin effect in conductors might be treated at greater length, and, when comparing the amounts of copper used in different systems of transmission, attention should be paid to the three-phase four-wire system as compared with the three-phase three-wire system using an equal pressure on the lamps.

The work is perhaps likely to prove too mathematical for many practical engineers, but students taking day courses will find in it abundant material of interest and importance whether their interests lie in the direction of light or heavy engineering. It should also be of great use to teachers, and is very suitable for inclusion in the libraries of technical colleges.

The All-Electric Age. By ADAM GOWANS WHITE, B.Sc. Pp. xiii+242, 50 illustrations. London: Constable & Co., Ltd. Price 7s. 6d. net.

" The All-Electric Age " is not a dry technical work, but a well-written and most interesting description of the changes which electricity has produced and will produce in social, industrial and domestic conditions. As its author claims, " electricity is dealt with as a factor in civilisation, not as a science or branch of engineering." The period covered is some sixty years, that is, from the days of Michael Faraday's great scientific discoveries down to the present time, when the wonderful developments have created an industry which, in Great Britain alone, represents a capital of close on £500,000,000 and " profoundly affects the lives of millions of people " in all parts of the world. A vision is also given of what we are to expect in the future.

In chapter I, The Birth of Electricity, commenting on the progress already made, the author says that " the wonders of the last forty years are only a prelude to the wonders to come "; that every discovery and improvement has opened up new possibilities of service to industry, security, or health, and no one anticipates the day when the progress will be arrested. The probable reason for the belief in the infinite possibilities of electricity is sugested in the following words:—

" When we analyse 'matter' and 'energy' we find electricity. The atom—once regarded as an indivisable grain of solid substance—is now conceived as a complex system of revolving electrons or infinitesimal charges of electricity. In radium we have an example of the system breaking up and throwing off its charges of electricity in the process. The special properties of the different elements are regarded as the outcome of various numbers and arrangements of electrons. Thus the ultimate 'stuff' of the universe is nothing else than electricity; and in the last resource all science is the study of electricity."

Chapter II treats of electricity itself, and of how it is made and how applied. After giving an amusing apology for declining to describe what electricity *is*, and speaking of its mysterious nature, its invisibility and intangibility, the author truly points out that the electrical engineer knows well what electricity can *do*. He can control it with certainty and measure its quantity, its pressure, and its energy with the greatest possible degree of accuracy, and even makes use of electrical instruments to measure any effect with precision. " Thus the thing which in itself seems most elusive to our senses is the most reliable guide to what is going on among the solids, liquids, and gases that we can see or weigh or analyse." This interesting chapter pleasantly imparts much general knowledge of electricity and electrical machines to the reader.

The scope and completeness of " The All-Electric Age " is shown by the titles of Chapters III to XIII: III—Pioneer Days in Electric Light and Traction; IV—Electric Traction on Roads; V—Industrial Uses of Electricity; VI—The Growth of Central Power Stations; VII—The Coming of the Super-Station; VIII—Modern Electric Lighting; IX—Electric Heating; X—Electric Cooking; XI—The Labour-Saving Home; XII—Electricity and Health; XIII—Electricity in Communication. In these chapters is given in language which all can understand, the history of electricity and a good idea of many electrical instruments and machines, from the simple battery invented by Volta to the great creations now to be found in the modern super-station, forming an absorbing story of the wonderful growth of electricity, of what it is doing, of how it is doing it, and what it is likely to do in the future in brightening the home, in lessening labour, in increasing industrial output, in facilitating transport, in bettering intercourse, and in promoting the health of mankind.

In the concluding chapter (XIV), which deals with the future, it is said that among the visions of the various unsatisfying mechanical Utopias which men have conjured up electricity plays a large part in reducing work to the pressing of a button to summon aid as versatile and efficient as the genii of the Arabian Nights. But it is pointed out that the all-electric age, or the Utopia of the electrical engineer, " is a different affair," for, " it contains nothing extravagant, nothing that demands a new kind of human being in order to be enjoyable or even tolerable. Neither is it a kind of Futurist sketch; it is a glimpse of the actual—that is, advanced examples of electrical application." Notwithstanding, the picture painted of country life—the new " back to the land "-the home, the factory, and the city of the future, which electricity could, and probably will, bring about, appears as a page from a pleasant romance.

" The All-Electric Age " is well printed on good paper

The text is illustrated by some fifty half-tone and line blocks, and there is a general index at the end of the book.

In conclusion, though the work is neither a text book nor a work of fiction, it is as instructive as the former and as interesting as the latter, and should have a large sale.—C.H.C.

Electricity in the Service of Man. Vol. II, Section 2, Technology of Electricity. By R. Mullineux Walmsley, D.Sc. Pp. ix+2,214; illustrated. London: Cassell & Co., Ltd. Price 15s. net.

The present volume deals with Electric Traction, Electric Lighting, Electrochemistry, Electrothermics, and Measuring Instruments. The work follows the general lines of the earlier edition, but it has been completely modernised and brought up to date. It is remarkable for the clear and simple language of the text and for the very large number of excellent illustrations which are rendered more valuable by the addition of dimensions to many of the drawings. This is a feature which is not as common as it might be in electrical text-books, probably because it is so much easier to insert a block from a manufacturer's catalogue.

This volume is mainly concerned with the descriptions of the actual apparatus used in the branches of electrical engineering outlined above, the fundamental theory underlying the design being dealt with elsewhere. Most of the examples are well chosen, and the amount of space devoted to each is in proportion to its novelty or importance. The author who is evidently a believer in the future of battery-driven electric vehicles, describes several modern examples and gives curves showing the annual costs for running and maintenance. A dimensioned drawing is included in this section showing the method of driving the front wheels by individual motors on a well-known type of electric lorry. A battery-driven locomotive for shunting work is stated to be fitted with a battery of 108 ampere-hours capacity. This would appear to be an error, since the current taken by the motors may be as much as 150 amperes.

The chapter on domestic electric lighting is not up to the standard of the rest of the book.

A considerable amount of space is devoted to descriptions and illustrations of well-known pieces of apparatus, such as switches and ceiling roses, with which even a lay reader might be expected to be familiar, whilst the different systems of wiring are not described at all.

A very interesting account is given of a large mercury-arc rectifier of the iron-clad type for traction work and the methods of paralleling and compounding these rectifiers are dealt with in some detail. There is also a description of an automatic sub-station and hydro-electric generating station.

The lamp in which an arc is formed between tungsten electrodes in a partial vacuum is dealt with fully, as is also the Sperry flame arc for projectors, which embodies many interesting devices, and appears to be a distinct advance on the earlier forms of searchlight.

The chapter on electro-plating contains much practical information on modern processes. In describing the Beardmore process for building up the water jackets of aero-engine cylinders by electrolytic deposition, the author states that the jacket is deposited "after the cylinder has been secured to the crank case and sweated on."

There is evidently an omission here; the reference is probably to the flange which secures the completed cylinder to the crank-case.

Several kinds of electric furnaces are described and also different methods of electric welding.

The book closes with a chapter on measuring instruments and meters.

The work, as a whole, is undoubtedly one of the best of its kind. It is written in such a way that it is exceedingly interesting to read, whilst at the same time containing a great amount of practical information. It is profusely illustrated and will prove valuable to students and to the large number of engineers who are compelled to specialise in a particular subject, but who like to know what is being done in the other branches of their profession.

MAKING HAY THE ELECTRIC WAY.

The Sunshineless Method.

So little headway has been made with the harvest that the country presents a very striking contrast with its aspect at this date last year. Rain and cold during the ripening period invariably affect the quality of all produce. While farmers are dubious about the quality of their cereals they have no illusions about their hay. They have cut a greater bulk because of the July rain, but much of it is still uncarted, and in consequence its feeding value will be below what it should be, so that welcome as the rain is for the other crops, it is seriously interfering with haymaking. Apart from the additional cost of labour involved in turning and redrying the grass, which has been caught in showers after cutting, partially dried, the value of the resulting hay is very much reduced as a cattle food. Although no great harm is done if the swathes of grass, as cut by the mowing machine, are left untouched until the rain has passed off, every drop of rain falling on the partly-dried grass after it has been once turned and shaken out of the original swathe washes away a proportion of the more easily dissolved constituents, which are of the greatest value from the nutritive point of view.

As the aim of the farmer is, or should be, to secure the greatest feeding value from his crops, it is easy to understand that the time-honoured method of making hay in the usually showery haymaking season is far from efficient. The more enlightened agriculturists have long recognised this fact, but it is only recently that any steps have been taken to find remedies therefor. On the Continent experiments have been tried (but with little success) to make hay by artificially reproducing the dry action of the wind on green cut grass. In a recent paper* read before the I.E.E. by Mr. R. Borlase Matthews, M.I.E.E., reference was made to some successful small-scale experiments which he had carried out in Scotland with improved methods of producing hay in rainy seasons. Following these experiments he this year made hay on a commercial scale by stacking 50 loads of grass off the field immediately it was cut; the yield was very heavy, and fully 25 tons of excellent hay is the result.

The grass was stacked as quickly as it could be carted to the rick, which was built in the usual manner, an air chamber being left in the centre of the stack and connected to the outlet of an electrically-driven "Sirocco" fan, and the natural heating due to the action of the fermentation bacteria was thus kept within safe limits by intermittent blowing, thermometers being used to register the temperatures.

Thermometer pockets were placed in definite positions in the rick as it was built, the positions being chosen as being theoretically the hottest places, and independent readings by hay thermometers stuck in at various other parts confirmed the accuracy of the results. Owing to causes which have now been corrected much more power was consumed than will be necessary in future. A second rick of similar size has since been cured, the total energy used for blowing being only 34 units of electricity. At 1d. per unit this amounts to 2s. 10d. for the stack, or 1.3 units per ton of cured hay. A third large rick—a continuation of the second—is now in progress.

It is worthy of note, however, that notwithstanding this fact, the hay made with the aid of the electric blower has cost much less than if it had been made in the usual way. At the same time the quality is superior and its feeding value much greater. At the time the grass was cut the weather was fine, but rain fell later and every day since; in the 14 days during which the hay rick was under hourly observation over 2¼ in. of rain fell. Two loads of grass which were made into hay on the field were only carted after 23 days, and it was then not properly cured in spite of repeated turnings and redrying. As is to be expected, the food value of this field hay is consequently much lower than that of the rick hay, and it costs more to make. The stack hay was completed in nine days (in less than half the time taken for the field hay cut at the same time).

So successful has been the result that a still further improved system of air ducts has been put down, and Mr. Matthews proposes to make the grass of an 80-acre meadow on his farm into hay this year, using his improved system. A noteworthy feature is that the ricks are of the usual rectangular type, and may be made as large as desired (it is well known to farmers that the larger the rick the better the hay). In exceptionally good weather hay can be made on the field, can be stacked over the ducts, which are then available as safety air passages in case of any overheating (which is only too common in the ordinary hay stacks) should occur. There is no doubt that this system has provided the farmer with a real means of circumventing the weather and the cost of the equipment can be paid off by the savings it makes in one normal season.

The cost of the electric power for drying the hay on this first large-scale experiment, on a rick, which when finished measured 20 ft. wide by a similar height, and of greater length, was 30s., very considerably less than the cost of turning the hay would have been. This represents the cost under the worst conditions, and even then it is under 2s. 3d. per ton for power. The capital cost of the electric fan was under £50—and it will have, judged by previous experience, a life of over 20 years.

A greater weight per acre of grass has, of course, to be carried than of hay, but practical experience shows that owing to the greater ease with which it can be loaded and packed on the wagons, the man-hours and wagon-hours are no greater than for hay dried in a field.

Arrangements are being made to electrically cure and dry the corn sheaves on Mr. Matthews's farm directly they are cut. Thus losses from stacking on the fields will be eliminated and further, ploughing can be commenced directly the cutting of the crop is done

*"Electro-Farming, or the Applications of Electricity to Agriculture." Elec. Rev., April 7th, 1922

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for the Journal by Messrs. Sexton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,870 "Wireless [illegible] apparatus." L. Robertson July 31st.

21,445 "Device for [illegible] electrical heating elements and connectors therefor from [illegible] overheating." K. Harry August 8th.

21,[illegible] [illegible] E. Y. Robertson August 8th.

21,520. "Electric batteries." M. I. David and E. E. Dutt. August 8th.

21,[illegible] "[illegible] [illegible] indicators." H. I. Holley and A. F. Norris. August 8th.

21,526. "Train control by electric means." L. Abrahams, H. Ball, A. [illegible] August 8th.

21,527. "Wireless tuning inductance." P. A. Broadwood and H. W. [illegible] August 8th.

21,528. "Sliders for tuning inductance coils." J. Clegg. August 8th.

21,[illegible] [illegible] K. Ambrose. August 8th.

21,536. "Electric batteries." G. N. Antonoff. August 8th.

21,[illegible] "[illegible] [illegible] communication with trains." A. K. Angus. August 8th.

21,565. "Fibre-covered cores, and manufacture thereof." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 8th.

21,[illegible] "[illegible] [illegible]." L. Polinkowsky and Western Electric Co., Ltd. August 8th.

21,588. "Safety device for electric precipitation apparatus." Lodge-Cottrell, Ltd., and J. Lodge. August 8th.

21,601. "Coil holders for wireless signalling systems." A. H. Curtis, Igranic Electric Co., Ltd., and A. H. Mackley. August 8th.

21,604. "Switch mechanism." H. A. H. Nijland. August 8th.

21,611. "Spark-plug testers." W. P. Moore. August 8th.

21,619. "Changeable tread rail for tramways." W. J. Saunders. August 9th.

21,620. "Electrical devices to prevent starting of internal-combustion engines." A. Buck. August 9th.

21,635. "Electric primary battery." M. I. David and E. E. Dutt. August 9th.

21,636. "Electric cells." M. I. David and E. E. Dutt. August 9th.

21,665. "Magneto-electric ignition machines." A. G. L. Neighbour. August 9th. (Australia, August 9th, 1921.)

21,673. "Electric advertising sign." A. M. Leyfield. August 9th.

21,683. "Submarine cable telegraph systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 9th.

21,691. "Wireless telegraphy." H. Abraham. August 9th. (France, August 9th, 1921.)

21,692. "Street lamp." E. G. Casey. August 9th.

21,703. "Automatic telephone-call recorders." J. A. L. Stokes. August 9th.

21,721. "Electrical joint boxes." C. J. Baker and E. R. Ingram. August 9th.

21,731. "Sparking plugs." A. Segal. August 9th.

21,732. "Sparking plugs." A. Segal. August 9th.

21,733. "Sparking plugs." J. H. Runbaken and W. Torrance. August 9th.

21,738. "Electrolysis of zinciferous materials." F. Hansgirg. August 9th. (Austria, September 30th, 1921.)

21,749. "Ceiling eyes, &c., for pendant electric lamps." C. Skaife. August 10th.

21,750. "Wall bracket electric lamps, comprising battery and bulb holder." Efandem Co., Ltd., and G. Green. August 10th.

21,751. "Roof electric lamps for interiors of motor vehicles, &c." Efandem Co., Ltd., and G. Green. August 10th.

21,752. "Electric torches." Efandem Co., Ltd., and G. Green. August 10th.

21,767. "Electric-current limiting device." Aktiebolaget Birka Regulator. August 10th. (Sweden, September 30th, 1920.)

21,768. "Electric switches." Aktiebolaget Birka Regulator. August 10th. (Sweden, September 30th, 1920.)

21,769. "Adaptor for telephone earpieces." H. W. Parker. August 10th.

21,788. "Radio signalling." M. Smith. August 10th.

21,789. "Electric terminals, bayonets, and sockets." A. Rothschild. August 10th.

21,794. "Telephone receivers." A. Orling. August 10th.

21,796. "Tramcars, &c." J. L. Burton and English Electric Co., Ltd. August 10th.

21,818. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. August 10th.

21,819. "Electric arc welding apparatus." British Thomson-Houston Co., Ltd., and A. P. Young. August 10th. (United States, September 23rd, 1921.)

21,826. "Arc gap terminals." Balt Manufacturing Co. August 10th. (United States, April 17th.)

21,827. "Incandescent filament electric lamp bulbs and lamp holders therefor." H. Workman. August 10th.

21,830. "Means for obtaining graphic record of electric currents." Marconi's Wireless Telegraph Co., Ltd. August 10th. (United States, December 6th, 1921.)

21,831. "Adjustable electrical apparatus." N. S. Magnus. August 10th.

21,836. "Multi-layer electrical coils for wireless telegraphy, &c." H. L. Thomas. August 10th.

21,837. "Electric storage batteries." Chloride Electrical Storage Co., Ltd. [illegible] August 10th.

21,841. "Charging device for miners' electric lamps." Concordia Elektr[illegible] A.-G. August 10th. (Germany, September 29th, 1921.)

21,845. "Support for electric resistance or reactance coils." W. W. Peck. August 11th.

21,875. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 11th. (United States, October 12th, 1921.)

21,885. "Rectifying devices." A. R. Angus. August 11th.

21,905. "Devices for testing ignition in internal-combustion engines." R. T. [illegible] August 11th.

21,910. "Electric motor control systems." R. H. Barbour and J. R. Walton [illegible] August 11th.

21,919. "Automatic emergency lighting systems." M. Arbus. August 11th.

21,927. "Illuminating plant for motor cycles, &c." K. Knapp and F. [illegible] Co. August 11th. (Germany, August 15th, 1921.)

21,929. "Electrical couplings." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. August 11th.

21,933. "Terminal connections for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). August 11th.

21,934. "Electric starting gate for racecourses, &c." J. Bageart. August 11th.

21,941. "Microphone." N. W. McLachlan. August 11th.

21,942. "Burglar alarms." G. B. Carpenter. August 11th.

21,948. "Combining electric cooking with heating." C. B. Gresham and H. W. Sullivan. August 12th.

21,959. "Automatic [illegible] systems." W. H. Grinsted and Siemens Bros. & Co., Ltd. August 12th.

21,960. "Means for sealing tappings on wireless tuning coils, &c." H. W. Parker. August 12th.

21,967. "Horns for [illegible] telephones." J. J. Hummerston. August 12th.

21,990. "Apparatus for [illegible], &c., circuits." H. S. Pocock. August 12th.

21,996. "Apparatus for making [illegible] connections with plunger for [illegible]." F. H. Smith. August 12th.

21,999. "Systems for measuring capacity of electrical circuits." D. Nunn and Western Electric Co., Ltd. August 12th.

22,000. "Electrical transformers." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 12th.

22,003. "Rotary converters." English Electric Co., Ltd. August 12th.

22,007. "Control systems for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. August 12th.

22,014 "Electric relays." J. L. L. Verney. August 12th. (France, August 19th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

3,303 "Elevators." H. Simon, Ltd., and C. F. Kimmonth. January 27th, 1921. (183,495.)

5,849. "Electric control systems." British Thomson-Houston Co., Ltd. (General Electric Co.). February 21st, 1921. (183,503.)

8,798. "Automatic regulation of a petrol or paraffin internal-combustion engine driving an electric generator subject to sudden load changes." H. Ogden and British Arc Welding Co., Ltd. March 22nd, 1921. (183,516.)

8,872. "Sparking plugs." T. Morrin. March 22nd, 1921. (183,522.)

8,883. "Renewal of the filaments in metal-filament electric lamps." A. H. S. Colebrook and W. A. Williams. March 23rd, 1921. (183,525.)

9,172. "Sound-emitting and receiving devices." Submarine Signal Co. (March 26th, 1920.) (180,798.)

9,959. "Ships' telegraphs and like indicating apparatus." W. Clark (C. P. Clark). September 19th, 1921. (183,528.)

10,883. "Control devices for dynamo-electric generators." R. Bosch Akt. Ges. May 3rd, 1920. (168,031.)

10,990. "Rheostats." S. T. Quilliam (Electric Railway Improvement Co.). April 15th, 1921. (183,533.)

11,679. "Electric arc lamps." S. B. Auras. April 22nd, 1921. (183,557.)

11,874. "Head lamps for motor vehicles." Pallas-Zenith Ges. and H. Breitfeld. April 25th, 1921. (183,570.)

12,005. "Means for the mounting and driving of magneto-electric machines on motor-propelled vehicles." R. B. North and A. M. Allen. April 26th, 1921. (183,580.)

12,052. "Electrical connectors." E. W. Pattison (Dictograph Products Corporation). April 27th, 1921. (183,584.)

12,119. "Lamp-shade supports." A. J. H. Haddan (Greist Manufacturing Co.). April 27th, 1921. (183,589.)

12,120. "Portable lamps." A. J. H. Haddan (Greist Manufacturing Co.). April 27th, 1921. (183,589.)

12,145. "Rheostats." N. E. North and Metropolitan-Vickers Electrical Co., Ltd. April 27th, 1921. (183,592.)

12,271. "Electric transformers." Metallurgique Electrique. October 29th, 1920. (170,821.)

12,334. "Electrically-propelled road vehicles." R. Freeman and Railless, Ltd. April 29th, 1921. (183,596.)

12,993. "Electrical operation of railway and like switch-points from the vehicles." M. Loughridge. May 6th, 1921. (183,611.)

12,994. "Alternating-current motors." Dewhurst & Partner, Ltd., and M. Dewhurst. May 6th, 1921. (183,612.)

13,064. "Lubricating means for loose pulleys, trolley wheels, guide rollers, and like free-running members." A. E. Nixon. May 7th, 1921. (183,613.)

13,295. "Electric locomotives." F. C. R. Marks (Soc. Anon. Constructions Electriques de Belgique). May 10th, 1921. (183,616.)

13,661. "Dry cell and method of manufacturing the same." Burgess Battery Co. May 15th, 1920. (163,317.)

13,662. "Dry cell and method of manufacturing the same." Burgess Battery Co. May 15th, 1920. (163,318.)

13,910. "Electric heating devices or elements." Phi-Kappa Syndicate, Ltd., and J. J. M. Kluijtmans. May 18th, 1921. (183,631.)

13,926. "Dynamo-electric generators." Watts, Williams & Co., Ltd., and J. R. Middleton. May 18th, 1921. (183,632.)

14,289. "Combined switches and plugs for electrical purposes." J. B. Tucker. May 23rd, 1921. (183,637.)

14,954. "Electric synchronous machines." Compagnie Générale Electrique. October 27th, 1920. (170,824.)

14,977. "Electric synchronous machines." Compagnie Générale Electrique. March 23rd, 1921. (Addition to 170,824.) (177,490.)

16,800. "Anodes for mercury vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. June 18th, 1920. (165,093.)

17,246. "Pressure-responsive electric-circuit controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). June 23rd, 1921. (183,678.)

17,811. "Conductors for making electrical connection with mercury." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th, 1921. (183,683.)

17,964. "Terminals for rail bonds and the like." F. C. Brittain and Westinghouse Brake & Saxby Signal Co., Ltd. July 1st, 1921. (183,684.)

18,267. "Sparking plugs for internal-combustion engines." W. Fickard. July 6th, 1921. (183,688.)

18,296. "Hunting arrangements in telephone systems." Siemens Bros. and Co., Ltd., E. A. Petithory, and J. E. Collyer. July 6th, 1921. (183,689.)

18,297. "Clamps for electrical junction boxes for bonding metallic-sheathed wires and the like." G. S. Boothroyd, S. E. R. Beecroft, and Callender's Cable and Construction Co., Ltd. July 6th, 1921. (183,690.)

18,541. "Telephones operated by heat." L. B. Miller. July 8th, 1921. (Cognate applications 20,266/21 and 27,379/21.) (183,692.)

18,825. "Electric arc-gap terminals." J. Y. Johnsons (Balt Manufacturing Co.). July 12th, 1921. (183,699.)

18,952. "Contact breakers for fly-wheel magnetos." Villiers Engineering Co., Ltd., F. Poutney, and J. Bradley. July 13th, 1921. (183,702.)

18,975. "Means for indicating the state of adjustment or output of dynamo-electric machines." J. Stone & Co., Ltd., and A. H. Darker. July 13th, 1921. (183,703.)

21,006. "Anchor for the stays of telegraph and like poles." T. S. Entwistle. August 8th, 1921. (183,716.)

25,544. "Device for the automatic operation of an electric circuit-breaker controlled by the pressure of a movable medium." Maschinenfabrik Oerlikon. October 9th, 1920. (169,970.)

27,622. "Trolley collectors for electrically-driven tramcars or road motor vehicles." P. T. J. Estler, E. P. B. Estler, and H. P. C. Estler. October 19th, 1921. (183,750.)

28,411. "Combination electric switch and fuse." A. H. Short. October 26th, 1921. (Addition to 8,456/14, as modified by 6,196/15.) (183,762.)

29,306. "Signalling systems employing light-emitting devices." McKenzie Holland and Westinghouse Power Signal Co., Ltd. March 2nd, 1921. (176,318.)

30,625. "Method and device for separating suspended particles from electrically-insulating fluids, especially gases." Lodge Fume Co., Ltd. (E. Möller). November 10th, 1921. (183,768.)

30,638. "Multiple fuse." J. Szykier. November 24th, 1920. (171,999.)

30,752. "High-voltage slot windings of electrical machines, and the process for the manufacture of same." Akt. Ges. Brown, Boveri et Cie. December 16th, 1920. (172,939.)

34,843. "Arrangement for minimising or suppressing sparking on the interruption of powerful alternating currents." H. Abraham. December 28th, 1920. (173,514.)

1922.

17,788 "Electric arc welding applicable for welding studs, tubes, and the like to or into metal plates, bodies, and the like." L. J. Steele, H. Martin, and A. E. McCarthy. January 19th, 1921. (Divided application on 183,101.) (183,787.)

THE

ELECTRICAL REVIEW.

VOL. XCI. SEPTEMBER 1, 1922. No. 2,336.

ELECTRICAL REVIEW.

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SUPPLY PRESSURES.

IN a letter to the *Electrical World* of July 29th, Mr. L. H. B. Sandwell asks: "Why do America's public utility undertakings use up copper four times as fast as is necessary? Is there any good reason why this must continue?" There is a very good reason, which the Editors append to his letter; admitting the truth of his contention that by distributing electricity at 110 volts the supply undertakings have incurred an excessive outlay on copper in their mains, they regretfully point out that the United States has standardised on the lower voltage and cannot now make the change, on account of the enormous investment in apparatus working at that pressure.

In this respect most other countries have almost entirely rejected American practice; the battle of the pressures was fought out many years ago, when lighting was the predominant element in the electricity supply industry, and pressures round about 220 volts were almost universally adopted for domestic supply. Not only did this pressure meet almost every household requirement—it also facilitated the adoption of electrical power at 440 volts, and enabled the same generating plant to be employed for traction. We know that Mr. C. H. Wordingham favours the lower voltage, but his arguments are based mainly upon the question of personal safety, and with due respect for his opinion, we believe the records of the past 25 years afford but little support for misgivings on this score. It is obvious that the highest safe pressure is also the best pressure from the technical point of view, for it implies the use of the smallest current and consequently the minimum size of cables and accessories; the fact that 220, and even 250, volts can be successfully dealt with in lampholders and lamp-caps, where the live parts are separated by only 3/16 inch, proves that the pressure is not too high for general use, and the remarkable achievements of the lampmakers in producing reliable metallic-filament lamps that take only 20 watts at 220 volts have similarly disposed of the objection that low-candle-power lamps could not be made for that voltage. We grant that 100-volt m.f. lamps would have a higher efficiency and a longer life; but the difference is not so great as to counterbalance materially the many advantages of the higher pressure, which have been greatly emphasised by the development of the domestic heating and cooking load.

It will be remembered that at the I.M.E.A. Convention of 1920, Mr. C. A. Gillin foreshadowed a possible increase in the pressure of domestic supply, to cope with the growing demand; we think, however, that it will be generally agreed that this proceeding would be very undesirable—the limit of 250 volts set by the Board of Trade was well chosen, and should never be exceeded.

On the whole, we think our engineers did wisely when they changed over to 200-250 volts, and we may congratulate ourselves upon being in a much more satisfactory position, in this respect than our transatlantic friends.

Contracts and Patent Infringements.

It is usual, in contracts for the purchase of new plant and also in the conditions of sale covering such plant, to embody a clause indemnifying the purchaser against loss caused by any action for infringement of patent rights arising out of the use of the plant.

The clause ordinarily states that in the event of any claim being made or action being brought against the purchaser in respect of infringement of patents by the manufacture or sale of goods supplied under the contract, the purchaser is to notify the manufacturers or vendors immediately. The vendors shall then be at liberty, with the purchaser's assistance if required, but at the vendors' expense, to conduct all negotiations for the settlement of such claim or any litigation that may arise therefrom.

It will be noted, also, that the clause states that the vendors will indemnify the purchaser in respect of any such claims.

It should be borne in mind, however, that in the event of financial instability on the part of the vendors the claims or the expenses of any litigation in which the purchaser might become involved might prove to be considerably in excess of any retention sum, held by the purchaser, on the contract. Further, in such a case it is highly probable that the holder of the patent rights would take action against the purchaser as user of the infringing device in preference to taking action against vendors who might choose to go into liquidation or otherwise evade their responsibilities.

Remedial action under the law covering infringement of patent rights is somewhat unwieldy; hence it tends to prevent unnecessary and vexatious actions being started, and not infrequently makes it difficult for a patentee to maintain his rights. On the other hand, however, in some respects the protection afforded the patentee is far-reaching. It is laid down that not only is a limited liability company liable to have an action brought against it as user of an infringing portion of plant, but each and every director of such company can be joined in the action, as they are equally liable as joint *tort feasors*.

In the event of the purchaser being an innocent infringer, cause for action would still lie against him as such, and an injunction might be obtained to restrain him from using the infringing plant. This might result in very serious hardship to a company which was relying upon such plant to maintain continuity of supply, but it would be open for it to secure an individual licence from the holder of the patent rights to enable it to continue the use of the infringing plant. The Comptroller of the Patent Office has power to cause such licence to be granted upon reasonable terms, and the procedure is rather simpler in the case of patents which have been endorsed in the register with "Licences of Right."

As the arbitration clause in most contracts provides for the settlement of "any question in dispute or difference whatsoever," it is usually preferable for a purchaser, who has contracted with vendors of meagre resources, to endeavour to secure the agreement of such vendors to arbitration. The referee in such arbitration as is provided for is usually as competent to adjudicate, with expert assistance, upon any but the most involved patent cases as either of the Higher Courts in which action might be brought. Furthermore, it would safeguard the purchaser from having to defend an action for injunction wherein he might ultimately find himself saddled with the whole of the costs, a by no means small matter, if the financial resources of the other parties to the action proved to be inadequate.

Such procedure as is outlined above would tend to lessen the amount of expensive litigation which often arises out of comparatively simple cases, and is in line with the recently expressed opinion of Lord Buckmaster, who stated that some new methods of determining disputes about scientific inventions were needed.

The Turning Tide.

Whilst the process of trade recovery is painfully slow, we believe it is sure. A rapidly rising barometer does not foretell fair weather but a storm; it is the slow, steady rise that justifies an optimistic forecast, and similarly we look upon the gradual improvement that is taking place in industry as a most promising sign of stable conditions and the passing of the clouds which have so long brooded over the land. On all hands we meet with hopeful opinions. On Monday, for instance, on one page of a financial contemporary we read of the "Turning Tide in Ulster—Steady Recovery"; "Shipbuilders Optimistic"; "Optimism in Scotland"; "Strong Demand for Coal"; "Better Trade Forecast —Improving Demand"; "Reduced Unemployment," and so on; and though there are less cheery items on the same page, the general tone of this and other journals concerned in industrial movements indicates the feeling that the tide is flowing again.

When we bear in mind that we are making upward progress in spite of the heavy handicap imposed upon our trade by the chaotic conditions prevailing over large areas of the Continent, the depressed state of many of our other markets, and the disturbances which from time to time invade our own industrial field, we cannot but congratulate ourselves upon the state of convalescence that we have already reached, and look forward with strengthened confidence and unshaken faith to the day when Britain will once more rejoice in abundance of trade, work for all, and prosperity for every class of her population.

The Electrical Industrial Situation in Sweden.

The Swedish electrical market was formerly almost wholly worked by the German electrotechnical industry. In late years it has gradually slipped away from that country's grasp, as an outcome, it is said, of irregularities in the supply of goods and of the fluctuations in prices. At the present moment, according to an article in *L'Electricité pour Tous*, German firms are making vigorous efforts to recover the outlets of which they had formerly an assured hold, and an extraordinary advertisement campaign is being engineered, while a German invasion of travellers and agents is under way. The establishment in Stockholm of a German trade information office and permanent exhibition of samples is even mooted, and a reconquest may perhaps attend these steps; but for the moment results are merely shadowy.

Sweden, however, while shunning Germany, is turning towards England. The mechanism of this phenomenon is easy to understand. Outlets are being sought in England which are not to be found in Germany, on account principally of the currency difficulty, and therefore to make sure of these outlets Sweden opens wide her ports to importations from England. Swedish electrical industry made big strides in development during the war, and the manufacture of many machines of the smaller and medium sizes has visibly progressed. Nevertheless, for large sets Sweden has remained dependent on Germany, and it is for these that she may become the customer of other countries. The plant for which she will make the greatest call is that needed for the working of mines and the installation of foundries, steelworks, paper mills, &c. The extension and improve-

ment of the equipments of the ports of Stockholm, Gothenburg, Malmo, &c., are also contemplated. A large portion of these plants is electrically driven. Electric stations and transmission and distribution networks are very numerous, and the use of electricity in all branches of industry is widespread, and all this progress and development implies large purchases of the bigger items of electrical plant. The conversion to electrical operation of several lines of railway is proceeding, but still more extensive schemes have had to be laid aside on account of the prevalent financial depression and the variations in the price of coal. This is the case, for example, with the Stockholm-Gothenburg line; but the works on the Kiruna-Svartsön line are being prosecuted.

In the wireless department it has been decided to build a powerful station capable of ensuring a regular service between Sweden and America. The various systems have been under consideration—French, English, German, American—and as we announced last week, the Radio Corporation of America has received the contract. The establishment of a link between Sweden and Finland is also contemplated. The Swedish Wireless Co., of Stockholm, has joined with the Marconi Co., and worked out a programme to establish wireless connections throughout the interior. Recent telephone departures include the laying of a cable between Sweden and Germany; and another cable, between Stockholm and Gothenburg by way of Västeras, Koping, Orebrö, Sköfde, and Allingsas, is in course of being laid. Two big companies making telephone material, the Ericsson and the Cedergren companies, have amalgamated, in order to extend their activities.

German Exports.

A German newspaper seeks to show that, contrary to the idea prevailing in certain other countries, the export trade has not been very active owing to the depreciation of the mark since the conclusion of the war. Taking the German official figures, it is stated that the exports of machinery averaged 540,000 tons in the years 1911 to 1913, while in the twelve months ended with June 30th, 1922, the exports amounted to 410,000 tons. The corresponding quantities for electrotechnical products are 125,000 tons and 90,000 tons respectively. If the exports for one month only are taken into consideration, it is shown that 36,500 tons of machinery and 6,500 tons of electrotechnical products were exported in June, 1921, these figures comparing with 41,000 tons and 7,700 tons respectively in June, 1922.

Dangerous Lifts.

Having regard to the highly-developed stage to which modern electric lifts and accessories have attained, it seems almost incredible that accidents such as that recorded in our "Notes" columns to-day can occur. The fitting of a simple gate-operated mechanism is not a very expensive or difficult matter, and it would be thought that all lifts installed before the introduction of such devices would by this time have been put right in this respect. It appears, however, that there are still cases in which safety has not yet been assured, and while this is so accidents are bound to occur through carelessness or inadvertency. It is essential that every lift system shall be so arranged that until all the gates on the system are closed it is impossible to start the lift, and that no gate can be opened until the lift is at that particular floor. Of course, no lifts are constructed without a safeguard against rope-breakage.

There are naturally objections to devices which secure the objects mentioned; it may be complained that over-refinement leads to complications and minor breakdowns which result in putting the lift out of action; again, the failure, in the case of automatic lifts, of passengers to close a gate may make it impossible for the lift to be "called" from another floor. But in spite of these objections it is incontrovertible that safety must even be placed before efficiency—where the two terms are not synonymous.

The South African Market for Domestic Appliances.

The position as regards the sale of domestic electrical appliances in Cape Town, as revealed by a report of the American Vice-Consul abstracted in our Business Notes this week, will be regarded by British manufacturers with mixed satisfaction. It is something to know that their goods are favourably placed in comparison with American appliances, but the Teutonic spectre is to be seen in the background. It is not surprising to learn that American toasters hold their own on account of superiority, for we have seen a number of British makes of very flimsy construction and poor finish at trade shows, although the more reputable makes are certainly not inferior to the American variety.

We think the claim of superiority thus advanced by America applies with even greater force when comparison is made between British and German manufactures, and on this score alone we think that British appliances will continue to hold their own in what is, after all, a British market.

The British Association.

The ninetieth meeting of the British Association for the Advancement of Science commences at Hull on Wednesday next, this being the second visit to the city after an interval of about seventy years.

Electrical subjects seem destined to play an ever-diminishing part in the Association's proceedings, and so far as we can learn at present, the study of electrical matters is confined to Section A—Mathematics and Physics—of which Prof. G. H. Hardy, F.R.S., is president. Papers dealing with X-rays are to be contributed by M. le Duc de Broglie and Prof. R. Whiddington, B.Sc. There will be an exhibition and description of physical apparatus employing electrical means for biological purposes, and Mr. J. E. P. Wagstaffe is reading a paper upon "The Determination of Dielectric Constants and Susceptibilities by Valve Methods."

One of the general discussions arranged in this Section is on "The Origin of Magnetism," to be opened by Prof. P. Langevin (Paris) and Prof. P. Weiss (Strasburg).

The president of Section G (Engineering) is Prof. T. Hudson Beare, and the subject of his address is "Railway Problems in Australia."

Section F—Economics (president, Prof. F. Y. Edgeworth)—is bound to be a source of some papers of general interest and utility, and the same may be said of Section J—Psychology (president, Dr. C. S. Myers, F.R.S.)—in which industrial or "applied" psychology is receiving a great deal of attention. One of the popular evening discourses this year is to be delivered by Dr. F. W. Aston, who takes as his subject "Atoms."

It is to be hoped that the weather and conditions generally will be as favourable as they were at Edinburgh last year.

Glasgow Tramway Contract.

We note with regret that the Glasgow Corporation, by a narrow majority, has accepted an American tender for tramway rails, effecting an apparent saving of £3,000. At a time when over a million British workpeople are unemployed, it is painful to see work sent abroad to "save" money which will have to come out of the pockets of the ratepayers in the shape of doles. The injury to the national interests is not confined to this consideration: idleness is demoralising and irksome to honest men, and the example set by Glasgow will result in other orders, both from home and abroad, being diverted from our workshops. We are glad that all the Labour members of the Corporation were alive to the meaning and consequences of this transaction; and did their utmost to prevent its accomplishment.

ASPECTS OF THE MOST ECONOMICAL TRANSMISSION LINE DESIGN.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

When designing a transmission line the object in view is, of course, the most economical transmission line. In practice, the actual results, more often than not, vary within a wide range from *the most economical* transmission line. The cause may be due to (*a*) an imperfect knowledge of this class of civil, of mechanical, and of electrical engineering; (*b*) lack of practical experience; (*c*) want of proper understanding of *all* the present and future independent and inter-dependent variable factors, &c.—in fact, the essential requirement is to be certain that every item entering into the problem of the most economical transmission line is receiving proper attention before any further step is taken. This is very often where the first great discrepancy is made, and, perhaps, added to it, there may be an inaccurate or an unsafe interpretation or an improper application of one or more of the varied and rather complex economic problems, technical details, &c. In the design of the most economical transmission line a number of assumptions and probabilities must first be made, some or all of which may offer avenues for a varying degree of discrepancies in the calculations upon which the transmission is to be designed. Moreover, seeing that the transmission line itself is but a part of the complete electric power system, the numerous economic problems involved may be seen to vary widely and to require the solution of many variable factors, difficult and sometimes impossible to solve to a fair degree of refinement.

In a general way, we do not take very kindly to the two following statements:—

(1) We have not designed and constructed the most economical transmission line because of the uncertainty of basic assumptions, &c., &c.; and

(2) That extreme refinement in calculations relating to the determination of the *proper* size of conductor, usually represents an unnecessary expenditure of thought and labour, in view of the fact that the final choice will in any case fall between two different standard sizes of conductors differing, appreciably in area, one or the other of which must be selected for commercial reasons quite independent of the *exact* size which theoretical calculation would show to be most advantageous.

Obviously, unless the designer is fully capable of solving, within a fair degree of accuracy (not necessarily extreme refinement), such problems as the best and most economical location, the most economical voltage, the most economical size of conductors, the most economical span between line supports, or the most economical phase correction or compensation, he is effecting no useful purpose in saying that the two above-mentioned statements do not apply to him, or that one or the other is wide of the mark. The writer's experience forces him to admit of much truth in the above statements, and also to admit that, in general, they are fairly well borne out in actual practice. As in the case of a railroad or a water conduit, our mathematical minimum or averages are made subject to circumstances, and our designs are made and the work is completed for conditions not in sight, and which, from time to time, call for changes in the original calculations, assumptions, probabilities, &c.

The most economical design of a transmission line is governed by many factors, the principal being load factor, transmission distance, cost of energy, and the annual expense of the investment. In general, big power capacity, high load factor, long transmission distance, high cost of energy, and low annual expense will result in a *high* most economical voltage; and, big power capacity, high load factor, short transmission distance, and low cost of energy will result in making the most economical size of conductors *large*. In the design of the most economical transmission line, the principal independent variables to be taken into account are:—(*a*) Distance of transmission; (*b*) amount of load; (*c*) nature of load; (*d*) cost of generating energy; (*e*) number of lines; (*f*) number of circuits; (*g*) factor of safety; (*h*) spacing of line supports; (*i*) electrical system; (*j*) transmission voltage; (*k*) spacing of conductors, &c.; (*l*) selling price of energy; (*m*) interest and depreciation, &c.

The cost of a transmission line consists of (1) the generating costs of energy lost in transmission; and (2) the allowances for interest and depreciation, &c., on the investment. By varying several independent variables, the cost will show a minimum for a *definite* power load (variable in practice) and *definite* transmission distance. The *real* problem is not purely a matter of solving for a theoretical minimum. The problem also demands practically an absolute security of service (best quality of the complete installation), as well as reasonably good line voltage regulation, &c. The former may mean (due to service requirements) a duplicate transmission line, a very high factor of safety, both electrical and mechanical, very high degree of protection against lightning and other disturbances, &c. The latter is always important, and is one of the requirements in the form of transmitted energy—its degree of variation will vary with the load.

Because of the large capital outlay involved in the transmission of energy over long distances in great bulk at very high pressures, it is very important to locate, design, construct, and operate the line in the most economical manner. Industrial, financial, and other conditions will change the cost of the complete transmission system, and the value of energy, &c., and the constants assumed in the calculation for the determination of the most economical conditions (involving wayleaves, line supports, conductors, insulators, earth wires, land, buildings, transformers, &c.) may differ at one time to another sufficiently to show that the original calculations are widely different from the actual practical conditions.

The electrical efficiency of a power transmission line depends upon (1) ohmic loss in the line conductors; (2) copper loss in the transformers at both ends of the line; (3) magnetic loss in the transformers located at both ends of the line. The ohmic loss in the line is directly proportional to the square of the current and to the resistance of the conductors. In long and very high-voltage lines the load current (I) may not always have an equal value along the line owing to the existence of capacity current (Ic). The ohmic loss is variable according to the change of load (power and power factor) and the temperature—the total energy is dependent on the power factor. In the design of a transmission line a value is usually assumed for the amount of energy annually transmitted, which value takes into account a load factor something after the style, "the maximum load is continuous for [*so many*] hours, the remaining [*so many*] hours being loaded about [*so many*] per cent. of the maximum." In actual practice the economical points upon which reasonings are based are rarely met, and where the most economical range of points has been adopted, the theoretical *true* minimum may be attained for but a very short period of the time, perhaps never; if, for instance, certain economic problems were not fully considered or not properly understood in the light of future changes in the character and amount of load, &c. Usually the load, diversity, &c., are assumed long before they actually exist, and, in consequence, certain discrepancies generally arise in practice.

When the distance of transmission is great, the cost due to the ohmic loss in the conductors and that due to the annual expense of line supports, conductors, and insulators, will tend to increase proportionally. Obviously the variation of load and power factor will have a great influence on the cost of transmission. When this latter factor is low, the efficiency will be proportionately low, and, as the total capacity is not being utilised efficiently, the annual expense will obviously increase in proportion. The cost of transmission is composed of an electrical cost (size, length, and spacing of conductors, the amount of load, the nature of the load, and the terminal apparatus, such as the efficiency of transformers, &c.), and a capital cost which represents the cost of line supports, conductors, insulators, transformers, land, buildings, switchgear, &c., and the interest, depreciation, maintenance, taxes, &c. The interest on the investment will depend on the value of the installation and the commercial conditions. The depreciation is usually carried forward from annual profits to provide for replacements. Maintenance, taken as a whole, will bear a definite proportion to the total amount of depreciation, hence the necessity of applying proper percentage values. The various items of depreciation and maintenance are not the same for the different parts of the complete undertaking. With regard to taxes, the usual taxes for a power transmission system are: (1) income tax; (2) land tax; (3) building tax. These taxes vary for different countries and for different localities in the same country. The cost due to annual expense will consist of several unequally durable and unequally costly items, the various items involved being wayleaves, line supports, conductors, insulators, transformers, lightning arresters, switchgear, land, buildings, &c. It can therefore be seen that the importance of one item is estimated not only by the amount of money invested, but by the coefficients of annual expense. Moreover the cost of the complete system is dependent not only on the first cost, but also on the coefficients representing the interest, depreciation, maintenance, &c., so that a low first cost for one part may very soon become a high-cost item when the maintenance expenses become excessive on account of short durability, *i.e.*, poor quality of materials, &c., and inferior engineering and workmanship. Thus, in the long "chain" of variables, we see many reasons that prove the accuracy of the above statements and the great need and importance of preparing reliable figures of every item, based on a sound engineering experience, so as to obtain as nearly as possible the best and the most economical design.

The modern tower line, carrying current at very high pressures, demands as careful study of its location as a railroad. In its proper location it demands a thorough knowledge of all the factors affecting the first cost, as well as subsequent operation; it requires a keen sense of observation, so that all the physical facts are accurately noted; that all advantages are taken and disadvantages avoided. In its location it is important to avoid, as far as possible, public highways, villages, telegraph and telephone lines, &c., at the same time keeping in mind such important points as the minimum distance of transmission, the minimum number of angles, the minimum altitude with minimum distance where corona is in evidence, and the safest protection from lightning. Sometimes tower lines are cheaper if located across rolling country (hills and valleys) where longer spans and fewer towers can be used than in flat country. A careful study of all these minimum points of cost, &c., will decide the best and the most economical transmission line *location*.

In the location of a line it is preferable to first run a preliminary line (on paper), then project the location. When the location line is being staked out, a careful classification of the ground crossed should be made showing rock outcrops, cultivated, bare, and/or swampy ground, &c. A line of fairly accurate levels should be run which will show breaks in ground of two or more feet. The field work should also show a record of all transverse slopes of more than about ten degrees. When the detailed profile has been completed, the line support locations can be made in the office. One such office procedure for properly locating line supports is to first make certain assumptions for loading—investigating sag and tension with a sudden drop in temperature or for a combination. A transmission line must be sufficiently high above the surface of the ground to conform with local and Government regulations, and the line support must be built to resist (*a*) the weight of the structure itself; (*b*) vertical load due to the lines; (*c*) windage on its own structure; (*d*) transverse load applied at the top. These will determine the size of members in tension or in compression of the support. The vertical load will be the total sum of the aggregate weight of conductors, insulators, sleet coating, &c., and the downward pull of conductors due to the difference in the height of the points of support. The weight of a steel tower is very much dependent on the tension of the conductors either in the deflection of line or in the unbalance of tension. The cost of structural steel and line support foundations will vary according to the commercial conditions. At the present time the type of steel towers generally used is the *rigid* type. The weight of the line insulators is dependent on the voltage. For very high voltages the predominating requirement is insulating capacity, so that transmission voltage principally defines the cost of insulators, although the cost is mainly dependent on their weight. Duplicate lines should, preferably, be constructed upon separate supports and over a different route to avoid the chance of interruptions from storms, &c. Against this advantage is the increased cost of line supports, wayleaves, patrolling, &c., but these may be offset by security of service. In the final staking out of line supports in the field it is most important to engage a first-class man. An inexperienced man may destroy part or all of the good work accomplished in the office by greatly increasing the cost of line supports (due to placing steel where it is not required), by endangering the line by mechanical weakness (due to placing ordinary supports instead of heavier supports at angles caused by changing the route to avoid obstacles not accounted for in the office location of the line), by causing an uplifting of the insulators sufficient to endanger or cause fracture of the cross-arms, by causing the clearance of conductors to extend below the allowable minimum, and, perhaps, finally causing a transmission line to be built that would, during the whole of its life, be an undue source of expense and danger.

For the transmission line itself, the *main* variables are voltage, power, and power factor; and, in view of the fact that a variation is dependent on the line constants and on the amount of and nature of load, it would seem that—considering all things—we are reasonably justified in basing the design on the *average* values of these said variables. Certainly at times there occurs in actual practice a wide range of the different values of these variables. Nevertheless, we may take it that, in general, the design—taken purely from the point of view of energy losses in transmission and the annual expenses of the line investment—may be limited to dealing with the averages of voltage, power and power factor.

As the cost of transmission would, in certain cases (perhaps generally), vary but little for different span lengths, a determination of the most economical transmission line would be to:

(1) Decide on the most economical span for a definite voltage and definite size of conductor.

When this has been done, the next move would be to:—

(2) Determine the cost of the transmission line with the most economical span against the size of conductors for different values of transmission voltages.

Then:—

(3) Plot these values to show one curve for each transmission voltage.

Afterwards:—

(4) Mark off the minimum which determines the *most economical* size of conductors with the *most economical* span for a given voltage (standard voltages among others).

Then:—

(5) From the minimum points thus obtained for different voltages, draw a curve.

Finally:—

(6) The curve should show a minimum point for the most economical voltage of transmission, the most economical size of conductors, and the most economical spacing of line supports.

In conclusion, although the final choice will in any case fall between two different commercial *standard* voltages and two different commercial *standard* sizes of conductors*, both differing appreciably, one or the other of which must be selected for commercial and economic reasons, a point always to be borne in mind is that, in general, an ample design is comparatively less expensive than a curtailed one.

When either voltage or size of conductors is increased, the cost of transmitting energy will increase, due to the greater cost of the line, &c. The variation of the different parts of the cost with the change of voltage will be much more pronounced than that with the change of size of conductors. For a definite size of conductors the total cost of transmission will vary but little with a change of span, but it will vary greatly for a variation in the size of conductors; also, for a definite span, the annual expense will increase with increased size of conductors. The cost of line supports will increase with increased size of conductors, and the cost of insulators will increase with increased voltage. Among other points of equal importance not mentioned here, all the above aspects of the most economical transmission line design go to show, when properly balanced as regards the range in the values of the different *variables* and the difference between standard of voltage and standard of size of conductors, &c., that the mathematical or theoretical minimum need not be calculated to a high degree of accuracy.

* "Electric Power Systems," London: Sir Isaac Pitman and Sons), by Wm. T. Taylor (page 61).

ESTIMATING FOR INTERNAL WIRING CONTRACTS.

By ALAN KIRK, A.M.I.E.E.

The collation and analysis of estimates for the internal wiring of buildings for electric lighting during the past 12 months has been an interesting, although somewhat saddening, study.

In 95 per cent. of the cases reviewed there was a great discrepancy between the highest and lowest tenders, ranging from the order of 3 to 1 to the order of 6 to 1; even in the comparatively few cases in which plans and a full specification had been provided, the variation between the highest and lowest tenders was as 2 to 1. To enable one to appreciate the actual facts of the matter, it is necessary to carefully study the relative responsibilities of the parties concerned.

Assuming that the work to be executed has been placed in the care of a paid technical adviser, then the faithful preparation and carrying out of the contract becomes a joint liability shared by the adviser and the accepted contractor. The advisor should clearly specify the materials to be used, stating their quality and quantity, where they are to be fixed, and the method of fixing, and, finally, he should make sure that his instructions are properly carried out. The contractor tendering has to price the materials specified, including his estimated cost of erection in the manner and places detailed by the advisor and, finally, when accepted, he should execute the work with the materials specified in the manner and ways in all particulars as laid down in his instructions.

It can be accepted as an axiom that all tenders for internal wiring contracts are governed by two factors, *viz.*, (*a*) materials to be erected, and (*b*) labour for erection; also before (*b*) can be ascertained it is necessary to know the magnitude and disposition of (*a*); therefore, it is essential that the parties tendering must be in possession of the full facts concerning (*a*) in order to equitably estimate the requirements of (*b*).

Having established our ground-work, let us now examine in detail the methods employed in present-day practice for (1) obtaining tenders, and (2) estimating for contracts; then, with the information thus available, we can finally consider and set down the best means of improving the method of obtaining tenders and estimating for them.

Price per Point.—With this method the tenderer is asked to give a price per point for a certain system of wiring, and in the majority of cases the information regarding the disposition of the points in question is of the vaguest description. How can anyone give a fair tender on such a basis when both of the requisite factors are unknown quantities? That this is a most reprehensible method must be admitted by everyone who gives thought to the matter; in point of fact, tenders obtained on these lines resolve themselves into guessing competitions, and should be brought within the scope of the Lottery Act.

Plans with Points only Indicated.—Under this heading are grouped all schemes that rely upon the marking of plans with spots, crosses, &c., to indicate the proposed positions of wiring points as sufficient information for the tenderer to base his estimate upon, without any guidance as to the path the conductors are to follow.

That tenders obtained by this method should show a considerable diversity in the prices is not to be wondered at, if the multiplex paths the conductors can legitimately follow are taken into consideration. It is obvious that before the tenderers can price their estimates they must decide how and where they are going to carry the conductors. Should one of the tenderers decide to adopt a lay-out whereby the greatest economy in materials is obtained with a concurrent economy of labour, and another decide to select more divergent paths requiring a greater quantity of material and consequent increase of labour, the result might well be that the first being the lower tender is accepted, possibly to find later that the paths selected for the conductors are not acceptable to the advisor; whereas the lay-out embodied in the second tender more nearly represents the scheme in the mind of the advisor, but of which no indication had been previously given, and conceivably the true measure of the value of the work involved may be that of the higher tender.

It is pin pricks such as these that often cause a feeling of irritation between the parties concerned in the contract, which could so easily be eliminated by the adoption of more businesslike and up-to-date methods.

Plans with Lay-out Indicated.—Under this heading are included schemes for which plans are supplied by the advisor, showing the positions of all points, accessories, &c., and having the proposed paths that the conductors are to follow clearly indicated in such a manner that the tenderers reading them, in conjunction with the specification and schedules, can by measurement and calculation obtain the full facts concerning the magnitude and disposition of materials required for the due execution of the contract.

That tenders obtained by this method also show great divergencies in prices is undoubtedly due to the

varying methods employed by the tenderers for measuring and calculating the quantities of materials required, which brings us to the consideration of (2)—namely, estimating for contracts.

Before proceeding with this consideration, it may be of interest to interpose a few extracts from specifications actually issued for the purpose of obtaining tenders:—

". . . the batteries are to be Leclanché dry cells fitted with nickel-plated gongs. . ."

". . . all v.i.r. cables and wires are to have an internal resistance of not less than 600 megohms. . ."

". . . the whole of the circuit wiring is to be arranged on the two-wire system suitable for 200 volts taken from the supply company's terminals at a pressure of 50 cycles per second. . ."

". . . all lamps and other current-consuming devices are to be grouped in such a manner that the periodicity on each phase of the supply is efficiently balanced when working under normal conditions. . ."

It is not suggested that the foregoing "errors of phraseology" are in accordance with the general trend of specifications issued, but merely examples of what the tenderer may meet with.

In considering the methods adopted for estimating the cost of executing internal wiring contracts it will be advantageous to classify them as follows:—

"*Bad*" methods of estimating embrace all those attempts which rely upon the "guessing ability" of the tenderer as their basis.

"*Fair*" methods may be taken as those which use as their basis a combination of definite information and averages obtained by technical experience.

"*Good*" methods are those which rely only upon definitely ascertained facts as their basis.

Average costs obtained from practical experience, if used for obtaining an approximate valuation of the work or as a check upon estimated values, serve a very useful purpose, but they should not be taken as a basis for an estimate. It is only by practical experience that a knowledge of the art of estimating the cost of labour can be gained, wherefore the attempted use of average costs by unskilled persons is liable to be disastrous. The method of estimating for internal wiring contracts generally used is the one designated as "Fair," the procedure being:—

After a perusal of the specification and plans has been made, certain circuits are selected as being those which will give, when averaged, the best representation of the average amount of materials required per point. The next step is to accurately measure up the quantities of material required for the selected circuits; having obtained this definite data, it is, by division and multiplication, converted into figures which are accepted as being the total quantities of material required for the contract, and, when priced together with the estimated cost of labour for fixing, form the net cost upon which the tender is based.

The procedure adopted for the method termed "Good" is similar in application to the foregoing, but instead of confining the measurement to certain circuits, the quantity of material required is obtained by measurement of the entirety.

The weakness of the "Fair" method lies in the human element involved, *i.e.*, the skill required to select representative circuits of true value. For the purpose of obtaining data upon this matter a considerable number of tests were made on various wiring plans by taking a definite number of circuits in varying positions, such as the longest and shortest runs, all medium runs, &c., and the results disclosed discrepancies ranging from 7 to 20 per cent. between the average quantities so obtained. In no case did the average quantities accurately represent the actual quantities required.

Some of the reasons why the "Good" method is not generally adopted are: Insufficient information, lack of time, inability of the person estimating, and satisfaction with average accuracy.

The remedy for nearly all the evils outlined is the adoption of "bills of quantities" for tenderers to price; by this method definite quantities of specified materials are given and, in conjunction with the necessary plans and specification, the tenderers have full and complete information regarding the magnitude and disposition of the materials required, and are thus in a position to accurately estimate the labour costs of erection.

It does not seem unreasonable to advocate a method whereby the quantity of material requisite and necessary for the due completion of the work shall be compiled and tabulated for the use of the firms invited to tender for such work, in lieu of the existing methods which necessitate the taking off of quantities by each individual tenderer. Electrical bills of quantities provide a complete schedule of rates usable for variations, and such rates are absolutely proportional to the estimated amount of the tender.

In conclusion, it may be claimed that sufficient evidence has been adduced to warrant the general adoption of Electrical Bills of Quantities for obtaining tenders for internal wiring contracts. There is no difficulty to be faced in the matter if the work be placed in the hands of a competent electrical quantity surveyor, the procedure being analogous to the well-tried method in vogue for nearly all building contracts, for which bills of quantities are prepared by a quantity surveyor and incorporated with the plans and specification for tendering purposes. It is confidently anticipated that if the method advocated was adopted generally the beneficial effects resulting therefrom would be felt throughout the electrical profession and industry.

THE LOADING OF A CURRENT TRANSFORMER.

(Communicated.)

Current transformers have two distinct ratings, the first specifying the primary current required to produce five amperes in the secondary circuit, the other rating giving the maximum loading of the secondary side in volt-amperes. The current rating of a transformer is fixed, more or less, on a basis of temperature rise; and the primary current required to give five amperes secondary current is the maximum normal current the primary winding will be called upon to carry. The volt-ampere loading of the transformer is, on the other hand, fixed on an accuracy of transformation basis, and specifies the maximum load that can be drawn from the secondary winding without definite limits of error being exceeded. The two standard ratings for current transformers are 15 and 40 volt-amperes.

Let us consider the case of a 15-volt-ampere transformer. Since the maximum secondary current is 5 amperes, the voltage on the secondary terminals when this current is flowing will be 3, and the impedance of the external secondary current 0.6 ohm. If now the primary current be reduced, the secondary impedance remaining the same, both the secondary current and the secondary voltage will diminish approximately proportionally to the primary current, and the volt-ampere output of the secondary will vary with the square of the primary current. With one-tenth of the full-load primary current, for instance, the volt-ampere output will be 0.15.

The errors of current transformers are due to the fact that a component of the primary current is used to magnetise the core to a degree sufficient to generate the required secondary voltage, and the whole of the primary current is not therefore available for transformation. The actual secondary current is therefore less than that calculated from the turns ratio, and moreover, there is a phase angle between this current vector and that of the primary reversed. The

magnitude of the errors clearly depends upon the magnitude of the primary magnetising component. For a secondary voltage of 3, the primary magnetising component depends upon the number of turns in the primary and upon the dimensions of the magnetic circuit and upon the characteristics of the iron. If the primary current be halved, the secondary voltage and the flux in the core will also be halved. If the magnetising current necessary to produce this flux were also halved, the proportion that this component bore to the total current would be the same, and the error of the transformer would be unaltered. Unfortunately, at the low densities used with current transformers, the relationship between flux density and magnetising force is not one of proportionality, the B H curve being in shape more like a parabola with a vertical axis. As the density diminishes, the magnetising current is greater than it would be if there were proportionality between these quantities. Accordingly, at low primary currents a relatively larger component is required to magnetise the core, and it is found that, with a constant secondary impedance, the errors increase as the primary current diminishes. In other words, as the primary current decreases, the secondary current becomes relatively less, and the phase displacement becomes greater.

The volt-ampere rating of a transformer, therefore, really fixes the value of the secondary impedance, which cannot be exceeded if the errors are to be kept within assigned limits. The volt-ampere loading refers to the output when the transformer is supplying 5 amperes, and at other currents the permissible loading varies as the square of the secondary current. The wording of the B.E.S.A. specification for instrument transformers is a little obscure on this point, as from a casual reading it might appear that a transformer is required to supply its rated volt-ampere output at any secondary current down to 0.5 amp. without the limits of inaccuracy being exceeded. If this were the requirement, the maximum secondary voltage for a 15 volt-ampere transformer would be 30. The flux would therefore be 100 times that required with a load of 0.6 ohm impedance.

In view of the fact that a 5-ampere full-load secondary current is now invariable, it would seem more reasonable to rate a current transformer on an accuracy basis by the maximum impedance of the secondary load it can supply. The two values of the impedance corresponding to the standard ratings of 15 and 10-volt-amperes are 0.6 and 1.6 ohms respectively.

In conclusion, it may be noted that the B.E.S.A. specification gives the limits of error with a non-inductive secondary load. The effect of an inductive load on a current transformer secondary is to diminish both the phase angle and the secondary current as compared with a non-inductive load of equal impedance. Since, in actual practice, the load of a current transformer is rarely non-inductive, it would seem preferable to specify the limits of error applying to a load of the character of those representing average conditions.

THE RAMSAY TURBO-ELECTRIC LOCOMOTIVE.

The Ramsay condensing turbine-electric locomotive, illustrated in fig. 1, may be regarded as the second practical attempt made in this country to introduce the condensing turbine locomotive with electric transmission, the first one being the Reid Ramsay locomotive built by the North British Locomotive Co., Ltd., Glasgow, and tried on the Cowlairs Incline, Glasgow, in the year 1910.

In locomotives of this type the principal, and indeed, the primary object, is to economise in fuel and water, and a super-heater boiler with, in this case, a total heating surface of 1,453 sq. ft. is provided for generating steam for actuating the main and auxiliary turbines. A condenser of novel design is installed into which the exhaust steam from the turbine is discharged through a large-diameter pipe, being expanded down from boiler pressure to a vacuum of 27½ ins., the condensate being drawn off from the condenser by a rotary extracting pump and returned to the well, from which a feed pump delivers the water into the boiler, thus completing the cycle.

The Ramsay locomotive is, in effect, two separate units which, when coupled together, to a large extent resemble a locomotive with its tender as in ordinary practice. As a matter of fact, however, both units form separate engines coupled together. The front one, both as regards the boiler and framing, differs but little from accepted locomotive practice, with the exception, of course, that the features of the cylinders, reciprocating parts, &c., are replaced by a turbo-generator, this being supplied by the Oerlikon Co., of Zurich. The main turbine is of the impulse pressure compounded multi-stage type, connected through a flexible coupling to a three-phase generator capable of sustaining a 25 per cent. overload for half an hour. This generator is separately excited by an auxiliary turbine driven direct current generator. The three-phase generator supplies power to four three-phase slip-ring motors arranged in two groups on the front and rear parts of the locomotive respectively. The two motors of each group are bolted to a common stretcher carrying a countershaft to which the motors are geared. The power is then transmitted from the countershaft to the six driving wheels on each engine unit by coupling rods in the ordinary manner. Each of the motors is capable of developing 275 h.p.

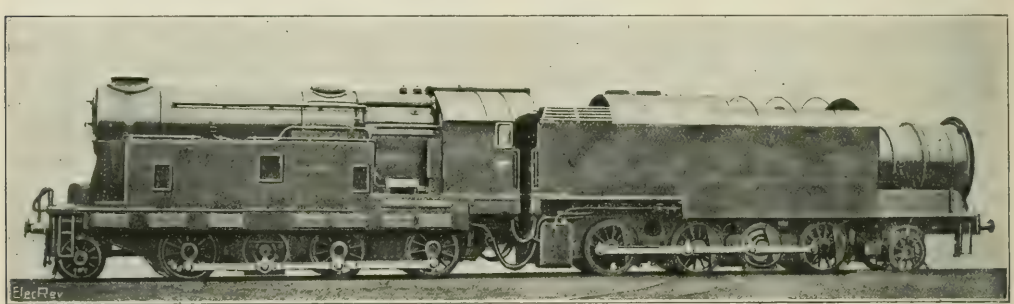


Fig. 1.—The Ramsay Turbo-Electric Locomotive.

The rear engine incorporates the coal bunker and cooling water tank, as well as the condenser and its appurtenances. The condenser is of the evaporating type supplied with air by a fan at the rear of the engine. The steam tubes of the condenser are arranged in the form of a cage, which is caused to revolve in water at slow speed, and through which air is impelled by the fan in a radial direction over the tubes. A flexible pipe between the two portions of the engine connects the turbine exhaust to the condenser.

The boiler is hand fired and fitted for forced draught. The driver manipulates the locomotive by means of a master controller placed in the cab.

The leading particulars are as follows: Length over-all, 69 ft. 7 in.; length, wheel-base, 59 ft. 4 in.; total weight, including 2,200 gallons of water for cooling purposes and 4 tons of coal, 130 tons 15 cwt.; adhesive weight, 108 5 tons; tractive force, 22,000 lb.; turbo-generator, 890 kW at 3,600 revs. and 27½ in. vacuum, voltage 600.

The locomotive was constructed by Sir W. G. Armstrong, Whitworth & Co., Ltd., at the firm's Scotswood works, to the design of the Ramsay Condensing Locomotive Co., Ltd.

We are indebted to our contemporary *The Railway Engineer* for the above information and the illustration of the locomotive.

International Trade Conference at Venice.—The General Council of the International Parliamentary Trade Conference will meet in the Doge's Palace at Venice on October 3rd.—*Reuter* (Brussels).

INSULATING MATERIALS.

Developments in Great Britain.

A paper that was presented at the June Convention of the American Institute of Electrical Engineers, at which the author attended as a delegate from Europe of the International Electrotechnical Commission, is intended to show the lines along which the manufacturers of electrical apparatus in Great Britain are dealing with their insulation problems. The facilities that have been established for insulation research are outlined and the more important developments in insulating materials and processes employed in the various classes of electrical apparatus are discussed, with special reference to thermal characteristics and consideration. The opinions of British electrical engineers upon certain aspects of temperature rating of machinery as effected by insulation are considered by the author, who suggests a bold advance in two main directions: first, the use of higher temperature limits where experience indicates that this can be safely done; and, secondly, the comparison of machine performance on a basis of temperature rise rather than on that of total temperature recommended by the International Electrotechnical Commission.

In the course of his paper, which we abstract from the *Metropolitan-Vickers Gazette*, Mr. A. P. M. Fleming, M.I.E.E., &c. (Metropolitan-Vickers Electrical Co., Ltd.) points out, *inter alia*, that most research work has been directed principally to extending knowledge of the behaviour of insulation, improving quality, developing more scientific insulating processes, defining the requirements of insulation users, and standardising the methods of testing materials. A most important development has been the increasing tendency in recent years for makers and users of insulation to co-operate either individually or through the medium of the British Electrical and Allied Industries Research Association.

Industrial Machines.—For machines other than traction, crane and mill motors, Class A materials are employed, *i.e.*, organic insulation of cotton, silk and paper, either impregnated or untreated. In addition mica wrappings or linings of similar material are employed to a very considerable extent on the slot portions of windings.

No very great advance in quality can be looked for in Class A materials. Certain improvements that are worthy of some note, however, are briefly as follows*:—

Pressboard is a fibrous insulating material otherwise known as fullerboard, presspahn, &c., which before the war was made only to a very limited extent in England, the supplies being obtained from America or the Continent. While materials similar to those originally imported are now manufactured in England to meet the requirements of certain markets, newer types of pressboard have been developed along two distinct lines, having the following characteristics:—

(1) A soft, porous, sheet material made from a mixture of fibres, and rendered as absorbent as possible. This material is principally used for transformers, but is also applicable to machine insulation. Its great absorbent property is secured at the expense of a comparatively low density and correspondingly decreased di-electric strength.

(2) A dense non-absorbent sheet material, of which the fibres are reduced to a semi-colloidal state, resulting in a product which is very hard and dense, possessing exceptionally high di-electric strength and capable of withstanding prolonged immersion in hot oil without loss of mechanical properties. It has been prepared from a mixture of fires containing a large percentage of jute. Owing to its ligno-cellulose character, however, jute has the characteristic property of becoming somewhat brittle at temperatures higher than about 100 deg. C. and, therefore, if required to meet more severe temperature conditions than this, it will probably be necessary at some manufacturing inconvenience to employ a cotton base to secure improved ageing properties.

The following table indicates the principal characteristics of these two types of materials, together with those of pressboard of ordinary quality, the test for comparative purposes having been made on 1/32 in. thickness of sheet:—

Quality.	Density	Breakdown voltage per mil in air after 1 minute's application.	Per cent. of water absorption after 24 hours.	Tensile str. in tons/sq. in.		Minimum radius bend without fracture after 24 hours in hot oil at 107 C.
				With grain.	Across grain.	
Soft absorbent ...	1·10	250	110	3·80	3·50	Folds flat.
Dense non-absorbent	1·43	518	44	5·20	3·80	3/32"
Ordinary grade ...	1·25	300	110	4·60	3·60	1/8"

Varnished Cloth.—Considerable progress has been made in the manufacture and in investigating the behaviour of this material under working conditions, particularly the well-known phenomenon of the very excessive reduction of the di-electric strength with increase in temperature, which is more marked in varnished cloth than in other Class A materials. Particular attention has been paid to the specially important point of dressing. Many large manufacturers claim that a dressing is essential to prevent varnish coming into close contact with the cotton fibres, as it is considered that such contact deteriorates the cloth. Another important consideration is the suitability of the varnishes used, or the resin content and the contents of driers. If the resin content is too high the cloth lacks flexibility; if too low, the varnish film lacks sufficient strength. The contents of driers is of supreme importance. For a varnish film to possess a high di-electric strength the varnish must be oxidised as completely as possible. Too low a content of driers causes poor di-electric strength. There is, however, an upper limit of drier content and if this is overstepped in the slightest degree bad "tendering" of the fabric results, which frequently does not reveal itself until several months after manufacture, and it can take place in a batched and wax-protected roll in the absence of air. It is thought that in the presence of excess driers unstable oxides are formed in the varnish film, and that these gradually decompose with the liberation of free oxygen, which causes the "tendering." In all cases where "tendering" results the di-electric strength of the varnish cloth is found to be exceptionally good. No knowledge has yet been gained as to the effect of such unstable oxides on the varnish film under actual working condition but it is quite possible that at a temperature of 100 deg. C. their decomposition would be accelerated, and that the film might be further oxidised either with the formation of an acid sticky mass, or possibly of a friable power. In any case there would be considerable mechanical weakening of the cloth which, coupled with the effects of vibration, might bring about a breakdown.

Synthetic Varnish Paper Boards and Tubes.—The general tendency is to curtail their use until their properties, particularly as regards absorption of moisture and low surface resistance, are more thoroughly understood. A great deal of investigation in this direction is in progress.

Moisture-proof Treatment of Windings.—In none of the materials employed in these processes has there been any marked improvement in recent years. While it is generally felt that Class A materials have nearly reached their physical limits of durability under the temperatures and conditions met with in practice, there is still much knowledge to be obtained which will correlate the results obtained in the laboratory with those of practical experience in service.

Turbo-Alternators and other Large Machines.—The tendency has been to employ materials of Class B. Some manufacturers do this to a limited extent in the case of stator windings, where the materials usually consist of combinations of mica with paper or cambric. The volume of mica ordinarily contained in a commercial grade of these materials may be as low as 25 per cent.; this proportion does not compare favourably with that of the insulation practicable on turbo-rotors. Mica paper tape and mica silk enable the application of a higher percentage of mica to be made.

No effective fire-proof treatment of stator insulation has yet been found. Turbo-rotor windings can be insulated almost entirely with hard-pressed micanite containing not less than 90 per cent. by volume of mica. The small quantity of Grade A insulation that has to be employed during the assembling of these windings can be disregarded. Further, in supporting the ends of the windings, an almost non-inflammable insulation, such as that prepared from asbestos and synthetic resin, can be used, thus rendering the whole of the insulation of the rotor extremely heat-resisting. Probably the most marked improvements in the insulation of this group of electrical machinery are secured through the closer technical control and supervision that is now exercised of insulation processes in the shops, and the more rigid selection of the insulation materials employed.

Transformers.—Materials of Class A are used extensively. There is a tendency now to employ pressboard of the very dense quality, which is very strong both di-electrically and mechanically at the highest temperatures met with in practice. Tests on a cylinder of this material after exposure to a temperature of 80 deg. C. for twenty hours and then to oil at a temperature of 90 deg. C. for two hours, yielded the following breakdown figures:—

Instantaneous breakdown ...	550 V per mil
Breakdown after 1 minute ...	445 V per mil
Breakdown after 5 minutes ...	400 V per mil

These results give a time voltage curve at this temperature of a very favourable character.

The correlation between laboratory tests on highly refined non-sludging oils and their behaviour in practice is not as yet very complete. It is possible that their use affords an unnecessary margin of safety in the case of certain types of transformers, and that somewhat cheaper oils would be satisfactory in transformers where there is a minimum amount

* See Elec. Rev., August 18th, 1922; p. 227.

of less copper exposed to the catalytic action, and where there is a minimum amount of surface exposed to the air.

Limitations of Tests on Short Experience.—While it is indisputable that the rating of electrical machinery must be based upon the temperature which insulation will withstand, it is becoming appreciated that only upon the results of practical experience with the operation of machines under known conditions and for long periods can an estimate as to the durability of insulation satisfactorily be drawn. There has been a tendency to attach too great importance to short-time investigations. The increasing tendency for power plant engineers to maintain careful records of temperature performances of their large generator and transformer units will eventually afford data of the utmost value and serve to confirm or amend present ideas as to correct temperature ratings.

Temperature Considerations.—The temperature limits now proposed for Class B materials, under the new methods of measurement, whilst apparently higher than the figures formerly recognised, do not actually imply higher internal temperatures than have existed in the past, or than the results of experience indicate as safe. In those cases where conditions permit the use of materials which withstand high temperatures, all features of design should be viewed in proper perspective, and full advantage taken of high temperature limits, if by doing so better all-round performance results.

In connection with the tendency on the part of British manufacturers to employ in transformers highly refined non-sludging oils, coupled with the use of dense fibrous materials which will withstand high temperatures without deformation or serious loss of insulating value, it is felt by some that the employment of oil conservators safely permits higher temperature limits both in the oil and windings than are permissible without the use of these devices.

Ratings based upon Temperature Rise.—In the case of industrial machines there is a strongly growing opinion among British engineers that in the rating of electrical machinery the decision of the International Electrotechnical Commission to establish a basis for comparing tenders by different countries, according to total temperature, was a mistaken policy, and that temperature rise affords a much more satisfactory means of securing this object. The combinations of insulation used, particularly on turbo-alternators and other large machines, differ considerably in the proportions of organic and inorganic materials that they contain and consequently also in their heat-resisting properties. It is felt that the present classification is unsatisfactory and should be revised, some differentiation being made in the limits set according to the quality and the position in which any particular type of material is used. For instance, the insulation that is possible for rotor windings throughout may be relatively of superior heat-resisting quality to that which is sometimes used on the slot portions of stator windings, which again is, in general, superior in this respect to the insulation on stator end windings.

A NEW TELEGRAPH SYSTEM.

Uninfluenced by Traction Currents.

At the recent 9th Congress of the International Railway Association at Rome a report was submitted regarding a new telegraph system for one-wire circuits with earth return which is claimed to be insensible to perturbation currents produced by induction from electric railways working on the a.c. system. This contribution to the solution of an old problem forms the subject of patents No. 139,241 (Great Britain), and No. 1,395,953 (U.S.A.), and has been utilised by the Administration of the Italian State Railways on the Turin-Torre Pellice-Berge three-phase, 16.7-cycle, 3,600-volt railway line where it has made it possible to retain unaltered, the one-wire external circuits even where they are mounted on posts placed on the railway track.

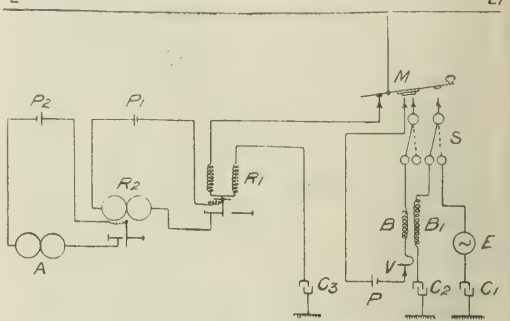
The system, which was devised by Messrs. Frattola, Castelli and Regnoni, officers of the said Administration in Rome, is based on the well-known principle of electric resonance. A Commission formed of officers of the Administration of the State Railways and the Ministry of Posts and Telegraphs has examined the installation and has ascertained, with satisfaction, its regular and practical working. The system is to be applied on some telegraph circuits of the Genoa-Spezia line, on which traction with three-phase current is shortly to be introduced; its application has also been decided upon for circuits on the Rome-Formia branch of the [illegible] line, which is also to be electrified with three-phase current; other installations have been taken up for study.

For transmission an alternating current of a relatively high frequency as compared with that of the perturbation currents is used, while for receiving purposes a device is employed which is in electric resonance with the frequency of the transmission current, so as to be able to work regularly only with the latter current and to be insensible to the perturbation currents. Such a device may consist, in its simplest form, of an inductance and a condenser in series.

In practice the transmission current may be obtained in various ways; for example, from an alternator controlled by a small electric motor which is fed by accumulators or by the local network for the distribution of electricity, or from an ordinary induction coil of the vibrator type. Where industrial current, for instance of from 42 to 50 periods, is available, it may be used directly after a duplication or triplication of the frequency by means of static transformers of the saturated-iron type, such as the Vallauri doubler and the Spinelli triplicator.

In the installation in question this latter apparatus has been adopted, by means of which the three-phase current of 42 and 50 periods is transformed into one-phase current of 126 and 150 periods; as a reserve generator each telegraph station has an induction coil with a spring vibrator fed by a battery of from two to four accumulators.

For receiving purposes the scheme shown diagrammatically in fig. 1 has been chosen, in which M is an ordinary Morse key with five clamps. By depressing this key the receiving



L L_1, line; M, double Morse key; S, two-lever switch; B B_1, induction coil; V, vibrator; P_2, P_1, accumulators; C_3, C_2, C_1, condensers; E, Spinelli transformer; R_2, polarised relay; R_1, ordinary relay; A, Morse apparatus.

Fig. 1.—Receiver Circuit Diagram.

device is separated from the line and alternating current is sent to it by a Spinelli triplicator E or by an auxiliary induction coil B B_1. When the key is at rest the transmitting device is insulated from the line, which instead communicates with the receiving device, which consists of a polarised relay R_1 whose armature vibrates so as to render intermittent a contact which closes the circuit of the cell P_1. This increases its resistance and thus diminishes the current supplied by the cell P_1. The relay R_2 now sets free its armature, which will then close a second circuit, which comprises the writer A. The receiving apparatus may be simplified by using the polarised relay as a sounder.

The "General Direction" of the Italian State Railways caused a series of experiments to be made with the above apparatus in order to ascertain its efficiency on the Torino-Pinerolo line (the first electrified track of the Torino-Torre Pellice-Berge line) on which the telegraphic circuits were exposed to inductive electromotive forces of considerable duration and higher than 100 volts and with maximum points up to 258 volts. With these strong induced voltages the apparatus assured clear and undisturbed communication, while with ordinary apparatus inserted in the same one-wire circuit an uninterrupted trembling of the armature of the writing device occurred, which rendered transmission quite impossible.

The conclusions arrived at after these experiments may be summed up as follows: (1) the system allows regular working of ordinary Morse apparatus on one-wire circuits exposed to perturbations; (2) the attenuation which the use of alternating currents inevitably implies as regards the distance of the transmission can practically have no importance within the limits of the ordinary lengths of circuits for railway service; (3) the perturbations produced in turn by the alternating-current telegraph system on the neighbouring and parallel telegraphic circuits have no influence on the working of the Morse apparatus; (4) the perturbations produced on neighbouring and parallel double-wire, telephone lines are, in the cases observed, of the same order as those produced by other telegraphic circuits when a generator of the coil type is employed; they are quite insensible when a current generator with a smooth wave is employed. The system might also be applied to telegraphic circuits worked by the aid of high-speed apparatus, such as the Hughes apparatus, by employing suitable transmission frequencies.

The installation on the Torino-Torre Pellice-Barge line comprises 35 telegraphic groups, with as many a.c. receiving apparatus, divided between 16 stations. The apparatus was constructed by the Società Anonima Arco, of Rome, and the Spinelli triplicators by the Società Officine per costruzioni elettriche già Biascà, of Milan. The latter have a power of 100 watts and three tappings on the secondary for voltages of 70, 110 and 150 volts. In all the circuits a pressure of 110 V is used, and at the stations of Piscina, Bibiana and Campiglione, where electric energy is not available, the induction coil is used for transmission; in the stations

between Turin and Airasca the Spinelli triplicator is fed with three-phase current at 50 periods, and generates single-phase current at 150 periods; beyond Airasca the Spinelli apparatus is fed with three-phase currents at 42 periods and generates monophase current at 126 periods. In this way different circuits are working, without its being necessary to regulate the apparatus, with two transmission frequencies and sometimes even with three frequencies; when in some stations the current supplied by the Spinelli transformers fails, the service is carried on with the reserve induction coil.

No modification is made in the external circuits fed and with an ordinary wire of galvanised iron of 4 mm. [illegible] the installation was put into use in November, 1921, and from this period onward it has continued to work in a satisfactory way. Also during periods of heavy electrical [illegible] contacts and breakages of the wires, the telegraphic service was not interrupted. As the telegraphic groups are connected in shunt on the wires of the line, each interrupted branch formed a circuit for itself, and two or more circuits with the wires in contact formed one single circuit.

THE ELECTRICITY (SUPPLY) ACT, 1922.

THE following is a summary of the principal clauses of the Act, which became law on August 4th:—

Section 1.—*Power of authorities to borrow.*—Subject to the consent of the Electricity Commissioners, a joint electricity authority may borrow money for the purchase of any generating station or main transmission line, or of any undertaking, transferred under the Act of 1919, or for the purpose of any work the cost of which is spread over a term of years (including the payment of interest on borrowed capital, up to five years), or for working capital. Such moneys may be charged on the undertaking and revenues of the authority, and must be repaid within 60 years. A limit is to be set on the borrowing power of the authority by the scheme constituting such authority.

Section 2.—*Sinking fund for new works.*—The sinking fund may be suspended for not more than five years.

Section 3.—*Power to authorise issue of stock.* The Electricity Commissioners may authorise an authority to issue stock charged on the undertaking and revenues of the authority.

Section 4.—*Power to discharge purchase price by issue of stock.*—An authority may discharge part or the whole of the purchase price, with the consent of the authorised undertakers concerned, by the issue of stock to the latter.

Section 5.—*Power of undertakers to give financial assistance.*—Any authorised undertakers whose area of supply is wholly or partly within the district of a joint electricity authority, any local authority, company or person supplied with electricity by the authority, and the Council of any municipality having a population of 50,000 or more, wholly or partly within the district, may lend money to the authority, subscribe for securities, or guarantee the payment of interest on loans, subject in the case of municipal bodies to the consent of the Minister of Health, and to prescribed limits to the liability undertaken. For the above purpose local authorities may raise loans in accordance with the relevant statutes, and any company or association may use its funds or raise loans, notwithstanding anything contained in its constitution. A scheme constituting a joint electricity authority or other body may authorise or require authorised undertakers, or authorise companies and other bodies represented on the authority, to contribute towards the administrative expenses of the authority. Any authorised undertakers may exercise such powers notwithstanding the provisions of the Electric Lighting (Clauses) Act, 1899, incorporated in their orders or special Acts.

Section 6.—*Power of authorised undertakers to lease undertaking to joint electricity authority.*—Any authorised undertakers may lease to a joint electricity authority the whole or any part of their undertaking, subject to the approval of the Electricity Commissioners, on terms agreed upon between the parties.

Section 7.—*Expenses of Electricity Commissioners.*—The period of two years mentioned in section 29 of the Act of 1919 is extended to March 31st, 1922, and advances made to the Commissioners must be repaid with interest before March 31st, 1925. The Electricity Commissioners may, during the financial year now current, apportion the excess of expenses over receipts among the joint electricity authorities and authorised undertakers of Great Britain in accordance with the units generated or purchased by each in 1921; subsequent apportionments must be made on the basis of the number of units actually sold by each authority or undertaker, less those sold in bulk to authorised undertakers. Returns must be furnished to the Commissioners by March 1st in each year.

Section 8.—*Method of payment of purchase price payable to local authorities.*—Payment to a local authority for transfer may be made by terminable annuities, a capital sum, or other form of payment approved by the Commissioners.

Section 9.—*Use of main transmission lines by agreement.*—A joint electricity authority may use transmission lines on terms agreed upon by the owners.

Section 10.—*Disposal of stations and works not required.*—A joint electricity authority may dispose of surplus plant, &c., subject to the safeguarding of existing rights of ownership.

Section 11.—*Power to continue wayleaves.*—Wayleaves for electric lines may be continued after the termination of existing agreements unless the owner or occupier of land involved objects, in which case the provisions of the Act of 1919 must be complied with; the joint electricity authority or authorised undertakers using such a line may at any time apply to the Minister of Transport for a revision of the terms of the agreement, in which event the case shall be treated as that of a new line.

Section 12.—*Power to make agreements as to working of generating stations.*—Where a station or line is transferred to a joint electricity authority, the authority may agree with the former owner that he shall work and maintain it on behalf of the authority.

Section 13.—*Conditions under which restriction on generating stations and obligation to take supply from are not to apply.*—The Electricity Commissioners are not to refuse consent to the establishment of a new, or the extension of an existing, generating station by an authorised undertaker, nor shall they require authorised undertakers to take a supply of electricity from a specified source if the undertakers can give an adequate supply to meet present and prospective demands at a cost not greater than would result if they obtained a supply from a source designated by the Electricity Commissioners unless the Commissioners determine that such refusal or requirement is necessary in the interest of the general supply of electricity in the district.

Section 14.—*Suspension of powers of purchase of undertakings.*—The Commissioners, with the consent of the authorities in whom the powers are vested, may by an order establishing a joint electricity authority or a special order suspend powers relating to the purchase of any undertaking or part thereof; in such a case they may make provision as to the relation between the prices which may be charged for electricity and the dividends to be paid by the undertakers.

Section 15.—*Mode of exercise of powers by authorities.*—The powers and duties as to the generation and supply of electricity conferred upon joint electricity authorities may be exercised by the authorities or, if so authorised by the order establishing that authority or by special order, through any authorised undertakers.

Section 16.—*Limitation on powers of joint electricity authorities in areas of power companies.*—A joint electricity authority is not to supply electricity in any part of the area of supply of a power company without the consent of the company, unless the latter is not willing and able to supply electricity under contract ensuring an adequate return, in which case the Electricity Commissioners may authorise a joint electricity authority to supply in the part of the company's area concerned, without the consent of the company, by special order.

Section 17.—*Special provisions as to power companies.*—On or after establishing a joint electricity authority, the Electricity Commissioners may exclude from the area of supply of any power company, any part of that area in which any right of the company to supply electricity is subject to the absolute veto of some other authorised undertaker, and where the generating station supplying that part is transferred to the joint electricity authority, any part which at the time of the local inquiry is not being supplied by the power company; and with the consent of the power company, any other part of the company's area; and in any such case they may empower the company to supply electricity for all purposes in any other part of its area not forming part of the area of supply of any authorised distributors. If objection is taken, the procedure is to be by a Special Order under section 26 of the Act of 1919. The rights of the power company to lay mains through such excluded areas, and to supply electricity for traction, are preserved.

Section 18.—*Limitations on prices charged.* The prices charged for electricity by a joint electricity authority are to be such that, over a term of years, the receipts shall cover the expenditure, with such margin as the Electricity Commissioners allow. A deficit, unless provided for out of a reserve fund, may be apportioned amongst the authorised undertakers who take a supply of electricity from the authority in proportion to the amount supplied to each, or may be made good out of the revenue of succeeding years.

Section 19.—*Amendment of section 5 of the Act of 1919.*—

Section 20.—*Amendment of section 6 of the Act of 1919.*—The representation on a joint electricity authority of persons employed in connection with the supply of electricity within

the electricity district is made permissible, and the provisions of the scheme may include determination of the conditions of employment of persons employed by the authority.

Section 21.—*Amendment of section 16 of the Act of 1919.*—The provision for compensation of employés displaced is extended to include consequential circumstances, the Electricity Commissioners to decide whether the circumstances are consequential. The Minister of Labour may make rules as to the procedure before the referees, for limiting the amount of costs, for fixing the fees payable to the referees, and for determining by whom they shall be paid.

Section 22.—*Methods of charging and revision of prices.*—The method of charging prescribed by the Electric Lighting (Clauses) Act, 1899, is repealed. The ordinary period of revision of maximum prices is made three years, and the provisions as to revision are extended to local authorities and to undertakers not otherwise included. The benefit derived by undertakers from the establishment of a joint electricity authority is to be taken into account in revising the charges. Undertakers who have already obtained an Order varying the charges may apply for revision though the period of three years has not expired. Section 10 of the Electric Lighting Act, 1909, is repealed.

Section 23.—*Stand-by supplies of electricity.*—Persons requiring a stand-by supply must pay the undertakers such minimum annual sum as represents a reasonable return on the capital expenditure and will cover other standing charges incurred in providing for the possible maximum demand, the amount to be determined in default of agreement by arbitration. Section 15 of the Electric Lighting Act, 1909, is repealed.

Section 24.—*Provision as to railways.*—Electricity supplied by a joint electricity authority or power company for traction or docks and harbours may be used by the recipient on any part of his system.

Section 25.—*Power of persons not being undertakers to supply electricity.*—Persons generating electricity for traction under statutory powers may supply electricity to a joint electricity authority, an authorised undertaker, or any consumer (subject to the consent of an authorised undertaker entitled to supply such consumer) provided that the consent of the Electricity Commissioners is obtained, who may impose conditions, and that supply shall not be given to authorised distributors within the area of a power company without the consent of that company, or to any premises within the district of a joint electricity authority but not within the area of any other authorised undertakers without the consent of that authority, and provided also that the rights of the owners or lessees of traction power stations are not interfered with. The Electricity Commissioners may authorise the breaking-up of roads, railways and tramways where necessary for the purpose of such a supply. The rights of the Postmaster-General under existing Acts are to be preserved.

Section 26.—*Provision for payment-off of debentures in certain cases.*—Where the generating station of a company is acquired by a joint electricity authority, provision is made for the payment-off of debentures charged upon it out of the proceeds of the sale; the cost incurred in obtaining and carrying out the scheme for payment to be borne by the authority.

Section 27.—*Winding-up of companies.*—After the whole undertaking of any company incorporated by Act of Parliament is transferred to a joint electricity authority, the company may be wound up as though registered under the Companies Acts.

Section 28.—*Expenses of London County Council.*

Section 29.—*Extension of period for repayment of money borrowed by Scottish local authorities.*—A period not exceeding 60 years to be substituted for 30 years for repayment of money borrowed after the passing of this Act, for electricity supply.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Spark Tester and Fuse-Wire Case.

The Humphrey Electrical Co., 21, Broad Quay, Bristol, has sent us samples of two useful devices. The first is a little appliance for cleaning and testing sparking plugs. It is in the form of a vulcanite pencil with a sliding interior. When the inner portion is moved two wires project and one of these is applied to the plug while the other is earthed. By the same movement a brush projects from the other end.

The second device is a small folding leather case in which are contained two coils of fuse wire—very convenient things to possess. The firm is supplying these with gold-blocked lettering as advertising media.

The "Baker" Lamp Shade.

A simple and inexpensive, but at the same time artistic, lamp shade, has recently been placed on the market by Messrs. Stanley H. Baker, Ltd., 5, Back Balloon Street, Manchester. It is made in two forms, circular and pentagonal, and consists of a shaped, flat piece of special parchment, bearing effective designs, which can be bent to take up its shape and fixed by means of tabs. It is fitted on to

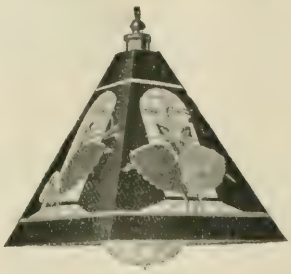


Fig. 1.—The "Baker" Lamp Shade.

a circular or pentagonal piece of cardboard which is placed over the lampholder. The material is treated to render it fireproof, and the colouring is such as to serve for a very long period without fading or changing. A typical design is illustrated in fig. 1.

The "Electrico" Photographic Plate Drier.

Electrico, Ltd., 105, Old Christchurch Road, Bournemouth, has recently placed on the market a cabinet for drying photographic plates and films (fig. 2). This is a rectangular box with a folding stand for eight plates. The box is mounted

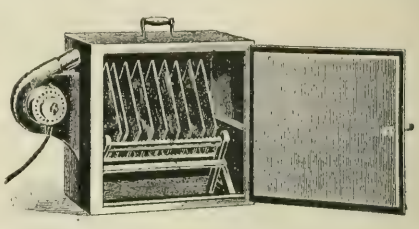


Fig. 2.—The "Electrico" Photographic Plate Drier.

on small feet and the bottom is perforated. In the top is a flat chamber with perforations in its lower portion. Fixed to the side is a small motor-driven blower with a heating element in its outlet. The discharge from this is led into the above-mentioned flat chamber, providing heated air, which will dry the plates thoroughly in ten minutes.

Electrically-heated Shaving Outfit.

The shaving outfit illustrated in fig. 3 possesses the feature of novelty. It consists of the usual appliances—a safety razor, brush, shaving stick, spare blades, and a mirror, but in the bottom of the case is fitted a heating element, and the water

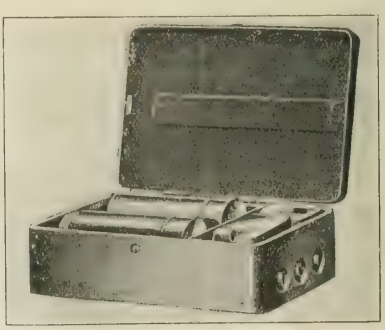


Fig. 3.—An Electrically-heated Shaving Outfit.

being placed in an inner shell, is soon brought to the right temperature for use. As the illustration shows, there are three terminals, making the appliance suitable for 110-150-V. or 200-220-V circuits. The device is made by Electrico, Ltd.

A Hand Vacuum Cleaner.

The Wayne Machinery Co., Fort Wayne, Ind., U.S.A., is marketing a new device described as a hand electric vacuum cleaner and motor-driven brush. This machine (fig. 4) is equipped with a standard type brush, driven by a 110-V universal current motor. The manufacturers state that the

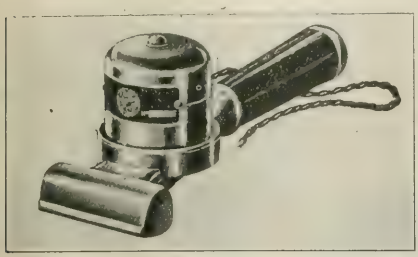


Fig. 4.—A Hand Vacuum Cleaner.

motor will operate on 220-V direct-current in series with a 60-watt lamp, and at any frequency. The discharge is into a dust bag inside the handle. This bag may be cleared by removing the cap on the end of the handle, when, with the motor running, all cleanings are blown outside. An auxiliary dust bag is included as a regular equipment to be employed where it is desired to clean for a long time without emptying. —*Electrical News* (Toronto).

The "Maco" Adjustable Template.

Mr. E. James Brown, the inventor of the "Maco" adjustable template, described in our issue of July 21st, has developed a form of the device suitable for obtaining the profiles of track rails. This consists of two templates mounted in a frame. One of these is fixed, while the other is free to move along the frame, being operated by a hand screw. In use, the movable template is taken out and the frame is put over and under the rail, with the fixed template pressed against one side. The movable part is then replaced, and by

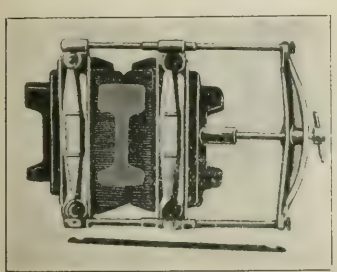


Fig. 5.—"Maco" Rail Profile Templates.

screwing it down the innumerable reeds in each template are forced to take up positions corresponding to the shape of the rail, as shown in fig. 5. Then the movable part can again be withdrawn and the frame slipped off the rail. When the sliding template has been replaced an outline of the rail's shape can be obtained by means of pencil and paper, or a piece of sensitised paper can be placed behind the gap, when the profile will be obtained photographically.

A New Electric Locomotive.—Britain's first high-speed electric railway engine, with a safe maximum speed of ninety miles an hour, and capable of maintaining an average of more than a mile a minute on a long journey, has been delivered to the North-Eastern Railway. The new locomotive, which was referred to in Sir V. Raven's papers in our issues of December 30th, 1921, January 6th, and August 25th, 1922, was made by the Metropolitan Vickers Electric Company at Trafford Park, Manchester. It will be used, says the *Daily Express*, on the forty-four miles run between York and Darlington, and later for hauling the famous "Flying Scotsman" between York and Newcastle. The new engine, which develops 1,800 horse-power, can maintain high speeds with a load of 450 tons.

FERGUSON-PAILIN ARMOURCLAD SWITCHGEAR.

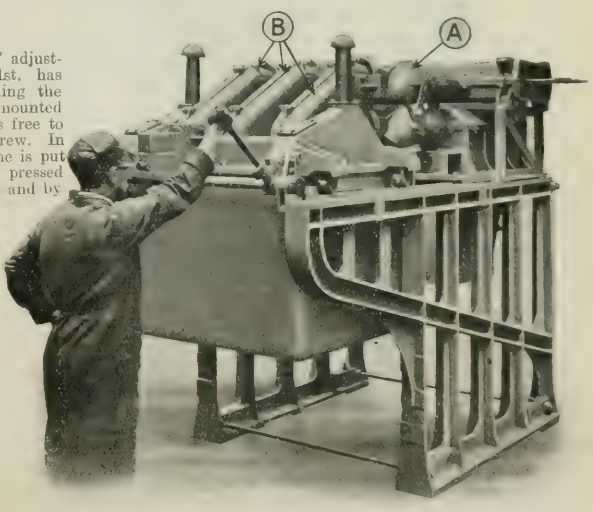
Armourclad switchgear of the totally-enclosed compartmented type, equipped with three-phase draw-out circuit breakers of 500,000 kVA capacity, has been developed by Messrs. Ferguson, Pailin, Ltd., Manchester, for central station and sub-station use. The basic principle has caused the designers to state that all "live" apparatus and conductors are embedded in compound or immersed in oil, thus rendering the gear completely self-contained and entirely independent of housing accommodation.

Complete freedom in choice of position is permitted with this switchgear. No brick or concrete cells are required. Valuable floor space may be saved, and building costs eliminated. In fact, being dirt and vermin proof, and capable of resisting bad atmospheric effects, armourclad switchgear is equally suitable for indoor or outdoor use. As compared, therefore, with the usual open-type gear, considerable installation costs may be eliminated, which more than compensate for the slightly increased cost of the gear itself.

An oil-immersed circuit breaker, when interrupting large fault currents, is liable to eject oil vapour of a semi-conducting character. With open-type switchgear this is very likely to cause serious trouble, but with completely enclosed armourclad switchgear such trouble cannot arise.

The only safeguard that can be introduced against electrical surges is the complete enclosure of all conductors, as in armourclad-type switchgear, which is practically immune from danger from this cause.

Armourclad switchgear is built on the sectional principle, enabling single sections to be used when desired, or a multiple switchboard to be built up to any requirements.



A, Shields over stationary diver contacts; B, armoured moving contacts.

Fig. 1.—Front View.

Each section comprises two main portions: a fixed portion containing the bus bars, cable terminal boxes and oil-immersed instrument transformers, and a movable portion consisting of a carriage-type oil-immersed circuit breaker. When the circuit-breaker carriage is completely drawn out the circuit breaker is isolated and the live contacts on the fixed portion are automatically screened, as shown at A, fig. 1.

Two massive cast-iron brackets form the main structural frame supporting the whole of the equipment. The wide upper surfaces of these main brackets are machined, to form beds for the rails on which ride the rollers of the circuit-breaker carriage. Substantial racking gear is provided to ensure easy movement of the carriage.

The bus bars, which are enclosed in a cast-iron chamber and adequately supported in moulded insulators, are jig-set in position, together with the connections to the isolating plugs; the whole of the space is then filled in with insulating compound of high dielectric strength and high flow point.

In the design special attention has been devoted to the proportioning of the various parts so as to obtain the maximum breaking capacity within given dimensions.

The circuit breaker is built up on a solid steel plate. This supports a tank of welded steel boiler plate, fully capable of withstanding the stresses imposed upon it. A [illegible] joint between the tank and the top plate prevents the escape of oil under operating conditions.

Three hood castings contain the projecting insulators sup-

porting the main pole assemblies, which engage with the pegs in the transformer oil tank chambers. These hoods are separate units fixed to the top plate and filled with insulating compound.

The circuit breaker is of very massive proportions, rendering it eminently capable of withstanding the enormous stresses which occur when interrupting short circuits on systems of large plant capacity. The breaker can be controlled by hand, directly or remotely, or can be electrically operated by a simple electrical solenoid device.

The moving contacts consist of heavy vee-shaped high-conductivity copper bars, the apex of the vee being upwards

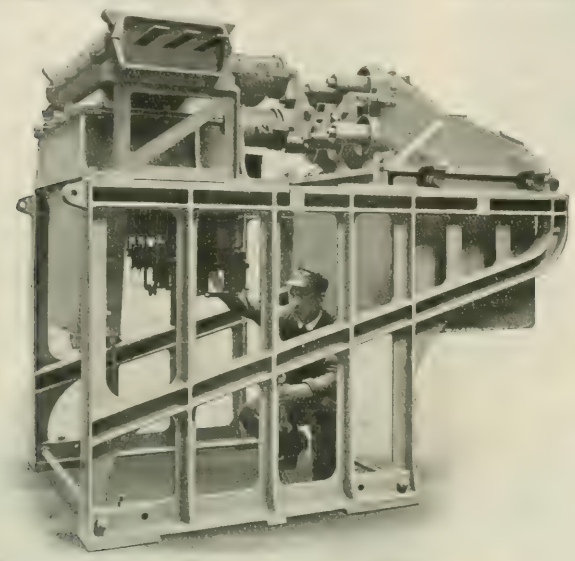


Fig. 2.—Ferguson, Pailin Switchgear.—Side View.

The fixed contacts are of copper loosely supported on the extremities of flat steel springs screwed on to either side of a heavy copper block, into which a substantial hard-drawn stem is screwed and sweated. The current is conveyed from the contacts to the block by means of flexible copper strips.

In closing the switch the apex of the vee-shaped moving contact enters between the contacts, forcing them apart; the contacts, being loosely supported by the springs, are free to align themselves accurately on the contact bar.

Each set of contacts is a unit, the number employed varying according to the current-carrying capacity of the circuit breaker, thus considerably reducing the number of spares required.

The contact fingers form parallel paths carrying currents in the same direction, the electromagnetic forces thereby tending to attract the contacts to each other. This increases the pressure on the moving contact and enables the breaker to pass very much larger transient currents without deformation of contacts.

A detailed technical description of this switchgear is given in a catalogues, section 171 A1, recently issued by Messrs. Ferguson, Pailin, Ltd.

The examples illustrated in figs. 1 and 2 are equipped with breakers rated at a breaking capacity of 500,000 kVA, and are designed for a current of 400 amperes at 44,000 volts, or 1,500 amperes at 22,000 volts.

Exide Wireless Batteries.—The prime necessity in a battery for use with a wireless set is the ability to hold the charge over long periods. It is claimed that Exide batteries do this, and the following particulars may be of interest as showing what can be done in this connection.

In June, 1911, a small 10-ampere-hour 2-volt accumulator in a celluloid box was returned by a customer to the London office of the Chloride Electrical Storage Co., Ltd. This accumulator remained undisturbed on a shelf until September, 1912, when it was found in good condition, but almost without acid. It was refilled and recharged and has been standing on open circuit ever since, receiving a freshening charge about once a year. In February, 1919, it gave 10 ampere-hours at the ½-ampere discharge rate; in February, 1920, it gave 17 ampere-hours at the 1-ampere discharge rate, and in 1922, it gave 10 ampere-hours, so that after remaining for 11 years on open circuit it now gives 70 per cent. more than its listed capacity.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Lightning Conductors of the County Hall.

With reference to Mr. Killingworth Hedges's letter in your issue of August 25th, 1922, I would like to point out that the impression conveyed in the last paragraph of his letter is not correct.

The National Physical Laboratory did not specify the method which has been adopted. The true facts are as follows: A scheme, with estimate, was submitted by the Electrical Department to the Chief Engineer of the Council, which embodied connections to the steel framework only. The data for this scheme were obtained by conducting a series of tests for conductivity resistance to earth between the highest points of the steel framework and the River Thames. The Chief Engineer recognising that it was a question for expert opinion and confirmation recommended that the Council ought to obtain the services of the N.P.L. or such like authority. After the services of the N.P.L. had been obtained, no tests or the like being made by them, a report was received, based on existing textbooks, &c., which recommended the use of "Down Tapes" and "Earths" outside the building and deprecated the use of the steelwork as the conductor system on account of an assumed "condenser effect."

The actual system fitted involves the use of the "steelwork frame" and down tapes, both "earthed" to the water-mains. Subsequently, as time and circumstances permit, river earths may be also fitted.

It is a peculiar fact, in view of Mr. Killingworth Hedges's remarks, that no particulars could be traced when the original tests were made of any building having been previously fitted in the manner which was recommended at the first onset.

Spark.

Westminster, *August 28th*, 1922.

Making Hay the Electric Way.

To those who have been privileged to see the operations on Mr. Borlase Matthews's farm, it is a pleasure to read your article under the above title; but, as the basis of "electro-farming," a sphere of great interest to electrical engineers, must be mainly cost, I venture to ask you to establish the power costs for hay making.

You state: "At 1d. per unit this amounts to 2s. 10d. for the stack, or 1.3 units per ton of cured hay," and further on "The cost of the electric power for drying the hay.....is under 2s. 3d. per ton for power." Which of these figures is the correct approximation?

A fact that appeals to me, but which is not remarked on in your article, is that in the Borlase Matthews method approximately 100 per cent. of the grass mown is converted into sound hay, whatever may be the condition of the weather.

Justus Eck.

Lyndhurst, *August 26th*, 1922.

[Both figures are correct: the 2s. 3d. per ton was obtained in the earlier experiments, and the 1.3 units per ton was the result of the final work and will be the basis of future operations.—Eds. Elec. Rev.]

Import Duties on Machinery for Argentina.—The Government of Argentina is making a determined effort to get a number of secondary industries started in the Republic, and with the view of encouraging capitalists to invest in such enterprises as oil production and refining, cotton ginning, jute manufacture, and so on, will ask Congress either to abolish altogether the import duties on machinery and plant for such purposes, or reduce the duties to a negligible minimum. Pending authority from Congress, the Minister of Finance is now accepting from importers their written guarantee to pay the duties if called upon to do so; meanwhile their machinery is admitted duty free. The Government proposal before Congress is that all machinery, plant and tools imported for use in certain new industries shall be duty free, while raw material from abroad, for local manufacture, shall pay only 5 per cent.—*Reuter's Trade Service* (Buenos Ayres).

BUSINESS NOTES.

Bankruptcy Proceedings.—J. E. Rollinson, electrical engineer and contractor, 5, Tavistock Chambers, Beastmarket Hill, Nottingham.—Trustee, Mr. H. F. Holloway, Bentinck Buildings, Wheeler Gate, Nottingham, appointed August 23rd.

W. Hill, seedsman and electrician, 3a, Leigh Road, Leigh, Lancs.—First and final dividend of 2s. 9¾d. in the £, payable September 4th at the Official Receiver's offices, Byrom Street, Manchester.

W. H. Borrows, engineer and electrician, Werrington, Northampton.—First meeting September 5th, at the Official Receiver's office, 5, Petty Cury, Cambridge; public examination, September 22nd, at the Law Courts, Peterborough.

F. A. Watkins, electrical engineer, 57, High Street, Hythe.—Trustee: Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., appointed August 26th.

B. T. Dale, electrical engineer, Erick Street, Newcastle-on-Tyne.—Last day for proofs for dividend September 16th. Trustee: Mr. W. Brittain, 4, Northumberland Street, Newcastle-on-Tyne.

T. Scott & J. Campbell (T. Scott & Co.), wholesale electrical suppliers, 42, Handyside's Arcade, Percy Street, Newcastle-on-Tyne.—Last day for proofs for dividend, September 16th. Trustee: Mr. W. Brittain, 4, Northumberland Street, Newcastle-on-Tyne.

Company Liquidations.—British Railway and Tramway Interchangeable Rail Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. A. Hitchins, 16, Waterloo Street, Birmingham.

Eclipse Carborundum and Electrite Co., Ltd.—A meeting of members is called for September 29th at 62, New Broad Street, E.C., to hear an account of the winding-up from the liquidator, Mr. G. Lord.

Fuller's United Electric Works, Ltd.—A petition for the winding-up has been presented to the High Court by Messrs. W. S. Caines, Ltd., of Andover House, The Broadway, Plaistow, Essex. Creditors of the company will be heard in London on October 17th.

Solectric Co., Ltd.—Particulars of claims to be sent to the liquidator, Mr. F. N. Clarke, 4, Pavilion Buildings, Brighton, by September 30th.

Dissolutions of Partnership.—Holmes & Co., ironmongers, mill furnishers, and electrical engineers, 181, Manchester Road, Mossley.—Messrs. J. H. & C. E. Holmes have dissolved partnership. Debts will be attended to by Mr. J. H. Holmes, who will continue the business.

Star Delta Wireless Supply Co., wireless specialists, 333a, Oxford Road, Manchester.—Mr. J. Griffin and Mr. J. O. Nichol have dissolved partnership. Mr. Griffin will attend to debts.

Trade Announcements.—The Advance Machinery Co., Higher York Street Works, C.-on-M., Manchester, has increased its automatic plant for the manufacture of terminals and turned washers suitable for the wireless and general electrical trade.

The Consolidated Pneumatic Tool Co., Ltd., of 170, Piccadilly, London, W., has been appointed sole selling agent for the British Empire and the Continent of Europe for the Duff Manufacturing Co., makers of the Duff Genuine Barrett and Duff lifting jacks, and the Duff Dunn patent trench braces.

Messrs. J. S. Peckham & Co., 405, New Compton Street, W.C.2, have been appointed sole agents for the British Isles and Dominions of the following Swedish firms: Elektriska Aktiebolaget Eck (motors, generators, switchgear, &c.); Jonkopings Mekaniska Werkstads A.B. (turbines up to 8,000 kW); and Aktiebolaget Pumpindustri (motor-driven pumps).

The Midland Electric Manufacturing Co., Ltd., has appointed Messrs. Campbell, Gardner & Co., of 44, Upper Arthur Street, Belfast, as its agents for Belfast and the north of Ireland. A stock of the full range of "M. E. M." switch- and fuse-gear will be kept at this address.

The Sevenoaks and District Electricity Co., Ltd., has now opened a showroom at Oxted, and will be pleased to hear from manufacturers prepared to lend apparatus for show purposes.

Mr. Edgar W. Dorey, Norwich House, Southampton Street, High Holborn, W.C.1, has been appointed sole agent for the United Kingdom for the Anglo-Belgian Co., Ltd., makers of semi-Diesel crude oil engines.

Catalogues and Lists.—Dugdill's Patents, Hazel Grove, Stockport.—A mailing card, illustrating numerous electric light fittings, telephone extension arms, &c.

Messrs. William Patterson, Ltd., Walker Gate, Newcastle-upon-Tyne.—A price sheet giving particulars of "Matchless" self-lubricating dynamo and other types of brushes.

Engineering Supplies, Ltd., 155a, Upper Thames Street, E.C.4.—A net trade price list of cables and wires of many types.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Folder No. K2,767, giving illustrations and prices of private telephones for domestic and office use. Leaflet No. K2,768, dealing with G.E.C. "Auto-reset" intercommunication telephones.

The Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—Three illustrated and priced lists dealing respectively with "Revo" electric fires, lighting, and general accessories, and small switch and fuse gear.

Messrs. C. E. Lugard & Co., Ashover, near Chesterfield.—An illustrated booklet describing the "Vulcan" electromagnetic clutch drive for machine tools; a description of an instrument for measuring the speed of cuts by means of a motor shunt current also appears.

The Record Electrical Co., Ltd., Broadheath, Manchester.—An illustrated and priced catalogue giving full details of electrical measuring instruments of numerous types, circuit breakers, automatic cut-outs for charging purposes, &c.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publication No. 238, an illustrated card giving instructions for the use of "Magnavox" loud speakers and amplifiers.

Electro-Dynamic Construction Co., Ltd., 4, New Cross Road, S.E.4.—An illustrated pamphlet dealing with electric arc welding plant.

Measurement, Ltd., 34-38, Provost Street, City Road, N.1.—List D, illustrating and describing a d.c. mercury motor ampere-hour meter for house service.

British Insulated & Helsby Cables, Ltd., Prescot, Lancs.—Publication No. P.175, describing the application of Dickinson's patent cover to joint boxes.

For Sale.—By direction of the Disposal Board, Messrs. G. N. Dixon & Co. will sell by auction on September 26th and following days at H.M. Factory, Queensferry, plant and machinery, including electric motors, transformers, cables, &c.

Bristol Corporation Electricity Department has for disposal one surface condenser, 1,460 tubes, complete with valves, &c.

Messrs. Edge & Burt, liquidators of Messrs. H. Alday and Son, Ltd., manufactureres of metalware for the electrical trades, &c., of Connaught Works, Holdford Road, Witton, Birmingham, invite offers for the business, plant, stock, and premises as a going concern.

Messrs. Goddard & Smith will sell by auction on September 4th, at Seymour Place, Bryanston Square, W., lead-covered and armoured cable, &c.

Todmorden B.C. has for disposal one 150-kW Bruce Peebles generating set, condensing plant, pump, tanks, &c. (See our advertisement pages to-day.)

Shortage of Iron in Germany.—According to the *Deutsche Bergwerks Zeitung* of August 18th, forwarded to the Department of Overseas Trade by the Commercial Secretary at Cologne, the iron shortage is taking more and more alarming proportions. Consumers are complaining that there is hardly any material to be obtained, as the works are still occupied for months ahead with the execution of orders received during the last few months. Where new orders are taken, four to six months' delivery is required.

German Price Increases.—The Commercial Secretary at Cologne informs the Department of Overseas Trade that the Central Union of the German electrotechnical industry has decided to increase prices, with effect as from August 11th by an average of 40 per cent.

The A.E.G. in Holland.—It is reported from Amsterdam that the Berlin A.E.G. has formed the Elektricitats Mij-A.E.G. in Amsterdam, with a paid capital of 200,000 florins, to promote the interests of the German company in Holland.

Price of Electrolytic Copper in Germany.—According to the *Boersen Courier*, the Association for German Electrolytic Copper has fixed the electrolytic copper quotation to-day at 40,306 marks per 100 kg. *Reuter's Trade Service* (Berlin, August 19th).

Annual Outing.—A section of the staff and employés of the South Shields Electricity Department held their first annual excursion on August 23rd, accompanied by the chairman (Ald. J. W. Henderson, J.P.) and the vice-chairman (Councillor J. Wilson) of the Electricity Committee, together with the borough electrical engineer (Mr. James Edgar). Leaving South Shields in one of the Tramway Department's saloon motor buses, the party journeyed to Wooler, where dinner was provided at the Temperance Hotel. After spending a short time in Wooler, the party proceeded to Alnwick. A tour round this ancient and historical town was followed by tea at the White Swan Hotel. Favoured by good weather, a most enjoyable day was spent, the party arriving back at South Shields about 10 p.m. A second section will carry out a similar programme on September 6th.

Copper and Lead Prices.—Messrs. F. Smith & Co. report August 29th: Copper (electrolytic) bars, £70 5l; do. do. sheets, no change; do. do. wire rods, £72 4l; do. do. h.c. wire, 10½d., ½d. decrease.

Messrs. James & Shakespeare report August 30th: Copper bars (best selected), sheet and rod, no change; English pig lead, £25 10s., 10s. decrease.

A Recent German Contract Ruling.—U.S. Commercial Attaché [illegible] Berlin reports:—

"As has been pointed out in several dispatches and articles in *Commerce Reports*, German practice with regard to contracts permits certain deviations from contract clauses as the [illegible] circumstances that intervene at some time after the signing of the contract and before the date of performance. This is known as the 'Fortstrebtheitbleibend' clause.

In a recent case a defendant had signed a contract whereby he agreed to sell at a fixed price his shares in business [illegible] months. When the contract was due he refused to [illegible] upon the ground that the depreciation of the mark had so changed economic conditions that the amount [illegible] represented a sufficiently fair exchange of values to enable him to fulfil his obligations. The court upheld this action of the defendant, and through its decision declared it to be legal to withdraw from a contract when the parties had mistakenly assumed that, on the date when due, the contract would provide for a fair exchange of values. The court furthermore emphasised in this decision the fact that a currency depreciation is sufficient cause to make the exchange of values sufficiently unfair to warrant the repudiation of a contract.

"This decision is important from two points of view. In the first place, to date the courts have generally held that a contract can be repudiated only when its fulfilment is adjudged by the court to be impossible, whereas with this recent decision the precedent is set that a contract can be repudiated if the court adjudges conditions no longer to warrant a fair exchange of values. In the second place, this decision sets the precedent that the depreciation of the currency is in itself a sufficient cause to create unfair conditions of exchange. In former cases the court accepted increased wages, freight rates, production costs, and other factors brought about by the currency depreciation as sufficient causes to change the terms of the contract but never the currency depreciation in itself." *U.S. Commerce Reports.*

Forthcoming Exhibitions.—The following exhibitions are being organised:

London: September 30th to October 7th, Wireless Exhibition; October 13th to 23rd, Commercial Motor Exhibition; October 28th to November 3rd, Brewers' Exhibition; November 2nd to 11th, International Motor Show; November 14th to 24th, Marine and Small Craft Exhibition. November 25th to December 2nd, Motor-Cycle and Cycle Show.

Birmingham. February 19th to March 2nd, 1923, British Industries Fair.

Manchester.—October 6th to 20th, Textile Machinery Exhibition.

Belgium (*Mons*). November, Commercial Fair.

France (*Paris*).—December 15th to January 2nd, 1923, International Aero Show.

United States (*Chicago*).—October 14th to 22nd, Radio Show.

A Prosperous Austrian Undertaking.—The report for 1921 of the "Elin" Aktiengesellschaft für Elektrische Industrie shows unusual progress in the year under review and far-reaching plans for future operations. In the past year a lively demand for the firm's products was experienced. The works at Weiz, the project department and the sales organisation each obtained ample business. Compared with the year 1914, production was almost threefold, and, contrasted with 1915, eightfold. The high-pressure department in the past year found valuable openings for its activities. The 100,000-V line, the first set up in Austria, mentioned in the report, had given the fullest satisfaction. Further, the same department secured from the Swiss Ministry of Traffic the contract for the complete sub-station equipment of the Arlberg railway at Zirl, Flopsen, and Flirsch. These contracts are now in full swing. Of the big schemes mentioned in the last report in connection with the development of Austria's water resources and the electrification of the railways, some had been realised, and fresh ones were under negotiation. As regards the firm's own works, only three are now retained, namely, those at Mixnitz, Wadowice and Ragusa. The Lugos works were advantageously disposed of to [illegible] group. The sales organisation opened a branch at Milan, which had appointed agencies in various Italian [illegible]. Agencies had also been instituted in Rumania and Poland, the working of which was very satisfactory. The office at Brux had suffered somewhat from the prevalent stagnation of [illegible] trade. On January 1st, 1922, the "Elin" Gesellschaft m.b.H. Marburg began its operations. This company, which was constituted with the co-operation of Jugo-Slavic Banks under the direction of the Laibach Credit Bank, has a [illegible] capital of 900,000 Jugo-Slav kronen. Furthermore, there was founded at Zagreb the capital of [illegible] the "Elin" Gesellschaft für Elektrische Industrie A.G. [illegible] capital of 10,000,000 Jugo-Slav kronen. Croatian [illegible] and Serbian banks assisted in its flotation [illegible] cent. of the capital. This company is intended [illegible] as a financing company for the acquisition [illegible] power stations or shares in such enterprises [illegible] in the Croatian and Serbian territories in union with the forenamed, another company was formed in the beginning of 1922 at Zagreb, styled the "Elin" Jugoslavische Gesellschaft für Elektrische Industrie, with a capital of 5,000,000 Jugo-Slav kronen, and is now actively operating. The company formed in Holland to promote export trade in the west, the Nederlandsche Maatschappij voor Electrische Industrie, Amsterdam, is developing favourably. Relations with the "Kontakt" A.G. Spezialfabrik have developed; this company produces high-pressure electrical plant of all kinds, and is able to record increased business, with improvements and extensions of plant. Its connection with the Weiz works has been proved of value. The "Kontakt's" capital was raised in the first year from 4,000,000 to 10,000,000 kronen. The Möllersdorf Foundry Co. has likewise benefited, greatly in the past year from the orders received from the Weiz works. The Telephon-Automaten Gesellschaft has had to suffer during the year from the increasing depreciation of the currency, which corresponded with a decreased use of automatic telephones. For the working of the automatic telephone business in Czecho-Slovakia, a company has been formed, with a capital of 3,000,000 Czech kronen. Its business, which extended throughout the Czecho-Slovak territory, had been satisfactory. The "Meteor" Gluhlampenfabrik, in which the firm had a share, was also able to give a good account. The Elektromos ipar r.t., in Budapesth, was able to distribute a dividend of 10 per cent. in 1920. With respect to the distribution of the net profit of 31,069,567 kronen, it was proposed to allot 5 per cent. to the reserve; 2,000,000 kr. to the Ingenieur Franz Pichel Fonds; and 5 per cent. to the holders of shares. Of the balance, 10 per cent. would be apportioned to the directors, 45 per cent. super-dividend at the rate of 90 kr. per share to the shareholders, and the balance carried forward. On the strength of a resolution of an extraordinary meeting in January, 1922, a further increase of the share capital from 45,000,000 to 90,000,000 kr. is to be made, by the issue of 225,000 shares, bearing dividend from January 1st 1922.

Business Prospects in Canary Islands.—*Commerce Reports* publishes a statement from the U.S. Consul at Teneriffe regarding trade prospects in the Canary Islands. It is stated that individual lighting installations and farm lighting plant are used to a very limited extent. There are probably not over half-a-dozen in the islands. It is probable that there would be a market for installations in villages with from 500 to 2,000 inhabitants. Nearly all towns with a population of over 5,000 already have electric light. There apperas to be a good opportunity for the sale of pumping plant.

Use of Cable Codes in Tenders.—In a recent dispatch to his Government, U.S. Vice-Consul Russell M. Brooks, of Newcastle-on-Tyne, states: "Trade opportunities usually specify the cable code used by the person desiring tenders, its name being listed under the column "telegraphic codes." English firms, as a rule, employ but one such code, and a reply received to any other code is a source of delay and of annoyance that may easily result in the loss of an order. Many firms in England are so located that copies of all the codes in use are not available, and cases have occurred recently in which it was necessary for the recipient of a cablegram to telegraph it to one of the principal commercial centres in order to have it decoded. The additional expense, the time lost, to say nothing of the annoyance caused and the possibility of errors in two additional transmissions, may easily be sufficient to prejudice the English firm against a tender made in such a form. One instance in particular is reported in which the original tender was made in the proper code and an order was placed with the American exporter. In cabling confirmation of the order the American company used a totally different code, in spite of the fact that it had been advised of the particular code employed and had used it in its first message. The code used in the confirming message was not available in the town where the English customer was located, and the entire message had to be telegraphed to Liverpool, decoded, and sent back in plain English over the wire. New codes are being prepared and advertised from time to time, and trade associations are making up codes suited to their own peculiar needs, so that a considerable number exist in different languages. This is a detail deserving of special attention, not so much for the slight difference in the expense, but for the confusion caused by the selection of an unusual code for commercial messages."

Australian Labour.—A conference of 62 trade unions assembled at Sydney to formulate opposition to reductions of wages and altered working conditions, has advocated a policy of "go slow" and "measure for measure," and has also recommended all Australian unions to act similarly.—*Reuter.*

An Exchange Telegraph dispatch from Melbourne states that since 1913 the Commonwealth industrial disputes have numbered 3,791, resulting in a loss of 18,000,000 working days and £11,000,000 in wages.

British Empire Exhibition.—The Government has decided to devote £60,000 to the New Zealand Section at the British Empire Exhibition. The Dominion will also participate in the Imperial sections with a portion of the allocation available this year. The committees have already begun to organise.—*Reuter* (Wellington).

German Railway Rates.—Owing to the further depreciation of the mark, the recent increase of 50 per cent. in railway goods rates, which will come into force on September 1st, is now considered insufficient and a further increase may become necessary.—*Reuter* (Berlin, August 22nd).

South African Electrical Prospects.—The American Vice-Consul at Cape Town, writing in *Commerce Reports*, makes some interesting remarks on the market conditions in Cape Town as regards electric heaters, irons, and toasters. The absence of central heating from most buildings, and of any kind of heating in many offices, causes a good demand for electric heaters. Those most favoured are the 1-kW size with coiled wire elements. There are still some of the large lamp-type sold. Heaters priced at about $15 (£3 6s.) have the best sale, and most of these are British. Heaters consuming more than 1 kWh per hour are practically unsaleable. The former American monopoly of the supply of electric irons has been almost "killed" by the recent reductions in the prices of English irons and the re-entry of Germany into the market. The average retail prices of a 5-lb. iron are: American, $9.50; English, $8.50; and German, $7. Dealers state that more German irons are being sold than all the others put together. The report says that unless American manufacturers can bring their price down to $8 the market will be entirely lost to them.

The Americans supply practically all the electric toasters sold in Cape Town, there apparently being no German toasters, and the English makes being much inferior to American makes at the same price. Sales could be increased by lowering the price from $9, which is the average. The high prices charged for spare parts for American appliances are against their sale in South Africa, and dealers say that American prices have not been reduced at the same rate as English prices. The report concludes that unless American manufacturers can materially reduce their prices they will be forced out of the market by English and German competition.

Trade Conditions in South Africa.—The general managers of the Standard Bank of South Africa communicate the following information regarding business conditions in South Africa during the past month:—

The volume of business shows little change during the month, although a continuance of the satisfactory agricultural conditions and the notable progress in the gold-mining industry tend to foster optimistic views regarding the immediate future.

In electrical goods, business is fair and prices are unchanged. Stocks are generally good, although supplies of ordinary lamps are dwindling in consequence of the recent heavy demand.

The trade figures for British South Africa for the five months ended May, compared with the corresponding period of last year, are as follows:—

	First Five Months.	
	1922.	1921.
Imports	£20,570,506	£20,521,149
Exports, including re-exports ...	£21,765,312	£25,611,999

—*Reuter's Trade Service* (Cape Town).

Local Electrical Exhibitions.—With reference to the note under the above heading in our last issue, we are informed by the E.D.A. that the Warrington Exhibition Committee has now definitely decided to hold the show from November 2nd to 11th, instead of November 27th and following days, as first suggested.

An Ideal Home Exhibition is being held at Bognor from September 6th to 30th.

We have received from Mr. John Christie, engineer and manager of the Brighton electricity undertaking, a copy of the poster being employed to advertise the electrical exhibition which is being held in the Corn Exchange, Brighton, from October 5th to 14th. It is an "attention-compelling" design which should secure its object.

New Canadian Companies.—Among the new companies recently incorporated in Canada are: La Compagnie Hydraulique de Portneuf, Ltd., Quebec (capital, $300,000); Radiophone Corporation of Canada, Ltd., Toronto (capital, $500,000); and Crescent Electrics, Ltd., Toronto (capital, $100,000), manufacturers and suppliers of machinery and apparatus.

Manufacturing in Russia.—It is reported that all the departments of the Siemens-Schuckert works in Petrograd have recently been in operation, and the production is said to have exceeded the pre-war output by 25 per cent. In May the output of electrical supplies was valued at 65,115 pre-war roubles. The North State works produced similar articles for 106,052 pre-war roubles, and No. 7 works, "Deka," for 57,135 pre-war roubles, whereas in April the latter scarcely turned out 12 per cent. of the pre-arranged programme. The value of the May production of the glow lamp factory, Swiedtjana was 16,996 pre-war roubles, that of the Fittings works was 4,489 roubles, and that of the No. 6 works, F.A., was 9,099 pre-war roubles. In the case of the Petrograd accumulator trust the output in May and June is returned at 88,846 pre-war roubles, being double the amount of the preceding two months.

Blackburn Contractors' Action.—Competition has become so keen in the electrical business of the East Lancashire district, consequent upon so many unqualified men starting in the business, that the Blackburn and District Electrical Contractors' Association has published a notice intimating to the public who its members are, with their qualifications.

French Locomotive Orders.—It is reported from Paris that the Compagnie Electro-Mécanique has just received an order for the supply of the electrical equipment for 120 locomotives for the Paris-Orleans Railway Co., at a cost of about 20,000,000 fr. Including similar orders previously obtained for other French railways, the total value of the contracts on hand reaches 70,000,000 fr.

German Goods Credit to Russia.—The official Rosta agency of Moscow reports by wireless that the Russian Foreign Trade Commissariat has given permission to the Russian Electrical Trust to enter into an agreement with the "Siemens works in Germany," under which the latter would grant credit to the trust in goods. It is added that this is the first time that a foreign firm has given credit to Russian industry. It is, however, not stated whether the German firm has expressed its willingness to conclude such an agreement.

Lead.—Under date August 26th, Messrs. James Forster and Co., report as follows: "Closing prices yesterday were £23 7s. 6d. for August and £22 15s. for November, against £24 15s. and £24, respectively, at the end of last week. A month ago, the relative positions were at £25 15s. and £24 12s. 6d. Transactions have been on a liberal scale and approximate to 5,500 tons for the week, most of which appear to be of a speculative nature. Lead is coming in more plentifully and there is more afloat than has been the case in late months."

The Dutch East Indian Market.—Vast developments have taken place in the Dutch East Indies during the past ten or twenty years which have rendered these islands a valuable market for machinery. During 1919 and 1920, such imports, consisting largely of sugar machinery, agricultural and estate machinery, and hand and machine tools, amounted in value to over £10,000,000. It is true that the demand then was exceptional, due to shortage during the war, and a reaction has since taken place. Now, however, there seems every prospect of Holland's island possessions resuming their path of progress.

The British Commercial Agent at Batavia (Mr. H. A. N. Bluett) is very enthusiastic about the possibilities of British trade in this territory, but with regard to machinery, he says that British manufacturers must endeavour to reduce their costs of production.

Czecho-Slovakia's Sound Currency. — Czecho-Slovakia stands out strikingly from the other new Central European States by reason of the sustained effort she has made to place her finances on a sound basis. Through steadily refusing to inflate her currency by means of the printing press, she has brought about a remarkable appreciation of the exchange value of her crown. Indeed, so rapidly has it risen, that her export industries have been embarrassed. While sympathising with a people who are suffering inconvenience because they have chosen the proper, though temporarily harder road, there is no need to assure them that their ultimate gain will be the greater for their boldness.

Czech manufacturers who, as Mr. Bruce Lockhart (H.M Commercial Secretary at Prague), points out in his recent report, depend upon export trade in much the same way as British industrialists, are now actively engaged in reducing their costs of production. Apparently, they must also diminish their margin of profit, improve their organisation, and possibly induce their Government to bring down some of the highly-protective import duties that are levied on goods which affect the expenses of manufacture.

Czecho-Slovakia's import and export trade last year with her chief customers in electrical apparatus, is shown below:—

	Czech Imports. Quintals = about 2 cwt.	Czech Exports. Quintals = about 2 cwt.
Electrical machines and goods		
Total	64,000	17,000
Germany	31,000	1,000
Austria	28,000	5,000

Czecho-Slovakia's exports are naturally also directed to the neighbouring states of Jugo-Slavia and Rumania, as well as Italy. With regard to the prospects of trade with Great Britain, H.M. Commercial Secretary points out that it has always been recognised that Czecho-Slovakia does not, and cannot, present a very wide field for the export of British manufactured goods. The country itself manufactures for export, many, if not most, of those manufactured articles which form the staple export commodities of Great Britain. There should be a fair opening for British goods of the highest quality, but at the present moment, the State control of commerce makes their introduction almost impossible.

A Trade Union Amalgamation.—It is reported that a ballot of members of the Municipal Employés' Association, the National Amalgamated Union of Labour, and the National Union of General Workers, upon a proposal to combine the three unions in one society, has resulted in a majority favourable to the arrangement. If the fusion is carried into effect the new union will be the largest in the country with a membership of over half a million. A further amalgamation of this nature is mooted by which the Transport and General Workers' Union and the National Union of Sailors and Firemen would combine.

Book Notices.—The *Bulletin* of the Hydro-Electric Power Commission of Ontario, July, 1922. Toronto: The Commission. Price $2 per annum. The whole of this number is devoted to the proceedings of the Association of Municipal Electrical Utilities held in June. Among these are two papers on street lighting, one dealing with the allocation of charges in municipal undertakings, and others dealing with questions affecting the industry in many ways.

We have received from the Swedish Consul-General in London a copy of "A Book About Sweden," an extremely interesting and informative guide published by the Swedish Tourist Association, Stockholm. This work is not written on the usual guide-book lines, but covers a wider field. In it are given in an interesting way particulars geographical, historical, and economic, as well as notes on the nation's culture of literary and artistic subjects. Each industry is made the subject of a brief note, and the electrical section is illustrated with a view of the generating room of the Trollhattan hydro-electric works, and a picture of the huge rotor of a 30,000-h.p. generator at Västeras. The illustrations throughout are very clear, and show the beauties of the country in an excellent way. The book is clearly printed on good paper, misprints are remarkably rare considering that the book was produced in Sweden, and upon the whole we think that the contents deserve something better than the paper cover in which the pages are bound.

"Labour Policy, False and True," by Sir Lynden Macassey. Pp. 320. London: Thornton Butterworth, Ltd. Price 7s. 6d. net.

"Electrical Circuits and Connections," by W. R. Bowker. Pp. xii+211; 166 figs. London: Crosby Lockwood & Son. Price 15s. net.

"Dictionary of Applied Physics," by Sir R. Glazebrook. Vol. II. Electricity, pp. 1,104, illustrated. London: Macmillan & Co., Ltd. Price 63s. net.

Financial Times "Income Tax Guide for 1922," by H. W. Palmer. Price 1s. net.—This guide explains the essential points of the last Finance Act, showing by test examples and tables what income tax to pay and how to obtain relief; chapters are also given on excess profits tax and the corporation tax.

New South Wales Industry.—The *Times Trade Supplement* states that important legislation relating to trade and commerce, vitally affecting the economy of the State, will be the feature of the present session of the New South Wales Parliament. As a first step, the Fuller Government has Government, ordinarily would expire at the end of this year. Trade (basic-wage fixing tribunal), but not to abolish it as threatened. It will be deprived of all power to fix a basic wage for rural workers, and special tribunals may function at short notice to award wages lower than the basic wage where industries cannot afford to pay them. This will enable the absorption of large numbers of the unemployed at "living" as opposed to "basic" wages.

The Profiteering Prevention Act passed by the late Labour Government, ordinarily would expire at the end of this year, but it has been decided to abolish it at once. This cumbersome piece of legislation will be replaced by a measure designed to prevent price-rigging by trusts and combines.

The Government has been taking careful stock of the various State industries established by the late and previous Labour Governments. It is intended to sell most of these State enterprises and to confine the operations of others to the supply of purely State requirements. The non-paying concerns will be shut down or sold as soon as possible.

The Midland Electrical Trade.—A Midland correspondent writes:—Until recently the general electrical trades were a bright spot in Birmingham and Midland industry, but they are now suffering from a relapse. The competition, particularly in the matter of small electrical fittings, from Germany and Japan is severe, but the quality of the imported goods is poor generally. Germany is, in fact, less competitive in higher-class articles than many people imagine. As might be expected with the approach of autumn, some fairly good orders have been placed for electrical fittings, for domestic lighting, and switch manufacturers and the like report rather improved trading, but most of the Midland factories are only partially employed. The large engineering houses, too, are only moderately employed on power-station and hydro-electric plant, the latter chiefly for Australasia. Developments in the home trade will, of course, be largely influenced by the rate of recovery of the general engineering trades, which so far has proved slow. At the moment it is slightly better, and the merchants report some improvement in the demand for constructional steel. One point for satisfaction is that producers are in a better position, consequent on wage adjustments, than they were recently to quote firm prices on a reduced level. Customers would not buy while values were as high as while the market was falling, so that with costs becoming a little more stabilised, the outlook should improve. At any rate, that is the opinion of representative electrical engineers.

Storage Battery Price Reduction.—We are informed that, as from to-day, the Chloride Electrical Storage Co., Ltd., is reducing the prices of all classes of its stationary storage batteries.

A Warning to Prospective Consumers.—The E.D.A. has sent us a copy of a notice being published by the Midland Electrical Corporation for Power Distribution, Ltd. This warns prospective consumers to make immediate application if they wish to be connected before winter sets in. Last year many applications were so late that the season was well advanced before the applicants could be supplied with electricity.

The Leipzig Fair.—The exchange position has had a pronounced effect upon the Fair, which opened on August 28th. Owing to the instability of the mark, German exhibitors have adopted the practice of concluding sales based upon the currency of the country to which the goods are sold, or, in many cases, upon the pound sterling, the dollar, or the Swiss franc. Because of this, large numbers of German buyers are unable to do business, and vigorous protests have been the result, as, of course, it is impossible to maintain a constant relationship between the mark and foreign currency. There are about 13,000 exhibitors at the Fair, and the visitors who attended upon the first day numbered over 100,000.

LIGHTING AND POWER NOTES.

Aberayron.—Electricity Scheme.—Application has been made to the Electricity Commissioners by Mrs. E. G. Richards, of Llyswen House, Aberayron, for authority to generate and supply electricity for all purposes within the urban district of Aberayron.

Accrington.—Extension of Supply.—The Electricity Commissioners have made a Special Order authorising the supply of electricity to Oswaldtwistle for both public and private purposes, and the approval of the Ministry of Transport is now being obtained.

Argentina.—Hydro-Electric Concession.—The Governor of Mendoza has presented a project to the Provincial Legislature for the granting of a concession, in public tender, for the utilisation of the Nihuil Falls on the River Atuel for the generation of electrical energy. The successful applicant would have to undertake to carry out the work in return only for the right to exploit the service for a term of years, on the expiry of which the whole installation would become the sole property of the Province. Interested parties would be required to state: (1) for how many years they ask the working rights; (2) the tariffs they would propose to charge; (3) the percentage of profit they would give to the Provincial Government. The project stipulates that the tariffs for electric power should not exceed the equivalent value of Argentine petroleum in Buenos Aires, plus cost of transmission. The firm obtaining the concession would be exempted from payment of Provincial and municipal taxes in respect of the establishment. It is anticipated that the energy obtained from the utilisation of the Falls would be anything between 10,000 and 100,000 h.p., the latter figure being conditional on the construction of a reservoir.—*Review of the River Plate.*

Athy (Co. Kildare). Electricity Scheme.—At a meeting of the Urban Council objections to the electric lighting scheme were heard and met, the engineer being assured of every support. Inquiries regarding a suitable power station site were ordered to be made.

Australia.—Victoria. The Melbourne *Age* states that no steps have yet been taken by the State Electricity Commission in connection with the amalgamation and standardisation of the supply systems in the Metropolis. So far the activities of the Commission have been confined to the supplying of electricity in bulk from the Yallourn and Newport stations. Only in a small district is electricity supplied to the actual consumers, and the Commissioners do not contemplate retail distribution at the present time. Until the whole matter has been fully considered and legislative powers reviewed it will be impossible for the Commissioners to formulate a policy.

New Supply Schemes.—Permission having been granted it to erect overhead electric mains, the Rockhampton City Council is about to approach the Queensland treasurer for authority to borrow £100,000 to supply electricity to the city and to electrify the tramways. The City Council at Bathurst (N.S.W.) has adopted an expert report on an electricity supply scheme for the city, and has decided to raise a loan of £40,000 to carry out the undertaking.—*Reuter's Trade Service.*

Barnstaple.—Offer to Purchase Undertaking.—It is stated that a syndicate—whose name has not been disclosed has offered to purchase the municipal electricity undertaking. So far the Council has not decided whether to proceed with negotiations or not.

Barrow.—Electricity Schemes.—The Corporation has commenced to lay conduits for the high-pressure cable which will feed overhead lines to be constructed to carry energy to the suburbs of Rampside and Roa Island, over three miles distant. At present there is neither gas nor electricity at Rampside, where the residents have to burn oil, but at Roa Island there has for many years been a supply of gas from the Furness Railway Co.'s plant, which, however, the com-

pany has decided to discontinue owing to its being unprofitable. It is expected the electricity supply will be available for the two places named before Christmas. Negotiations are also proceeding between the Barrow Corporation and the neighbouring authorities of Dalton and Liverston with a view to the supply of electricity to these towns. A special inducement to proceed with the work just now is that it would afford considerable employment for the many electricians formerly employed at Messrs. Vickers, who are now idle owing to the slump in trade.

Biggleswade.—Canvass of Residents.—The Urban District Council is circulating letters to residents asking them to what extent they would take electricity if it were available. If the Council is unable to carry out a scheme itself, the information will be placed before any company which may be interested.

Blackpool.—Loan.—The Electricity Committee is urging the Electricity Commissioners to issue sanction in respect of the Corporation's application, in May last, for a loan to carry out the proposed electricity extension scheme.

Brighton.—Breakdown.—The Southwick district was deprived of power on the afternoon of August 22nd, owing to the breaking down of two motor-generators in the sub-station. Tramcars came to a standstill and several works were stopped. Repair work was carried out very quickly by Mr. Christie and his staff, and the supply was re-established in about ten minutes.

Canada.—British Columbia.—The contract for the enlargement of the power storage dam at Ocean Falls has been awarded to Messrs. Robertson & Randell by the Pacific Mills, Ltd. The work involves raising the height of the existing water storage at the outlet of Link Lake, and will cost approximately $250,000.—*Reuter's Trade Service* (Vancouver).

The British Columbia Electric Railway Co. has large construction works in hand and is spending $1,000,000 on increasing its storage capacity at Stave Lake. It has under consideration plans involving an additional expenditure of some $10,000,000 on further development as the increase in population and industrial demand warrants. The installation of a fourth generator of 13,000-h.p. capacity at the Stave Lake plant is almost completed, bringing its total power plant capacity up to 136,000 h.p. Under the plans now in hand it is the intention to make provision for a fifth generator. The power resources of the company available for development include water rights on Alouette Lake, water rights farther down the Stave Lake, and on Jones Lake. These projects, when completed, will provide 150,000 h.p., sufficient to supply Vancouver and the lower mainland of the province for a considerable time.

Vancouver and New Westminster are developing apace as industrial centres, and with the exception of lumber mills and other industries which develop power from waste fuel, every industry needs electric power. The demand for power has been increasing rapidly since the end of the war. In June, 1921, the output of the British Columbia Electric system for all purposes—light, power, and street railway—was 17,578,600 kWh, whereas in June, 1922, it had risen to 21,280,700 kWh. In 1914 it delivered to its power and light customers on the mainland 64,129,692 kWh, compared with 113,909,973 kWh in 1921. In the same period the horse-power of motors connected rose from 29,562 to 54,553.—*Times Trade Supplement.*

Ontario.—The *Electrical News* (Toronto) reports that the Hydro-Electric Power Commission has acquired a lease of the power rights on the Trent Valley waterways from the Dominion Government. The annual rental is $24,000 for a minimum of 6,000 and a maximum of 12,000 h.p. The Commission has made important reductions in its rates, affecting 67 municipalities. On the other hand, increases have been made in the case of 46 municipalities. A great encouragement to the domestic use of electricity has been given by a reduction of the maximum rate for this type of supply from 4 cents to 2 cents per kWh; this applies to the whole province.

Castleblaney.—Withdrawal of Wayleave.—The Urban Council was recently informed, with regard to the electric lighting contract, that Mr. McQuillan could not discharge the terms imposed, and asked for the time to be extended to the winter of 1923. The Council thereupon decided to withdraw the wayleave granted to Mr. McQuillan.

Ceylon.—Electricity Supply Schemes.—The Municipality of the seaport of Galle, which is still lighted by oil lamps, has decided to have an electric-lighting scheme prepared, and similar schemes have recently been spoken of in connection with Kalutara, Panudara, Moratuwa, and Kurunegala.

Mr. J. G. Fraser, the Government Agent of the Western Province, is studying the questions of lighting small towns and groups of villages with electricity, and also of supplying them with water by the aid of electric energy generated by windmills combined with auxiliary motors to tide over the calm periods. As a preliminary venture he has put in an installation at Gampaha, a group of five villages some fifteen miles from Colombo. The dynamo is driven by a 7½-h.p. oil engine, and a charge of Rs.1 per month is made for each lamp installed.—*Times Trade Supplement.*

Chelmsford. Electricity Supply. The Rural Council has decided to offer no objection to the application of the Wickford and District Electricity Supply Co., Ltd., to supply a portion of the parish of Runwell with electricity, provided the wires are placed in approved positions.

China.—Electrical Developments.—The third power station of the Fushun Collieries (owned and operated by the South Manchuria Railway), work on which was started in 1919, has just been completed at a cost of 1,585,000 dollars. Previous to the installation of the new power plant, the collieries had a generating capacity of 17,000 kW which was almost wholly taken up. The new plant has a capacity of 12,500 kW, making the total almost 30,000 kW. The electricity section of the collieries is now prepared to supply Mukden with cheap power in practically any quantity.—*Reuter's Trade Service* (Washington).

Shanghai.—The 1921-22 report of the engineer-in-chief of the municipal electricity undertaking states that the gross profit was Tls. 1,863,610 and the net profit, after provision for interest on loans, depreciation &c., was Tls. 1,047,608; the estimated net profit was Tls. 1,029,816. From 1916 to the end of 1921 a sum of Tls. 2,170,000 has been handed to the Council's general funds out of electricity profits. The past year has, in every way, been a record one, both as regards the profit made on invested capital and the number of kilowatt-hours sold; Shanghai sold very nearly as much electricity as the Manchester electricity department. Although the Riverside power station is not yet working under ideal conditions, nevertheless very great improvements have been effected, and the thermal efficiency of the plant has been improved to a very appreciable extent. The generating plant at this station has been increased by 46,000 kW. On March 15th the first of the two 18,000-kW turbine sets was commissioned; the second was commissioned on August 11th; on November 12th a 10,000-kW turbine was put into service, and by the end of the year the installed plant capacity at Riverside totalled 79,000 kW. When the two additional 20,000-kW turbines are ready for service, together with the two 3,000-kW machines for providing an independent supply of electricity for operating the auxiliary plant in the power house, it will be possible to dispense with two of the smaller machines, which are each of 2,000-kW capacity, and when this is accomplished the plant capacity will amount to 121,000 kW. It should then be possible to close the old Fearon Road generating station, which contained, at the end of the year, 5,600 kW of plant. During the period under review the amount of overhead cable erected reached a total of 167.64 miles, and 65.57 miles of underground cable was laid. All this work was carried out entirely by the department's staff.

Continental.—France.—As a result of proposals placed before the French Cabinet by the Ministers of Finance and Agriculture, these two ministers have been authorised to prepare a Bill to settle the conditions under which loans can be advanced by the State, under the guarantee of the Departments, to groups of towns, agricultural companies of collective interest, or to the National Office of Agricultural Credit, in connection with the establishment and working of rural electricity supply networks.

Norway. The power station of Kristianssand municipal authorities at Nomeland has now been brought into full operation with three 7,500-h.p. turbo-generator sets. The commencement of the hydro-electric works was made in 1916 and the expenditure has been 10,600,000 kronen.

Folkestone.—Extension of Supply.—The Minister of Transport has confirmed a Special Order made by the Electricity Commissioners, empowering the Folkestone Electricity Supply Co., Ltd., to lay mains and supply electricity in the Cheriton, Saltwood, Newington, and Hawkinge districts.

Glasgow.—"All-Electric" Houses.—At a recent meeting of the Corporation Electricity Committee, the chairman referred to the success which had attended the recent demonstration of the "all-electric" system of heating, lighting, &c., in the houses at Riddrie, and, after discussion, it was agreed that the Special Committee on Housing and General Town Improvement be asked to allow two of the five-apartment type of house at Mosspark to be similarly equipped by the Department, for the purpose of further demonstration of the "all-electric" system.

Hospital Lighting. Among schemes of work which may be put in hand by the Corporation for the relief of unemployment is electric lighting work at Belvidere Hospital, estimated to cost £7,600.

Proposed Multi-part Tariff.—A sub-committee of the Corporation Electricity Committee is considering the institution of a "multi-part" or a "two-part" system as a means of developing the sale of electricity for domestic purposes.

Visit to Gennevilliers. A deputation from the Town Council, including Mr. Mitchell, the electrical engineer, is to visit the Gennevilliers undertaking.

Hastings.—Year's Working. The accounts of the municipal Electricity Department (engineer: Mr. Russell F. Ferguson) for the year ended March 31st last show a total revenue of £49,468, comparing with £42,809 in the previous year. Working expenditure amounted to £33,216, against £34,277, giving a gross profit of £16,252 (£8,032). Capital charges and bad debts were higher, totalling £11,889, as compared with £8,279, and the net result was a profit of

£4,363, comparing favourably with a deficit of £247 in 1920-21. The number of units sold rose from 1,521,697 to 1,745,127, and the number of consumers from 3,541 to 4,005. A total of £27,2[illegible] was spent during the year on capital account; this included instalments on new plant, £9,383; transformers, £7,805; mains and services, £5,375; and buildings, £2,929.

Lampeter.—Proposed Electricity Order.—At a meeting of the Town Council on August 22nd, Mr. William Jones asked for the consent of the Corporation to his application for an electric lighting Order. The matter was referred to [illegible] consideration.

Leek. Loan.—At a recent meeting of the Urban Council it was decided to borrow the sum of £15,000 to carry out extensions at the electricity works.

Leith. Electric Cranes in Docks.—The Dock Commissioners are to erect additional electric cranes at the Victoria Dock.

London. Islington.—The Borough Council has received the permission of the Electricity Commissioners to borrow £28,000 for new plant.

Lydney.—Supply Scheme Work. Last week operations were commenced by a London construction company upon the large electric power station which it is proposed to provide near Norchard Colliery, Lydney, Forest of Dean, in connection with the syndicate which is to supply electricity throughout Gloucestershire. On Friday evening, however, the whole of the men engaged upon the work were paid off, and inquiries revealed that some misunderstanding had arisen between the syndicate and the colliery company. It is understood that this interruption in the progress of the work is not likely to continue long.

Marlborough.—Proposed Electricity Supply.—It is stated that the local gas company has under consideration a scheme for supplying electricity to the town.

Northern Ireland.—Development of Bann.—Steps are being taken to promote a Bill for the development of power from the River Bann in the "Northern" Parliament in the coming session, and the requisite surveys and plans in preparation for this important undertaking are already well in hand. Dr. J. F. Crowley, the well-known authority on water power and electricity, was recently in Belfast in conference on the matter. Dr. Crowley was a member of the Board of Trade Committees on Electricity Supply and Water Power Resources.—*Irish Independent.*

Retford. Proposed Electricity Supply.—A report is to be prepared as to the possibility of the provision of a municipal electricity supply in conjunction with the Gas Department.

South Africa.—Electricity Act.—The Electricity Act, 1922, which was outlined in our last issue, becomes operative to-day (September 1st), says the *Financial News.*

Johannesburg. The Corporation Electricity Department has erected a large sub-station in the central part of the city for the accommodation of four converting sets with a total capacity of 6,500 kW, to meet the growing demand for supply. Some of the plant has been transferred from the central power station, which was in a congested state.

South Shields.—Year's Working.—The Corporation Electricity Committee reports a successful year. After meeting all charges there is a surplus of £15,000 to dispose of. The reserve fund, which has been considerably depleted, will receive £5,000, and £3,000 will be placed to a special reserve fund, whilst £5,000 will be asked for to carry out necessary extensions to buildings. The reduced charges recently decided on are expected to mean a drop in revenue for the current year of some £10,000.

Stirling.—Extensions.—The Town Council has decided to extend its electricity works at a cost of £5,700, as an alternative to taking a bulk supply from the Scottish Central Electric Power Co., or linking up with the Alloa undertaking.

Thanet.—Electricity Scheme.—A scheme for the electrification of Westgate and Birchington was considered at a joint meeting of the two parish councils held at Birchington on August 23rd. Councillor J. A. Forde, of Broadstairs, manager and engineer of the Isle of Thanet Electric Lighting and Tramway Co., Ltd., attended, and explained the outline of the proposed scheme of supply by overhead wires to Westgate and Birchington. The idea, he said, was to form a subsidiary company to the Isle of Thanet Electric Lighting Co., Ltd., and to supply that company with electricity in bulk from the [illegible] He [illegible] stated that in principle the scheme would be desirable.

United States.—Long-distance Transmission.—The Californian-Oregon Power Co. is erecting a 110,000-V transmission line from its Prospect hydro-electric works to the Springfield sub-station of the Mountain States Power Co.—a distance of 115 miles. By the arrangement a "block" of 12,000-kW is to be transmitted for distribution among the Mountain States Co.'s consumers. The line will consists of size 00 bare copper [illegible] mounted on suspension-type insulators.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—A Long-distance Scheme.—Mr. Charles I. Baker, who recently left Blackpool (where he was traffic superintendent) to take over the managership, has introduced a novel scheme in the Ashton tramways. With the co-operation of the Oldham and Stalybridge authorities he has evolved a circular tour covering the three tramway systems, enabling passengers to travel the whole 12 miles with any break they desire for 1s. The tour covers several townships.

Australia.—Melbourne.—The Melbourne and Metropolitan Tramways Board has submitted to the Minister for Public Works a scheme for the construction of lines linking up Essendon and Coburg with the city. The estimated capital expenditure involved, including rolling stock, plant, and buildings, is £270,000.

Barrow.—Inquiry.—An inquiry was conducted *in camera* on August 24th by the Tramways Committee into the management and administration of the undertaking, which has been the subject of a great deal of hostile criticism by the Town Council. Since the Corporation took over the electric tramways from the British Electric Traction Co., a heavy loss has resulted to the town. A great deal of up-hill work, however, has had to be undertaken, as the whole of the cars fell into a bad state of repair during the war, and since then many new cars have been bought and other improvements have been carried out including the erection of a new large shed at the depôt.

Bolton.—Sliding Scale.—At a recent meeting of Bolton Trades Council it was decided to memorialise the Corporation Tramways Committee not to support the movement on foot in the country for tramway authorities to interfere with the sliding-scale system of regulating wages.

Burnley.—Deficit.—There was a net loss of £2,313 on the working of the tramway undertaking for the past year.

Chile.—Railway Electrification.—The Nitrate Railways Co., Ltd., the British corporation operating the principal railway system of the Province of Tarapaca, is planning to go ahead with the electrification of the Iquique-La Carpas section—a stretch of about 17 miles with heavy grades. The proposed work was covered by a contract made between the Nitrate Railway Co. and the Chilean Government in July, 1921. Although this contract has been declared void by the Chilean Congress, representatives of the State Railway say that so far as the company is concerned the contract is in full force and effect. The preliminary estimate of the cost of the work is £2,000,000, and an engineer has arrived from England to work up the necessary technical data for the preparation of detailed plans.—*Journal of Electricity and Western Industry.*

Continental.—Italy.—A concise statement upon the present and future position of electrification of the State Railways by the U.S. Assistant Trade Commissioner, at Rome, was recently published in *Commerce Reports.* It is shown that the total length of the State Railways is 15,908 km. At present the electrified portion amounts to 683 km., mostly in the Genoa, Lecco, Milan, Savona, and Turin districts. A further length of 87 km. is almost completed. As regards the future, the position is as follows:—Lines for which electrification has been authorised by ministerial decree have a total length of 2,695 km. Surveys and plans are well advanced in connection with a further 352 km. 593 km. of line is to be completed by 1926, and plans are under consideration for another 706 km. to be converted by 1926. Thus the total electrified length in that year will be 5,116 km. The lines with the greatest traffic density have been selected, the figures for these being 360 metric tons per km., as against 80 in the case of those lines not yet down for electrification. Ninety-six locomotives have been ordered from several Italian firms for delivery by October 31st next. These range in price from 1,150,000 to 1,550,000 lire.

London.—Piccadilly Railway Extension.—The London Electric Railway Co. is shortly placing contracts for the extension of the "Piccadilly" tube from Hammersmith to Ravenscourt Park, where it will join the Metropolitan District Railway and the almost disused London and South-Western line. From Ravenscourt Park to Turnham Green the London and South-Western track is to be electrified. The main object of the new construction is to relieve the Metropolitan District line from some of the heavy Richmond traffic. It will provide a through route from Finsbury Park to Richmond (13¼ miles) and Hounslow (16¼ miles).

Manchester.—Reconstruction.—During the early part of the week the busy junction where Market Street intersects Cross Street was closed to all vehicular traffic while reconstructional work was carried out. The worn track and crossings are to be renewed and the line along Cross Street straightened out—an improvement permitted by the widening due to the construction of the new Royal Exchange.

Nottingham. Proposed New Route.—A sub-committee of the Tramways Committee recently considered the question of running a tramway service to Beeston; it eventually decided to refer the matter to a meeting of the main committee.

Southport.—Year's Working.—The annual report on the tramways for the past year shows a gross profit of £27,701, which is £3,012 more than in the previous year. Traffic receipts dropped from £80,389 to £78,293, but working expenses were also less, *viz.*, £51,242, as against £56,330. Of the gross profit, interest on loans absorbed £9,355, sinking fund £6,017, renewals fund £6,628, income tax £3,800, and £1,900 was taken to wipe out the previous year's deficit. The number of car miles run fell from 888,492 to 812,420.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—Cable Monopoly Renounced.—The American State Department has received advice that the Argentine Government has accepted the renunciation by the Western Telegraph Co. of its monopoly rights in Argentina. It is explained that the effect of the Argentine Government's action will be to open up South America to the All-America Western and Western Union Companies, with equal privileges in all the South and Central American Republics.—*Financial Times.*

France.—New Telephone Invention.—M. Sinturel, a French postal official, has invented a new apparatus by which he claims that six or even eight telephone conversations can be conducted simultaneously on one wire. He claims that no alteration in the existing circuits is necessary, and calls his apparatus the "telemultiphone." During the war he was head of the wireless service at General Headquarters.—*Reuter* (Paris).

Wireless Telegraph Congress.—The Congress of French Wireless Telegraphy, which opened last week at the Marseilles Colonial Exhibition, will furnish an opportunity for concerting measures to bring France and her colonies, and the colonies among themselves, into regular and rapid communication by wireless. While much has been accomplished much remains to be done if the French are finally to free themselves from their dependence on foreign submarine cables. *The Times.*

Forest Fires.—Devastating forest fires have started on the Vaufreges Hills, many telegraph poles have been burned down, and communication has been cut between Marseilles and Laciotat.—*Reuter* (Marseilles).

Ireland.—Cable Station Freed.—It is officially announced that the Irregulars have been driven from Waterville cable station, in Kerry, and that a guard of National troops is now stationed there. The damage done to the cables is being repaired. *Westminster Gazette.*

More Telegraph Lines Cut.—The telegraph wires between Mullingar and Athlone were cut on August 24th.—*Evening News.*

An official bulletin issued by the Publicity Department of the South-Western Command, Limerick, on August 24th, records that a boat arrived in Valentia Harbour, and the occupants, who were Irregulars, proceeded to cut the transatlantic cables. They had succeeded in severing one when troops arrived, and the cable cutters departed.—*Daily News.*

Wireless Telegraphy.—Broadcasting.—The articles of association of the proposed British Wireless Broadcasting Co. have been submitted for the approval of the Postmaster-General. Mr. Kellaway is on holiday, and it was stated at the General Post Office last week that after the permanent officials had examined the articles it might be necessary to forward them to him. In the circumstances it was impossible to name a date for the inauguration of the scheme.—*The Times.*

Police Apparatus.—A large van containing the first travelling wireless receiving station of the Metropolitan Police drove into the courtyard at Scotland Yard on August 24th, and a number of detectives listened-in to a concert which was going on at Marconi House. Travelling wireless stations will, it is expected, play a great part in the detection of crime in the future.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—Victorian Electricity Commissioners. January 15th, 1923. Four water-tube boilers, each 4,500 sq. ft., with pumps, piping and structural steelwork for boiler-house.

January 23rd. Back-pressure steam turbine, including a 1,500-kW turbo-alternator.

October 17th. Postmaster-General's Department. Automatic c.b. telephone equipment, together with all associated equipment, including apparatus for use at subscribers' premises (August 18th.)

Victorian Railways. November 29th. Three electric storage-battery industrial trucks capable of carrying 4,000 lb. at five miles an hour.

Sydney.—October 23rd. Municipal Council. Two thousand 240-V d.c. and 25,000 240-V single-phase electricity meters.—*Reuter's Trade Service* (Sydney).

Belfast. September 11th. Electricity Department. Stores (including wires, cable, lamps, electrical accessories, &c.) for six months. (August 25th.)

Belgium.—Brussels.—September 31st. Municipal authorities. Installation of a number of new boilers at the central electricity station. Particulars (10 fr.) from 11, Rue Sainte Catherine, Brussels.

September 20th. Municipal authorities of Coursol (Province of Limburg). Establishment of a l.p. distribution system in the town.

Belgian Congo.—January 5th, 1923. Belgian Ministry of the Colonies. Installation of an electrical distribution system for the town of Elizabethville. Further to our note on page 200, Elec. Rev., August 11th, a copy of the general condition of tender in French can be consulted at the Department of Overseas Trade (Room 49).*

Blackpool.—September 7th. Health Committee. Electric wiring of abattoirs. Specification, &c., from the Electricity Works Offices, West Caroline Street, Blackpool.

Brazil.—S. Luis do Maranhao.—November 27th. Municipal Council. Concession for an electric light, power, and traction supply and an electric tramway system, the concession to run for 30 years.*

Brentford.—September 25th. Board of Guardians. Six months' supply electric lamps and accessories. Mr. F. E. Harmsworth, clerk, 24, Twickenham Road, Isleworth.

Brighton.—September 18th. Electricity Department. Two water-tube boilers, superheater, economiser, steel chimneys, fans, feed pumps, steam pipes, valves, &c. (August 18th.)

Chile.—September 14th. Chilean State Railways. Electrical plant for the San Rosendo station. Departmento de Materiales y Almacenes, Alameda station, Santiago, Chile. Representative of the Chilean Railways at Paris, M. Bertrand, Boulevard St. Michel 33, Paris.*

Egypt.—Cairo.—September 11th. Ministry of Public Works. Installation of switchboard and system of armoured feeders for works of the Palais de Ras el Tine, Alexandria. Chief electrical engineer, Electrical Service, Ministry of Public Works, Cairo.—*Reuter's Trade Service* (Cairo).

Holmfirth. — September 7th. Electricity Department. E.h.p. switchgear, l.p. switchgear, transformers, underground cables, and feeder pillars. (August 25th.)

Llanfyllin.—The Town Council has decided to ask for tenders for installing electric lighting in the town hall.

London.—Hammersmith.—September 7th. Electricity Department. Transformers, oil-cooled and air-cooled; e.h.p. cables; e.h.p. and h.p. switchgear. (August 18th.)

County of London Electric Supply Co.—October 18th. Supply and erection of steam turbo-alternators for the Barking power station. (August 25th.)

Edmonton.—September 14th. Board of Guardians. Six months' supply of electric lamps. Mr. E. Ridley, clerk, 77, Bridport Road, Edmonton, N.18.

Bermondsey, S.E.—September 14th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Reeve, clerk, 283, Tooley Street, S.E.

Westminster.—September 13th. Board of Guardians. Supply of electric lamps, fittings, &c. Mr. W. J. Lickley, clerk to the Guardians, Princes Row, Buckingham Palace Road, S.W.

Manchester.—September 9th. Waterworks Committee. One electrically-driven air compressor. (August 25th.)

September 12th. Tramways Committee. Steel girder tramway rails; general stores. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Merthyr Tydfil. September 5th. Board of Guardians. Electrical fittings for six months. Mr. F. T. James, clerk, High Street.

New Zealand. Auckland. February 1st, 1923. Harbour Board. Twenty-two electric cranes for Princes Wharf.

Wellington.—October 24th. Public Works Department. 400 miles 19/13 S.W.G. bare h.d. copper wire for Mangahao electric power scheme.*

Small electrical installation for a municipal corporation, consisting of one 50-h.p. and two 100-h.p. sets, to be run separately or together. System 3-phase a.c., at 2,300 or 2,500 volts, to be broken down to 230 volts and 400 volts. The engine to be driven by crude oil or producer gas. Conditions for complete plant, including transformer equipment and switchboard, to Messrs. Wm. Coward & Co., Ltd., 22, Buckingham Gate, S.W.1.

Plymouth.—September 12th. Electricity Department. Steam turbine [illegible] electrical pump. (August 25th.)

South Africa. — October 18th. High Commissioner. Electrification of the South African railways, Maritzburg-[illegible]. Equipment. Coal handling plant, ash-handling plant, [illegible] water-screening plant. Specifications from the Office of the High Commissioner for the Union of South Africa, 116, Pall Mall, S.W.1.

Bloemfontein. — September 20th. Municipal Council. 1,200 yd. of 4-core, .2 sq. in., 660-V paper-insulated armoured cable.

Pretoria.—September 28th. Municipal Council. Electric capstans, coal elevator, ash elevator, and coal-stacking elevator.*

Johannesburg. — September 27th. Municipal Council. House service meters and time switches.*

St. Annes-on-Sea.—Electricity Department. 3,530 yd. [illegible] 25 l.p. 3-core armoured cable; 1,160 yd. 7/.22 l.p. ditto; 500 yd. .2 x .2 x .1 l.p. ditto. (August 18th.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Glasgow.—The Corporation has decided by two votes to accept the offer of the United States Steel Products Co. for the supply of rails for special tramway track work amounting to £15,325. Messrs. Hadfields, Ltd., Sheffield, quoted £18,962.

Tramways Committee. Recommended :—
[illegible] M. Bringan
[illegible], Ltd., Brown & Co., Ltd.

Huddersfield.—For electrician's work in connection with conversion of warehouse and offices, Northumberland Street, into kinema theatre, the tender of Messrs. J. W. & R. Graham, Huddersfield, has been accepted.

FORTHCOMING EVENTS.

International Radio and Wireless Exhibition and Conference. September 2nd to 8th. At the Central Hall, Westminster.

Iron and Steel Institute. Annual meeting Tuesday and Wednesday, September 5th and 6th. At the Museum of the Yorkshire Philosophical Society, York. Commencing each day at 10 a.m.

British Association for the Advancement of Science. September 6th to September 13th. At Hull. Annual meeting.

The Nations' Food Exhibition. Olympia. September 6th to 26th.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to inquiries received this week we need the names of suppliers or manufacturers of :—
Brevard electric lighting sets.

NOTES.

Amateurs' Wireless Masts.—Steel masts, instead of wooden masts, which are difficult to obtain, and often unsuitable [illegible] recommended by *Steel Structures* for use in connection with amateurs' wireless installations. A simple tubular mast 30 ft. or 40 ft. high is usually suitable. This [illegible] is made up of several lengths of galvanised solid drawn tube, each length being slightly less in diameter than the one immediately below it. A cross-bar may be inserted in the upper end to provide a ready means of attaching the span [illegible] and [illegible] inserted around one of the sockets permit of the [illegible] of guy ropes. For larger installations lattice girder masts are available, and are as easily erected.

Association of Engineers in Charge.—Prof. H. S. Hele-Shaw, [illegible], has consented to succeed Capt. H. Riall Sankey, C.B., C.B.E., R.E. (retired), as President of the Association for the 1922-23 session. This is the second time [illegible] been President of the Association, he having occupied the chair in 1912-13. The Presidential Address will be delivered in October.

The Electric Vehicle Committee.—A meeting of the Electric Vehicle Committee of Great Britain was held at the Institution of Electrical Engineers on July 13th, when Mr. F. Ayton occupied the chair, and the first business taken was the election of officers of the Committee. Mr. Ayton recalled the fact that when he resigned the hon. secretaryship on his leaving municipal service he had agreed at the unanimous wish of the Committee to remain chairman of the Committee until the end of the official year. He felt obliged to adhere to his decision to retire from the chairmanship partly on account of the great pressure of other duties.

Mr. J. A. Priestley (cleansing superintendent of the Sheffield Corporation) was then elected chairman of the Committee; Mr. W. H. L. Watson (Electricars, Ltd.) was elected senior vice-chairman; and Mr. W. Worby Beaumont, junior vice-chairman. Mr. E. E. Hoadley was re-elected hon. secretary; and Mr. John Christie, hon. treasurer. The report of the publishers of *The Electric Vehicle* recorded continued progress, and a letter was read from the Society of Motor Manufacturers and Traders stating that Col. Newton had been elected a representative of the Society on the Electric Vehicle Committee in place of Mr. Hixson. Mr. P. Still (Chelsea Electricity Supply Co.) has resigned as representative of the electricity supply companies in London, and no other name was put forward. The report of the Publicity Committee, consisting of Mr. J. W. Beauchamp, Mr. W. Alderson Smith, and Mr. E. E. Hoadley, was approved. A scheme of newspaper advertising in connection with electric vehicles will be carried out, and proposals will shortly be announced for a prize competition in the design of a poster for electric vehicles. The hon. secretary reported the result of the invitation recently issued to electricity supply authorities, manufacturers, and others, in connection with subscriptions to the Electric Vehicle Committee. The Institute of Cleansing Superintendents has appointed Mr. J. A. Priestley, and Mr. J. E. Everitt (cleansing superintendent, Hampstead), to represent it on the Electric Vehicle Committee.

Mr. Makower reported that the electric vehicle section of the Society of Motor Manufacturers and Traders was considering the production of a standard illuminated sign indicating the position of electric vehicle charging stations.—*Electric Vehicle.*

Fatalities.—A locomotive fireman named Harry Hartley died at Manchester on August 22nd, as the result of an electric shock. He was attending to an engine at Victoria Station and upon alighting from it, his foot came in contact with the wooden guard of an electric rail. Rain during the day had soaked this, making it conductive, and Hartley in this way received a shock at 1,200 V. An engine driver removed him from the rail, but upon the way to Roby Street Hospital the man succumbed.

By accidentally cutting an electric cable when engaged at a fire at Grimsby, Fireman James Troop was seriously injured, says the *Daily Mail*.

A London resident, Mr. J. A. Chappell, was injured on August 26th by a lift accident at Ilfracombe, and succumbed on the following day. His wife had entered the electric lift of the hotel at which they were staying and as Mr. Chappell was entering, the lift commenced to ascend and he was caught between the lift floor and the wall. It is presumed that Mrs. Chappell must have accidentally moved the starting lever.

On August 27th an early-morning electric train running from Queen's Road to Clapham Junction on the London and South Western Railway ran into a group of platelayers. One William Rushby, of Croydon, was killed, and two others, Charles Wingate and William Gore, were slightly injured.

Sheriff Orr and a jury, on August 24th, conducted an inquiry at Edinburgh regarding the death of a baker in a bakehouse. At the time of the fatality it was stated that death was due to suffocation from fumes given off by an electric cable which had fused in the street. With the fusing of the cable the insulating material caught fire and was supposed to have given off heavy fumes which, it was stated, found their way into the bakehouse. An official of the Corporation Electricity Department stated that the cable in question was laid in November, 1902. The insulating material which had apparently given off the fumes was composed of vulcanised bitumen, but that method was discarded 18 years ago, and lead-sheathed cables were now being used.

Educational. Polytechnic, Regent Street. *Electrical Engineering Department.* The 1922-23 session opens on September 19th for day courses, evening classes commence on September 25th. Enrolments for evening classes commence September 13th.

Lectures on Costing.—A special course of lectures on costing will be delivered by Mr. R. G. Legge on Fridays at the Polytechnic, Regent Street, W., commencing September 29th. (For full particulars see our advertising pages to-day.)

Institute of Metals.—A notable feature of the forthcoming Swansea meeting of the Institute will be the inauguration of a series of annual public lectures on subjects of practical interest to those engaged in the non-ferrous metals industry.

Dr. R. S. Hutton, a member of council and director of the British Non-Ferrous Metals Research Association, is to deliver the first of the new lectures, this being entitled "The Science of Human Effort (Motion Study and Vocational Training)." The lecture will be given on September 19th. Tickets can be obtained from Mr. G. Shaw Scott, 36, Victoria Street, London, S.W.1.

Proposed Institution of Structural Engineers.—*Steel Structures*, the quarterly journal of the Steel Structural Section of the British Engineers' Association, states that a movement is afoot to form a non-trading technical institution to cater for the interests of constructional engineers. Mr. Douglas Young, consulting engineer, of 6, Queen Anne's Gate, S.W.1, is in charge of the project, and it is reported that Mr. E. Fiander Etchells, the present president of the Concrete Institute, has been invited to act as the first president.

Institution of Engineers (India). The April *Journal* of the Institution is a bulky volume of 161 pp., supplemented by a large number of plates. The papers reprinted include "Hydro-Electric Power in Mysore," by S. G. Forbes. The second annual general meeting is reported in full. At this the report for the year ended August 31st, 1921, was presented. The report records an increase in membership to 567, and the accounts show an excess of receipts over expenditure of 27,078 rupees. The presidential address of Major G. H. Willis gave a concise review of the position of the Institution. He showed that the co-operation of the Institution had been invited in several matters, as, for instance, the revision of the standard specification for steel rails, the drawing-up of a standard specification for Portland cement for India, and the work of formulating engineering standards for India formerly carried on by the Electro-Technical Commission. He pointed out that membership of the Institution was already regarded as a testimonial to qualifications, and a rigid standard was being maintained.

Fire.—The whole of the huge switchboard in the power house at the Barrow Iron & Steel Works was completely destroyed by fire, believed to be the result of a short circuit, on August 25th, and practically the whole of the works were brought to a standstill, including two blast furnaces, the rail mills, the Siemens furnaces, and the foundries. Temporary arrangements were made with the Corporation for supplying the motive power, and the works were again in operation on the same scale as before the fire on Monday of this week.

X-ray Martyrs.—Two cases of severe injuries caused by X-rays have been reported in the course of the last few days. In both cases the victims have had to suffer the loss of an arm. The two gentlemen who have made this sacrifice for the advancement of X-ray science are Prof. Bergonié of the Faculty of Medecine, Bordeaux University, who has already suffered the removal of several fingers, and Dr. Reiss, of the Medical School, Metz.

Americans Study European Transport. — Twenty-five aldermen of the Chicago City Council recently toured the principal cities of Europe, including London, Paris, Berlin, Hamburg, Vienna, Prague, and Munich, to study transport conditions and systems. Their main object was to investigate the working of municipal ownership as against company ownership, and the leader of the party expressed himself as being in favour of the former.

Ignition of Coal Dust by Arcing.—The *Colliery Guardian* states that in America the extensive use of pulverised coal for fuel in industrial plant has brought to the front again the question whether coal dust can be ignited by an electric arc. Messrs. L. C. Ilsley and E. J. Gleim review the work done by Thornton and Bowden with electrical flashes in coal dust, and report two preliminary investigations conducted by the United States Bureau of Mines.

In the first series of tests, the source of potential was a 200-kW direct-current generator connected in series electrically with another generator of a booster set, so that any desired voltage up to 750 volts could be obtained. The cloud of dust was set in motion by a blower at the bottom of a chamber (16-in. inside diameter) and passed from the chamber into a 6-in. pipe by which it was returned to the intake of the blower and thus kept in motion. The density of the cloud could be determined photometrically, according to the amount of light that penetrated it. By calibration, different densities could be approximated. When the dust was so thick in the cloud that the lamp could not be seen through it, a readily explosive mixture was attained. The electric arc was made by separating the ends of two rods in contact. The coal dust used in nearly all the tests was bituminous obtained from the Pittsburgh bed at the Bureau's experimental mine, and passed through a 70-mesh screen. The approximate analysis of this coal as received in the analytical laboratory showed 1.91 per cent. moisture, 37.03 per cent. volatile matter, 55.77 per cent. fixed carbon, and 5.29 per cent. ash. In 637 flashes only 34 ignitions were obtained. The voltage ranged from 750 down to 220 and the current from 0.25 A to 40 A. The results were curiously inconsistent, varying no doubt with the type of mixture and other conditions. Although 100 arcs were made with a current of .87 A at 674 V, there was not a single ignition. When 40 A at 220 V was used, there were 11 ignitions from 14 flashes.

In the second series of tests, an endeavour was made to produce conditions still nearer to those that might exist in a mine. The testing gallery apparatus consisted of a [illegible] shell 6 ft. in diameter, in which was a trough 20 in. wide, 12 in. deep and 5 ft. long. Dust was placed in this trough and on shelves at the side, so that when a hinged door made of 2-in. plank was permitted to fall, a cloud of dust was raised and directed to [illegible] the explosive [illegible] an electric arc. Difficulty was experienced in obtaining a propagation of an explosion. After experimenting with different amounts of dust, moving the arc nearer the bottom of the gallery, and modifying the scheme for producing the cloud of dust, fairly consistent results were obtained under what may be considered practical "field" conditions.

In these tests, each trial consisted of five successive flashes, unless fewer flashes caused ignition, and out of 39 trials the number of ignitions was 17—a much higher proportion than given in the first series of tests. The voltage remained at 650 while the current varied from 0.10 A to 0.50 A. The difficulty of obtaining consistent results on a large scale lies mostly in the inability to produce a uniform dust cloud in a single test or during a series of tests. With this problem solved for a given kind of coal dust, it is believed fairly consistent results could be obtained. For samples of dust differing in constituents, it is likely a different set of results would ensue.

An Electrical Stethoscope.—A simple but very useful piece of apparatus that has been made by Mr. E. Humphries and used by him for some five years may be described as a "listening-in" apparatus for use on small d.c. supply systems. It consists of a double head gear telephone receiver and induction coil, the primary of the coil being connected in series with a radiator lamp taking a current of about 1 amp. A flexible cord is attached with an adaptor to connect up to any lampholder, thus lighting up the lamp through the primary winding. The receiver, of course, is connected across the ends of the secondary winding. Mr. Humphries, being in charge of a small generating station and supply system in Devon, has found this apparatus invaluable, and having a total of 150 h.p. in small motors on the supply system, it is possible to listen in on any part of the system and detect any unusual disturbance; any motor with bad commutation, faulty brush gear, or bad motor-starter can easily be located by the peculiar noises. Every motor has its own particular note, and one running badly can be distinctly heard above the rest. The slipping of a belt is heard easily owing to the erratic rise and fall of the current, also a motor driving a circular saw. The starting and stopping of a motor also conveys a lot of useful information to the interested listener. A single-stroke pump driven by belt was fixed up during the war about a mile away from the supply station to supply water to a war hospital. This had to be attended to by the supply company's staff and was left running all day. The pump worked at 60 strokes per minute, and any irregularity in the running was easily heard on the telephone. Many weird sounds and happenings too numerous to mention can be heard—a loud crack tells of a short circuit, and can be heard anywhere in the room. This apparatus is chiefly used at Mr. Humphries' home, which is some distance from the station, and should prove interesting to other engineers in a similar position.

The Next President of the F.B.I.—It has been reported in the daily Press that Sir Eric Geddes will probably be the next president of the Federation of British Industries, in succession to Col. Armstrong. The rumour cannot be confirmed, as the president will be elected at the annual general meeting this month, but it is stated that Sir Eric has been approached and has returned a favourable reply, and in that case there can be no doubt as to the result of the election.

Wages in the Tramway Industry.—The employers in the tramway industry have given notice to terminate the sliding-scale agreement on September 21st, and propose to reduce wages by 12s. a week in three instalments, taking effect in September, October, and November. The representatives of the employés on the National Joint Council have unanimously rejected the proposal, claiming that the existing agreement should remain in force for 12 months. The employers have offered to submit both proposals to the Industrial Court, but the employés will not agree to this, and the Transport and General Workers' Union is organising a national campaign in opposition to the reduction, commencing at Manchester on Sunday next.

Another Short-circuiting Rat.—Rats are frequently the cause of considerable trouble in electrical installations of one kind and another. An interesting example of this recently occurred in the power station of a prominent Lancashire corporation. Incidentally, it afforded an excellent tribute to the design and manufacture of G.E.C. turbo-alternators.

A certain rodent managed to cause a "dead short" on the main bus-bars by getting across the bus-bar side of the oil switch. The "short" lasted 1½ minutes, due to the fact that the charge engineer happened to be away from the switchboard. A 3,000-kW G.E.C. turbo-alternator was running on load at the time and far from there being any untoward happening, the voltage died down naturally and a careful inspection of the alternator subsequently revealed that no damage whatever was sustained by the machine.

"The Scientist."—A wireless invention which enables a man to watch another at a distance beyond the range of unassisted human vision, is a feature of a British film drama being produced at Shepherd's Bush. It is, of course, only an "invention" for film purposes. The film story, called at present "The Scientist," has been written by Miss Alicia Ramsay, authoress of the Byron film "A Prince of Lovers." She and the producer, Capt. C. C. Calvert, have studied the technique of wireless telegraphy so that technical inaccuracies may be excluded from the film. The theory of the invention is that light reflected on sensitive cells, within the range of which is the man under surveillance, is transmitted by ether-waves to the receiving apparatus, which projects them on the screen in the form of a picture of all that the watched man is doing. Capt. Calvert is also trying to show on the screen the accidental killing of a man by a Rontgen-ray spark. The man comes in the path of the ray and the difficulty is to show the passage of the spark and its arrival at his body. To complicate matters the man is holding a revolver, and the audience must be made to understand that the ray has not been attracted by the revolver, the explosion of which after his death is an important part of the story.—*Evening News.*

Electricity in Agriculture.—According to information compiled in Stockholm from the results of an inquiry concerning the use of electricity in agricultural districts in Sweden, a supply is available and is utilised to a considerable extent. Between 1917 and 1921 the electrified areas increased from 6.4 per cent. to 38.5 per cent. of the acreage under cultivation. It is calculated that the electrified area now amounts to 61,750 acres, or 25 per cent. of the total acreage under cultivation.

Indian Contract for Vickers, Ltd.—Messrs. Vickers, Ltd., have secured an important Indian hydro-electric contract. This is related to the development of the Bari Doab Canal, Punjab, where a head of about 6 ft. is to be used to develop 1,925 h.p. Energy from this source is to be used principally for irrigation purposes, and will be transmitted to a number of pumping stations.

The development of so much power from this low head makes the undertaking of great interest to hydro-electric engineers, and it is gratifying to know that British manufacturers are able to deal with such a problem.

Appointments Vacant.—Constructional draughtsman for the Watford U.D.C. Electricity Department; junior assistants for the Installation Department, Birmingham Electricity Works. (See our advertisement pages to-day.)

OUR PERSONAL COLUMN

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. CHARLES D. LIGHTFOOT has relinquished the post of chief engineer to the Crystalate Manufacturing Co., Tonbridge, which he has held for the past ten years, and has taken up the appointment of works manager to the Solidite Manufacturing Co.

Mr. J. EDWIN STORR, superintending engineer of the Construction Department of the Yorkshire Electric Power Co., Ltd., for the past eleven years, terminated his services with that company on August 31st, for the purpose of commencing in business on his own account, dealing with all classes of generation, distribution and installation work. Mr. Storr will shortly open an office in Leeds; in the meantime inquiries may be addressed to "Lindum," Street Lane, Leeds.

The Hackney Board of Guardians has increased the salary of its engineer-in-charge, Mr. F. J. W. BETHEL, from £300 to £350 per annum (with emoluments). Also, in recognition of the way in which special work, including the installation of electrical plant, has been carried out he has been granted a gratuity of £100.

The Bessemer Medal was awarded this year by the Iron and Steel Institute to Dr. KOTARO HONDA, the celebrated Japanese scientist, for his researches into the magnetic properties of iron and steel. Dr. Honda, who was born in 1870, has devoted nearly 30 years to the study of physics, and a great part of this time has been occupied by the research for which the medal was awarded. He has occupied the Chair of Physics at the Tohoku Imperial University, and was one of the founders and first president of the Iron and Steel Research Institute of Japan. Dr. Honda has a fertile pen, and the results of his studies have been given in a large number of papers and several monographs and text books. Among other honours conferred upon Dr. Honda are included the gold medals of both the Institutes of Electrical and Mechanical Engineers of Japan. In addition to his duties at the University, Dr. Honda is a member of the National Research Council of Japan and of the Aeronautical Research Institute of Tokio.

Engineer Vice-Admiral SIR GEORGE GOODWIN, K.C.B., late Engineer-in-Chief of the Fleet, and Dr. JAMES COLQUHOUN IRVINE, C.B.E., F.R.S., Vice-Chancellor and Principal of St. Andrews University, have been appointed by an Order in Council to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

Obituary.—C. A. HEMINGWAY.—We regret to record the death of Mr. Charles Arthur Hemingway, which took place at Teddington on August 13th. Mr. Hemingway was one of the pioneers of electrical contracting, being, in his early days, associated with Messrs. Drake & Gorham. Afterwards, with a partner, he opened under the style of Hemingway & Pritt, at Victoria Street, S.W., and at Richmond. At a later stage he joined the staff of the General Electric Co., Ltd., where his ripe experience and genial personality made him a valued employé and a respected colleague.

J. RENÉ BENOIT.—In the *Revue Générale de l'Electricité* an account is given of the work of M. J. René Benoit, who died on May 5th, 1922, aged 78. M. Benoit was a physicist of the first rank; trained as a medical man, he abandoned that profession in order to pursue the study that he loved. Under Jamin he carried out a classical research on the resistivity of metals, and in 1878 he became assistant to the director of the International Bureau of Weights and Measures, which had just been established. There he was in his element; he was appointed director in 1889, and held that post until 1915, when the International Committee, on his retirement, conferred on him the title of honorary director in recognition of his distinguished services.

M. Benoit developed the methods of measurement of the expansion of substances with temperature to a degree of perfection which left hardly any scope for further improvement, and carried out numerous researches in connection with the determination and comparison of the international standards of length, in which he was aided by the present director, M. Ch. Ed. Guillaume. His collaboration with Michelson in 1892 and with Fabry and Perot in 1906 resulted in increasing by 100 times the accuracy with which the wave-lengths of light were known. To electrical men the most important of his achievements were connected with the construction of mercurial standards representing the resistance of one ohm; the International Conference on Electrical Units which met at Paris in 1884 adopted the value of 106 cm. × 1 mm.^{2} at zero C., and M. Benoit was instructed by the Minister of Posts and Telegraphs to construct four mercurial standards of these dimensions; his expert knowledge of thermometry stood him in good stead, and his four standards when completed differed by less than two parts in 100,000 from the value named at. M. Benoit made and distributed many copies of his standards. Ten years later, at the Conference held in London, the value 106.3 cm. was adopted, and again M. Benoit was called upon to embody it in new mercury standards, for which purpose he employed the most refined methods, an accuracy of one part in a million being attributed to the mean value of the ten units that were made. He was made an honorary member of the Physical Society of London and of the Société Francaise des Electriciens, and was appointed Correspondent of the Bureau des Longitudes and of the Academy. He was an Officer of the Légion d'Honneur.

NEW COMPANIES REGISTERED.

"B. N. B." Wireless, Ltd. (183,840).—Private company. Registered August 18th. Capital, £5,000 in £1 shares (3,500 pref.). To take over the business of manufacturers of and dealers in and agents for the sale of instruments, apparatus, accessories, and materials for radio or wireless telegraphy and telephony carried on by B. Bryan, T. N. Newton, and H. D. Bloomfield at 27, Water Street, Liverpool, as "The Anglo-American Radio Co." The first directors are: B. Bryan, 34, Cairns Street, Princes Park, Liverpool, radio engineer; T. N. Newton, 1, Delta Road, Litherland, Liverpool, haulage contractor; H. D. Bloomfield, "Alderstone," Mayfield Road, Timperley, Cheshire, engineer. Registered office: 65, Renshaw Street, Liverpool.

Corwen Electric Light Co., Ltd. (183,842).—Registered August 18th. Capital, £2,000 in £1 shares. To adopt an agreement with R. V. Wynn and to carry on the business of suppliers of electricity in all its branches. The first directors are: J. W. Black, Crown Hotel, Corwen; W. McCalium, "Bodheulog," Corwen; W. J. Kington, "Iscoed," Corwen; D. Davies, "Glanaewen," Corwen; M. Hughes, "Tyisa," Corwen; K. J. Jones, "Primavera," Corwen; R. W. Jones, The Stores, Corwen. Minimum cash subscription, £1,200. Qualification, £20. Remuneration (if any), as fixed by the company. Solicitors: I. Lloyd John, Corwen, N. Wales.

Standard Wireless Supplies, Ltd. (183,924).—Private company. Registered August 22nd. Capital, £5,000 in £1 shares. To carry on the business of sellers of wireless receiving sets on the hire-purchase system, &c. The subscribers each with 100 shares are: E. Smith, "The Grange," Strines, Cheshire, engineer; F. S. Des Barres, 330, High Street, Ponders End, Middlesex, accountant. The subscribers are to appoint the first directors. Secretary H. O. Collyer. Registered office: 76, Finsbury Pavement, E.C.2.

Cinema Broadcasting, Ltd. (183,954).—Private company. Registered August 24th. Capital, £100 in £1 shares. To carry on the business of "broadcasting," by means of wireless or otherwise, news, theatrical, concerts, and other like performances, to manufacture and deal in broadcasting sets and to dispose of the same to kinema theatre proprietors, &c. The subscribers (each with one share) are: A. E. Jennings, 73, Ashbourne Road, Mitcham, Surrey, clerk; P. F. Hedges, "Elmswell," 27, Fairmead Avenue, Westcliff-on-Sea, clerk. The first directors are not named. Registered by Peter Thomas & Clark, 1, Bush Lane, Cannon Street, E.C.4.

Western Union Code Co., Ltd. (183,886).—Private company. Registered August 21st. Capital, £100 in £1 shares. To carry on business as agents for the sale of telegraphic codes and cable registers and similar publications, &c. The first directors are:—Mrs. Anne J. Barnes and C. M. Barnes, both of 23, Pellatt Grove, Wood Green, N. Qualification, 10 shares. Registered office: 604-5, Salisbury House, E.C.2.

Union Wireless Co., Ltd. (183,891).—Private company. Registered August 21st. Capital, £100 in £1 shares. To carry on the business of manufacturers of wireless and electrical apparatus, &c. The first directors are: C. Lazarus, 151, Hammersmith Road, W.14, accountant; V. S. Petrie, 61, Cresswell Road, East Twickenham, accountant. No qualification required. Secretary: C. Lazarus. Registered office: 26, Leather Lane, E.C.

Scott Insulated Wire Co., Ltd. (183,890).—Private company. Registered August 21st. Capital, £12,000 in £1 shares (2,000 8 per cent. cum. pref. and 10,000 ord.). To carry on the business of manufacturers of insulated, electrical, and other wires of all kinds, &c. The subscribers (each with one ordinary share) are: M. J. Morley, 77, Elm Road, New Malden, Surrey, clerk; T. W. Stroud, 60, Ashburton Avenue, Addiscombe, Surrey, clerk. The first directors are: D. H. Scott, W. I. Sandes, and E. G. Oliver. Remuneration of two first-named fixed by agreement, of other directors, £100 each per annum. Registered office: 10, Arthur Street, E.C.4.

Aerophones, Ltd. (183,866).—Private company. Registered August 21st. Capital, £15,000 in 20,000 pref. shares of 10s. each and 100,000 ord. shares of 1s. each. To take over the business carried on as the Westminster Radio Co., and to adopt an agreement with F. R. Pool. The first directors are: F. R. Pool, 60, Cromwell House, Highgate, N.6, engineer (managing director); J. O. Jones, 86, Leeside Crescent, Golders Green, N.W.11, merchant. Remuneration, £100 each per annum (chairman, £150). Registered office: "Morning Post" Buildings, 346, Strand, W.C.2.

B. Hesketh, Ltd. (183,896).—Private company. Registered August 22nd. Capital, £1,000 in £1 shares. To adopt an agreement with B. Hesketh, of High Street, Chalvey, Slough, and to carry on the business of wireless engineers and contractors, manufacturers of and dealers in electric, magnetic, galvanic, and other apparatus, &c. The permanent directors are: B. Hesketh, B.Sc., High Street, Chalvey, Slough, wireless engineer; T. Hesketh, 42, Castle Hill Avenue, Folkestone, managing director for Folkestone Electricity Supply C., Ltd.; R. H. Klein (M.I.Radio E.), 18, Crediton Hill, West End Lane, N.W., wireless engineer; H. L. McMichael (M.I. Radio E.), 32, Quex Road, West End Lane, N.W., wireless engineer. B. Hesketh is managing director and signs for 499 shares. Qualification: £1. Remuneration of managing director, £260 per annum; of others, £5 each per annum. Registered office: High Street, Chalvey, Slough, Bucks.

Acme Radio Valve Co., Ltd. (183,894).—Private company. Registered August 22nd. Capital, £100 in 1s. shares. To acquire and turn to account an invention relating to wireless telegraphy or telephony, &c. The first directors are: H. S. Tyler, 65, Upper Gloucester Place, N.W.; F. Adair, 65, Upper Gloucester Place, N.W.; E. J. Stammers, 13, Poynders Road, Clapham Park, S.W.4. Qualification: 500 shares. Remuneration as fixed by the company. Secretary: E. J. Stammers. Registered office: St. Andrew's House, 32-4, Holborn Viaduct, E.C.

Beckett & Anderson, Ltd. (12,338).—Private company. Registered in Edinburgh August 22nd. Capital, £25,000 in £1 shares (6,000 cum. part. pref. shares and 17,500 ord.). To acquire as a going concern the business of Beckett & Anderson, engineers and electricians, 59-65, Greendyke Street, Glasgow. The first directors are: F. Beckett, 31, Calderwood Road, Rutherglen, Glasgow, electrical engineer; R. C. Anderson, 7, Kersland Street, Glasgow, engineer; J. B. Lang, Johnstone, engineer. Qualification: 250 ordinary shares. Remuneration £900 each. Solicitors: David Inglis, 223, West George Street, Glasgow.

Elgin Electric Supply Co., Ltd. (12,343).—Registered in Edinburgh August 23rd. Capital, £15,000 in £1 shares. To generate and supply electric current for light, power, and any other purpose in or near Elgin. The subscribers (each with one share) are: J. Wittet, 81, High Street, Elgin, architect; W. Carrie, 83, High Street, Elgin, merchant; G. Geddes, Forteath Avenue, Elgin, builder and quarry master; F. A. Ritson, 78, High Street, Elgin, C.A.; J. R. Hamilton, 92, High Street, Elgin, solicitor; J. Young, 92, High Street, Elgin, solicitor; A. G. Cockburn, 92, High Street, Elgin, solicitor. Minimum cash subscription, 10,000 shares. The first directors are: J. Wittet, W. Carrie, G. Geddes, A. N. Rye, 16, Eaton House, Belsize Park Gardens, London, S.W., electrical engineer, and Edward J. Williams, 7, Queensgate, Inverness, electrical engineer. Qualification: 50 shares. Secretary: A. G. Cockburn. Registered office: 92, High Street, Elgin.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

General Wireless, Ltd.—Debenture dated July 28th, 1922, to secure £230, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. H. Burgess, 11, Clement's Inn Passage, W.C.2.

Kelvin-Hardy Electric Co., Ltd.—A. A. Whittingham-Jones, of 41, Castle Street, Liverpool, was appointed receiver on August 16th under powers contained in debenture dated May 1st, 1922.

C. G. Prewett, Ltd.—F. N. Clarke, of 4, Pavilion Buildings, Brighton, was appointed receiver on August 11th, 1922, under powers contained in debenture dated December 23rd, 1919.

C. H. Mason & Co., Ltd.—Mortgage and mortgage debenture both dated August 9th, 1922, to secure all moneys due or to become due from company to Bank of Liverpool and Martins, Ltd., not exceeding £11,500, charged on 65-73, West Street, Gateshead, and company's undertaking and other assets, including uncalled capital.

F. Geere Howard, Ltd.—Particulars of £6,250 debentures authorised August 10th, 1922, charged on the company's undertakings and property, present and future, including uncalled capital; whole amount issued.

Calcutta Tramways Co., Ltd.—Particulars filed of £250,000 second debentures authorised May 8th, and covered by trust deed dated July 25th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, subject to trust deed dated June 4th, 1901, securing £350,000 4½ per cent. first debenture stock, the whole being now issued. Trustees: Beaver Trust, Ltd. (discount and commission, 5 per cent. to subscribers and 2 per cent. underwriting commission, with an overriding commission of 1 per cent.).

General Electric Co., Ltd.—Land Registry charge on Osram-G.E.C. lamp works, Brook Green, Hammersmith, dated August 11th, 1922, supplemental to trust deed dated July 22nd, 1921, securing £3,500,000. Trustees: London City and Midland Executor and Trustee Co., Ltd., 5, Threadneedle Street, E.C.

Parmiter, Hope & Sugden, Ltd.—Mortgage dated August 15th, 1922, to secure £2,500, charged on certain land and premises in Vernon Street, Longsight, Manchester. Holders: Mrs. M. J. Ross, 45, Howard Street, Salford, and others.

Birmingham Central Supply Co., Ltd.—Particulars of £300 second debentures authorised August 12th, 1922, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital; whole amount issued.

A. W. Richardson & Son, Ltd.—Satisfaction in full on July 28th, 1922, of mortgage dated April 3rd, 1919, securing any moneys due or to become due from the company to the Manchester and Liverpool District Banking Co., Ltd.

CITY NOTES.

Southern Brazil Electric Co., Ltd.

The report of this company for 1921 states that, although the net operating results showed a large increase in Brazilian currency, through the fall in exchange a loss of £39,046 was shown after allowing profit for the sale of certain investments. This, added to the debtor balance brought forward, made a total of £76,895 at debit of profit and loss.

The general meeting was held, under the chairmanship of Mr. E. H. Tootal, on August 29th. Mr. Tootal said that the capital re-organisation scheme was awaiting the Court's approval, which would no doubt be obtained soon after the Long Vacation. The anticipated rise in Brazilian exchange had not materialised owing, in part, to political troubles. An encouraging feature was the present prosperity of coffee planters, cotton-growers, and others, which was leading to many new applications for power. The services of the company and subsidiary concerns were all working satisfactorily, and there should be a gratifying increase in currency revenue during the present year.

Tyneside Tramways and Tramroads Co.—For the half-year ended June 30th, 1922, the surplus of receipts over expenses was £4,134, and the balance brought forward was £591. After deducting interest on mortgages, loans, &c., the available balance is £2,711. After paying preference dividend at the rate of 5 per cent. per annum (less income tax); a dividend on the ordinary shares at the rate of 2 per cent. per annum (less income tax); putting £500 to the credit of reserve for renewals, depreciation, and other contingencies, and writing £143 off expenses of mortgage issue, £128 remains to be carried forward. The traffic receipts show a decrease of £9,910 for the period, largely due to trade depression.

Mr. G. E. Henderson has been appointed chairman in place of the late Dr. J. T. Merz, and Mr. Norbert Merz has joined the board.

Stock Exchange Notices.—Dealings in the following have been specially allowed under Rule 148a.

September 7th. Bromley (Kent) Electric Light & Power.—90,000 shares of £1 each, fully paid, Nos. 1 to 90,000.

An official quotation has been granted to £2,500,000 six per cent. first mortgage debenture stock 1925-49 and to 1,500,000 seven and a-half per cent. cumulative preference shares of £1 each, Nos. 1 to 1,500,000, in Whitehall Electric Investments, Ltd.

The undermentioned have been ordered to be officially quoted:—

Bromley (Kent) Electric Light and Power.—90,000 shares of £1 each, fully paid (Nos. 1 to 90,000).

American Telephone and Telegraph Co.—The American Telephone and Telegraph Co. has authorised the issue of new capital stock to stockholders of record September 8th in the proportion of $100 new stock at par for every five shares of $100 each held. The company has declared regular quarterly dividends of $2.25 a share payable January 15th, April 16th, and July 16th, 1923, to stockholders of record December 20th, 1922, March 16th, 1923, and June 20th, 1923.

Companies to be Struck off the Register.—The following are to be struck off the register within three months unless cause is shown to the contrary:—

Institute of Medical Electricity, Ltd.
International Electrical and Mechanical Supplies Co., Ltd.
Pebco Accumulators, Ltd.
Simplex Power Generator Co., Ltd.
United Electrical Works, Ltd.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Interim dividends of 3¾ per cent. on the 7 per cent. preference shares and 2½ per cent. on the 5 per cent. preference shares, both less tax.

Hurst, Nelson & Co., Ltd.—Dividend on ordinary shares at the rate of 2s. per share and a bonus of 1s. per share, both free of tax.

Pinchin Johnson & Co.—Interim dividend of 5 per cent. actual on ordinary shares for the half-year ended June 30th.

Pennsylvania Water and Power Co.—Dividend of 1¼ per cent. on common stock.

British Columbia Electric Railway Co.—Interim dividend of 3¾ per cent., free of tax, on preferred and deferred stocks.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—By an order of the Chancery Court a meeting of preference and ordinary shareholders will be held at Winchester House, Old Broad Street, E.C., on September 14th, to consider, and, if thought fit, approve a scheme of arrangement proposed to be made. A copy of the proposed scheme of arrangement can be seen at the registered offices of the company.

STOCKS AND SHARES.

Tuesday Evening.

The general aspect of Stock Exchange markets is coloured by the foreign political developments. With the mark jumping about in headlong fashion day by day—it has touched extremes of 11,000 and 6,000 in less than a week—the nerves of the investor, as well as those of the speculator, are severely tried, and money tends to keep away from Stock Exchange markets. At the same time, it becomes unfortunately clear that the expectations of a trade revival that were entertained in the spring, stand little chance of fulfilment at present. Consequently, those people who had been keeping money on deposit at the banks, are beginning to despair of wanting that cash for their own businesses.

The result is that attention is being turned once more to Stock Exchange securities, and, although there are more inquiries than orders, a quiet amount of business goes on day by day in the industrial departments. Amongst the purely gilt-edged stocks, the disposition is for prices to droop. A good many financial engagements have to be met this week, more especially on the Friday, when the year's grace from the official conclusion of peace, allowed by the various Emergency Regulations, comes to an end. New issues are conspicuous by their absence. August is invariably a lean month in this respect, owing to the holiday influences at home and abroad.

The electricity supply market is firm, with rises of 5s. in Bromptons to 7¾ and half-a-crown in Westminsters to the same price. City Lights ordinary have risen to 2 1/16. London Electric preference at 5 have lost the half-a-crown they gained a week ago. It is interesting to compare the present interim dividends, declared by the leading companies, with those of a year ago; the table is as follows:

Company.	Div. per cent. 1921.	1922.	Increase.
Brompton	9	9	—
Charing Cross	6	10	4
Chelsea	5	8	3
City	10	10	—
County	5	6	1
Kensington	8	9	1
Metropolitan	4	5	1
St. James'	7	10	3
Westminster	8	9	1

It is not to be assumed from the substantial increases that some of the companies have declared, in their present interim dividends as compared with those of a year ago, that the final dividends will be equally advanced. The companies' policy has been to bring into nearer equality the interim with the final distributions. Nevertheless, as we were mentioning just lately, pleasurable anticipations await the dividends for the year. All the above dividends are "at the rate of" the amounts placed against the companies. In other words, the actual cash paid out is one-half of the figures given.

The Newcastle-on-Tyne Electric Supply Company announces that there will be no interim dividend on the ordinary shares this time, repeating the experience of a year ago. This has had no effect upon the prices of the company's shares. In fact, the 7 per cent. preferences at 23s. are 1s. higher. Urban Electrics at 20s. are half-a-crown up. Brush ordinary remain at 25s. 6d.; English Electric preference strengthened to £1; India Rubber shares at 12s. 6d. are rather easier; Siemens hardened to 27s. 6d.; and the other movements in this group are comparatively small.

Interest in Home Railway stocks has subsided; speculation has drifted to a low ebb in this market. There came a violent rise in Districts, lifting the price to 42 before profit-takers caused a reaction to 41. This still leaves the stock 1½ higher on the week. Metropolitans have been 56 and are now back to 54. Metropolitan Surplus Lands at 55 is a point lower and Central London ordinary assented stock at 67 is similarly down. No changes have occurred in the Underground Electric Railways group. A few of the London traction shares are a trifle easier, London and Suburban preference, for instance, easing off to 9s. 6d., which is 6d. lower than three weeks ago.

The foreign tramways division is dullish, with Mexican Light & Power issues mostly easier. There is still a disappointing absence of news from Mexico, and with no fresh enterprise on the part of speculation, the natural course of prices sags. The British Columbia Electric Railway Co. declares an interim dividend of 3½ per cent., free of tax, on its preferred and deferred stocks. These are advances in both cases of ½ per cent. as compared with August, 1921. They make the yield on the stocks look tempting, and the deferred at 76½ paying as it does 5½ per cent. on the money, free of tax, is worth considering by the speculative investor not averse from taking risks in order to secure a big yield.

Movement in the cable group is confined to a rise of 5s. in Globe preference, which makes the price 11¾. Other members of the same family are holding the improvements secured last week. The American division is exceedingly quiet. Marconis have gone back to 4os., there being a noticeable lack of interest. At the moment, more attention is being paid to other industrials, and the wireless group is out of favour. Radio Corporations, after a rise to 24s., went back to 21s. 9d., shares coming in from the United States. The preferred remain about 14s.

Babcock & Wilcox are unchanged at 2⅞. Rubber shares are heavy, owing to the price of the produce being still a trifle under 7d. per lb. The iron and steel market shows little resiliency, and armaments move with the leading shares in the former group. Amongst new issues, County ordinary hold their premium at 3s. 7½d., and the preference at 1s. 9d. are keeping very firm.

Amongst the sound debenture stocks on offer, a small amount of Yorkshire Electric Power 5½ per cent. is worth mentioning; it can be bought at 102½, with interest in April and October, and pays £5 7s. per cent. on the money. It will be redeemed at 100 in 1944 or earlier. Whitehall Electric investments 6 per cent. first mortgage debenture at 89¼ yields 6¾ per cent. This is, of course, more speculative. Melbourne Electric 6 per cent. general mortgage debenture is on offer at 102, free of stamp and fee. A small interest payment (30s. per cent.) falls due on December 1st; after that, the half-yearly interest in June and December is, of course, the full 3 per cent. British Thomson-Houston 7 per cent. mortgage debenture stock stands at 105, at which it returns 6⅔ per cent. on the money. It is liable to redemption at 102½ between 1931 and 1941; or at 100 in 1962.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	1921.	Price Aug. 29. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7¾	+ ¼	£7 14 10
Charing Cross Ordinary	8	9	7⅜	—	5 17 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6¼	—	4 18 0
City of London	14	14	2⅛	+ 3/32	6 15 6
do. do. 6 per cent. Pref.	6	6	2⅜	—	5 4 4
County of London	8	8	1⅞	—	5 11 4
do. do. 6 per cent. Pref.	6	6	2⅜	—	5 4 4
Kensington Ordinary	9	10	7⅜	—	6 15 7
London Electric	2½	4	2¼	—	5 11 6
do. do. 6 per cent. Pref.	6	6	5	— ¼	5 17 1
Metropolitan	7	7	6⅝	—	6 4 5
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	13	8⅜	—	6 17 2
South London	7	7	6½	—	5 10 0
South Metropolitan Pref.	7	7	1 5/16	—	6 18 0
Westminster Ordinary	10	10	7⅜	+ ¼	6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104½	—	5 14 8
do. Def.	1½	34/6	23½	—	7 9 0
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 9 8
Eastern Extension	10	10	18⅝	—	5 6 8
Eastern Tel. Ord.	10	10	186½	—	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 8 5
do. do. Pref.	6	6	11⅝	+ ½	5 2 2
Great Northern Tel.	24	22	29½	—	7 10 6
Indo-European	10	10	36	—	6 19 0
Marconi	15	15	2⅜	— ⅛	6 13 4
Oriental Telephone Ord.	12	12	23	—	*5 1 1
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 3
Home Rails.					
Central London Ord. Assented	4	4	67	—1	5 19 5
Metropolitan	1½	2½	54	—	4 2 7
do District	Nil	1	41	+ 1½	2 8 10
Underground Electric Ordinary	Nil	Nil	9½	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	3	84½	—	*4 14
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8¼	—	7 17 2
do. do. 2nd Pref.	Nil	5½	8 5/16	—	7 0 9
do. do. 5 per cent. Deb.	5	5	80	—	6 2 0
Brazil Tractions	Nil	Nil	49½	—	8 1 0
British Columbia Elec. Ry. Pcc.	5	5	76½	—	6 9 9
do. do. Preferred	5	9/8/-	69½	—	*6 18 6
do. do. Deferred	3	12/1/-	76½	—	*8 2 4
do. do. Deb.	4½	4½	76	—	5 11 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	73½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	45½	—	Nil
Mexican Light Common	Nil	Nil	20¾	—2	Nil
do. Pref.	Nil	Nil	48½	—2½	Nil
do. 1st Bonds	Nil	5	64½	+1	7 15 0
Manufacturing Companies					
Babcock & Wilcox	15	16	2⅞	—	5 11 4
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	42/-	—6d.	7 2 10
Callenders	15	15	2⅛	+ 3/32	7 1 2
do. 6½ Pref.	6½	6½	1¼	— 1/32	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	Nil	Nil	3/3	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	5	5	17/6	—	5 14 8
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/9	—	5 6 8
Henley	15	15	2½	— 3/32	6 18 4
do. 4½ Pref.	4½	4½	4½	—	5 2 10
India-Rubber	10	—	⅜	— 1/32	—
Met.-Vickers Pref.	8	8	2⅝	—	6 8
Siemens Ord.	15	10	27/6	+6d.	*7 5
Telegraph Con	20	20	28	—	*4 13 9

* Dividends paid free of Income Tax.

FALSE MARKING AND DESCRIPTION OF GOODS WITH SPECIAL REFERENCE TO ORIGIN.

By THEODORE RICH.

Part V.—Actions and Decisions Under the Merchandise Marks Act.

Owing to the fact that most proceedings under the above Act take place before a Court of Summary Jurisdiction, and owing to the great expense involved, there are comparatively few decisions of the High Court of material value with reference to the wording of the Act.

There seems to be little special literature, notes and comments on the law being tucked away in various legal and popular handbooks. The most complete exposition is perhaps to be found in the minutes of evidence of the 1920 Merchandise Marks Committee spread over nearly 6,000 questions and answers.

Two trades have been specially attacked by Anglo-alien tricksters—the linen trade of Ulster and the edge-tool trade of Sheffield. Judging by the 1920 minutes, the Irish Department of Agriculture and Technical Instruction is an exception to the rule that Government Departments refuse to move. A Mr. R. A. Whyte, giving evidence, stated that he had been identified with about 80 prosecutions under the Act, apparently with general success. A material number of these, however, related to foodstuffs.

The Irish Development Association was started in 1906 to administer an Irish national trade mark and to take proceedings against persons in any part of the world detected selling or misdescribing non-Irish goods as Irish goods. This Association successfully prosecuted a trader who advertised and sold Bristol-made boots as Irish, a firm that sold shoddy as Donegal tweed, and stall-holders in an "Irish section" of an exhibition at Shepherd's Bush who sold non-Irish goods, and stopped a Liverpool firm which had only bought one hogshead of Irish tobacco from selling "Irish Home-grown Plug." The success that this Association has had shows what such an organisation can do when it tries.

One case remarkable for the very long time it took to carry through from first to last, and for the great expense involved, was "Lemy *v.* Watson" (1915, 3 K.B., page 731). The defendants had sold tinned "bristing" as sardines, and the plaintiff, representing a number of people interested in the real sardine industry in France, took the matter up; in the end the prosecution was successful, and the defendant, Augus Watson, had to give up the use of the name "sardine."

The Object of the Act.

Lord Reading put the essence of the Act into a nutshell when he said: "The object of this statute was to protect the public against false descriptions which might be given to goods by members of the trade"; in this case the goods were called Norwegian sardines, and not Norwegian sprats, "because by that means they got a better sale for their goods, and they got a better sale because the public did not know that they were buying sprats and not sardines."

An old case, "Starey *v.* Chilworth Gunpowder Co." (24 Queen's Bench Division, page 90), is of interest. In 1888 the powder company made a contract with the Government to supply 5,000 barrels of gunpowder known as "Rifle Large Grain No. 4"; there was no stipulation in the contract that the powder should be made by the company, although in other contracts of the same firm with the Government there was an express stipulation to that effect. Two explosions prevented the company from making the powder; the company was pressed for delivery, and a sub-contract was placed in Germany, and the powder was imported in drums marked "Manufactured in Germany." The powder was repacked in Government barrels and labelled, "Chilworth Gunpowder Co." There was no indication that the powder was German, there was no difference in quality, and the company actually made a loss on each barrel; the powder was accepted by the Government without complaint.

The magistrates found that there had been no intention to defraud, and dismissed the petition. The case went to appeal, and it was pointed out that the label must have been used to convey the meaning that this company, which usually manufactured, had manufactured the powder in question. It was decided that there had been a "false trade description."

It is well known that some years before the war several well-known normally manufacturing electrical firms imported from Germany three-phase apparatus, especially induction motors, the machines being painted up and labelled with the names of the British firms; there is little doubt that the firms could have been prosecuted with success.

Foreign Components.

There have been several cases where watches containing foreign parts have been sold as "English lever," and in the case of "Williams *v.* Turney" (65 Justice of the Peace, page 70) it was decided that the fact that there were some foreign components in a watch did not oblige the Court to decide that there had been a "false trade description," though there was nothing in the law to prevent a magistrate from coming to such a conclusion in view of the nature of the imported parts and the degree of foreign labour and skill involved.

According to the evidence of Mr. Fountain, of the Board of Trade, at the 1920 inquiry, the Board has prosecuted in cases where foreign goods have been described in catalogues and advertisements as of British manufacture; details, however, were not given.

The fact that a manufacturer marks his goods with the place of origin does not necessarily protect him. In the Godfrey Phillips case (*Times*, July 24th, 1909) cigars were sold marked on the box "Bella de Cuba" and with labels on the lids "guaranteed British make." It was held that the combination of words, marks and labels which had been used "were calculated to lead to the belief that the goods were made in the island of Cuba or that the cigars were composed of Havana tobacco, and therefore there was a false trade description."

The genuinely British manufacturers and the more honest section of the commercial community have little grounds of complaint regarding the legal decisions given in the High Court regarding such matters, but they have great cause to complain regarding the delay, expense, and difficulty before they get there.

Intention to Defraud or Lower Value Not Material.

It has been held that the "use of a false description which misleads the public cannot be said to be lawful, even if there was no intention to defraud" ("Holmes *v.* Pipers," 1914, 1 K.B. 57), although the Act only punishes those who use false trade descriptions which are untrue in fact.

In the case of "Kirschenboim *v.* Salmon & Gluckstein" (1898), some machine-made cigarettes were sold under a label marked "guaranteed hand made"; the magistrate decided that the using up of a stock of old labels was not a false trade description within the meaning of the Act. The Court of Appeal, however, decided that the fact that the cigarettes were of as good a quality as those described on the label afforded no defence, the description being "false in a material respect"; the tobacconist had knowingly applied a false description and had not acted innocently, and therefore an offence had been committed. The purchaser was induced "to purchase goods which he would not have purchased if the description in question had been omitted from the label."

Public Entitled to Their Views.

Lord Russell of Killowen said that "people think that hand-made cigarettes are better than those made by machine, and they are entitled to be supplied with what they ask for and pay for . . . . or, again, a person may call for hand-made cigarettes for different reasons independent of the question of quality, as, for instance, the desire to encourage and support the industry of hand workers."

Mr. Justice Hawkins said that "The materiality of the trade description cannot be made dependent on a comparison of the quality of the goods supplied to the purchaser with that of other goods."

In a case where Glauber's salts were sold as soda, "Fowler *v.* Cripps" (1906, 1 K.B.), Mr. Justice Wills said: "The Merchandise Marks Act is an Act passed not to ensure scientific accuracy in trade terms, but to protect trades and to ensure, as far as legislation can do so, that trade shall be carried on honestly, and that terms shall not be applied to substances where the application would, according to the common acceptation of those terms in the trade, lead the purchaser to assume that he was buying something different from what he really was buying."

Proposals for Alteration of the Law.

Since the original Merchandise Marks Act, many proposals have been made to alter and especially to strengthen the law. The lowest grade of merchant and huckster, those who change the labels on the goods they handle with the same nonchalance as they change their own names and nationalities, naturally object to the law as it stands. Owing to representations made some time ago, there is now nothing to prevent a merchant from bringing goods marked "British made" from abroad and shipping them to, say, a South American port, where they can be sold "*per* steamship so-and-so from London."

Compulsory Marking.

Even in places like Sheffield the resistance to "free fraud" is weakening. If the evidence of Trade Union representatives is anything to go by, then the feeling of the working classes in this country is overwhelmingly in favour of the compulsory marking of all goods, although in evidence given in the 1920 inquiry significant sympathy for Germany was shown by some officials.

The politician proclaims from the housetops his love for the masses, but he only too often listens to the blandishments of the international merchant, who often makes much more profit than the manufacturer and often has more margins to invest in political subscriptions "on terms" than those who spend much more in labour and taxes than the middleman.

In the United States the legislators who do not seem to be afraid of any twopenny-halfpenny power that might object, have made it a rule that all goods capable of being marked without injury must be marked with the country of origin. Proposals have been made that goods coming to this country from abroad should be marked "made abroad." This is shirking the real question whether those who purchase have a right to know what they are buying, where it comes from, and which, in fact, is the firm dealt with. If the country of origin had to be indicated, then many superficially naturalised merchants and retailers with brothers and cousins in the Fatherland would howl, and the public might then realise who was making money out of the bad exchange.

The Government Bill.

Owing to the continuous complaints of the manufacturing community, the Government has drafted a Bill to amend the Merchandise Marks Act; superficially, at least, it looks as if further steps are going to be taken in the right direction, but when it is closely examined much of the gilt seems all the gingerbread. One great objection is that of extension of the system of legislation by a bureaucracy by means of "Orders," that is to say, there is to be more power for officials, who quickly find out which way their bread is buttered. A department that has lamentably failed in the past cannot be expected to do its duty, with added spragging powers, in the future; there are so many "ifs and ans"; the Bill looks too much like a bit of popular legislative camouflage for it to mean business. The means taken to delay the progress of the Bill by deliberate abstentions in Committee at the end of last July, which was too marked to be accidental, tends to show that even the proposed milk-and-water instalment might inconvenience some of those who believe in the right to deceive the buyer. The opposition to the Bill, which comes from certain quarters, is a distinct testimonial in its favour.

Goods Conveying a False Impression.

According to Part I, if the Board of Trade, after making such inquiries as it thinks necessary, is of the opinion that a false impression as to their origin is likely to arise, the Board may (not must) make an order requiring an indication of origin to be given, by means of a mark applied to the goods or otherwise, either at the time of importation or when put up for sale. By an order, goods in transit or any other special class of goods can be exempted. The representations of trade or manufacturing bodies are to be considered.

According to Section 2, the application of national or public devices likely to "lead any person to believe that the goods are goods made or produced" in the United Kingdom or in the Empire, can (not must) be prohibited by the Board of Trade unless accompanied by an indication of origin. Needless to say, those who have in the past imported goods with a deceptive device *shall* be entitled to go on doing so; the extra profits of merchants based on deception naturally come before the rights of the public that pays.

The sale or exposure of goods for sale not marked, or marked contrary to Section 3, is an offence unless the person responsible proves that he acted innocently (a nod being as good as a wink to a conveniently blind horse), or that the goods were imported before the date of the order.

Those who remember the deliberate delays over the Safeguarding of Industries Bill and the delays regarding the Reparations Bill will realise how warehouses would be stocked with offending goods pending a Board of Trade decision on such questions, and who doubts that material sums might be made with the aid of inside information.

Action in the High Court.

Section 3 seems to be a real improvement, but it apparently applies only to the contravention of the principal Act, as instead of having to wait months, if not years, while a case is being dragged out in a magistrates' Court, it can be taken direct to the High Court, but this facility is only open to any person who claims to have suffered damage or to any trade association, and, further, the permission of the Board of Trade or the Minister of Agriculture must be given before proceedings in the High Court can be commenced; but "consent shall not be withheld in any case unless the Board are of the opinion that the case is one which ought to be undertaken by the Board in pursuance of their powers under Section 2 of the Merchandise Marks Act, 1891."

This is another sample of the depriving of the public of their rights of action, except by permission of the bureaucracy. Matters might be hung up for weeks; those wishing to prosecute might experience difficulties in Government offices, like Trade Unionists who object to political contributions, and information might also leak out.

It would be much more satisfactory if the right of the individual to commence proceedings was not clogged in any way either regarding the principal Act or the amendments, and if the Board of Trade after commencement could intervene in Court with a certificate to the effect that it intended to start proceedings with regard to the same question within a given time; on such a certificate being given the private case could be adjourned.

In order to discourage frivolous prosecutions on the one side and to discourage undesirable practices which might not amount to legal fraud, the Court should be empowered, where desirable, to grant "solicitor and client" costs and to order a sum to be paid into Court as security for costs.

As the Board of Trade has for years failed to take adequate steps to promote honest trade, it is not for it to have too much of a "finger in the pie," and if a case taken by private individuals is of importance to the general public the Judge should have powers to certify it as such, and then a grant should be made out of the public purse towards expenses for having taken steps the Government failed to take.

Indications of Origin.

According to section 4, goods to which a forged trade mark or false trade description has been applied, goods made outside the United Kingdom which have the name of a British manufacturer, dealer or trader, or with a national device, not accompanied by an indication of origin, are prohibited to be imported and are liable to forfeiture.

In section 5, goods, the importation of which would be prohibited but for an indication of origin, must not have the indication removed, altered, or obliterated, and to sell such goods or possess them for any purposes of sale or manufacture will be an offence. This apparently only relates to indications required by the Act, so that if goods come into this country marked "made in Japan" or "made in Germany" there is nothing to prevent the marking being rubbed out or covered up; there are some people sufficiently reactionary to think that the obliteration of any mark of origin should be looked upon as a fraud and punished as such.

Verbal Descriptions.

There is a great improvement in Section 6 which adds the following to the end of sub-section (2) of Section 5 of the principal Act: "and in the case of a trade description, whether it is oral or consists of a statement contained in an advertisement, catalogue, or other document." This wording should go a long way towards removing difficulties frequently complained about.

Sections 9 to 11 deal with the use of Government Marks and Royal Arms.

In Section 14, under "indications of origin" in relation to any goods, the indication can either state the country in which the goods were produced or that they were produced abroad. This section is obviously inserted to please the importers of German goods.

Shirking the Issue.

If a thing is worth doing, it is worth doing well; if it is desirable to mark goods at all, they should be marked with the country of origin—if not, why not?

In Part II of these articles, the bogy of the advertisement of Germany through the "made in Germany" mark was dealt with. There is not the slightest doubt that if a referendum was taken on the subject, regarding the subject of the compulsory marking of all goods capable of being marked, as in the U.S.A., there would be an overwhelming majority. If it is right for any imported goods to be marked, then as far as practicable, they should all be marked, and no favour shown for any trade, article, or concern.

If the Bill gets passed as it is, full of departmental loopholes and orders, then there will doubtless be the same sort of state of affairs as there was during the war, when there was importation of prohibited goods under licence for approved concerns; there is a danger that "axe-grinding and log-rolling" would take place in the neighbourhood of Whitehall.

They say that "half a loaf is better than no bread," although it looks as if the bread which looks attractive in the drafted Bill may turn out to be "Pumpernickel."

Trick the People.

A democracy kept in ignorance is the most dangerous form of government for any state, and if the public realised some of the reasons for trade or industrial action or inaction in recent years, there would be "wigs on the green." Those who cry "trust the people" seem often to be anxious for freedom to "trick the people."

One of the first duties of any government, is to prevent the tax-paying public from being tricked and defrauded; inspired deception lowers the national prestige and it was the fair deal, not "Houndsditch" false marking, that built up the trade and prosperity of the country.

This country keeps going on its manufacturing business which is largely based on "national goodwill"; winking at deception is gradually destroying the reputation of British firms, and efforts are made to block or side-track every measure likely to promote honest trade. The people want to be treated fairly; the trade Merchandise Marks Act badly wants strengthening, but in these days of ultra-professional politics it is difficult to get a craft steered through the rocks, whirlpools, and deliberately laid mines, to the desired haven of fair play.

Remedies Must Inconvenience Some People.

One cannot have remedial legislation which does not, even where fairly and properly administered, inconvenience some people; the good citizen realises this, but the difficulty is that, as with the Companies Act of 1908, as soon as the remedy begins to work, rogues misuse their brains to try and find some means to get round it, and, besides this, to-day an Act of Parliament can become almost a dead letter by departmental passive resistance.

The present state of the exchanges makes genuine reform in the matter of marking, more urgent than ever before; trades should put their cards on the table and should not be allowed to play a sort of three-card trick with the purchasing public, on the ground that it is for the public to find out.

The Government recently stated that it could only give facilities for the new Bill to go forward if there was no controversy about it—the strictly up-to-date constitutional take-it-or-leave-it attitude—as if fair play in trade was such a minor matter, while Whips were recently put on to obtain approval of the notorious Rutenberg concession. Deprived of our manufacturing prosperity, our trade and national wealth would disappear and we should become almost like Venice or the dead cities of the Baltic resorts for tourists. If the Government had wanted the question of marking to be thrashed out it would not have charged 30s. for the most recent Blue-Book on the subject.

THE ANGLO-DUTCH TELEPHONE CABLE.

The telephone cable between England and Holland, which, as already briefly announced, was inaugurated for public use on August 15th, is a further addition to the long list of loaded submarine telephone cables manufactured by Messrs. Siemens Brothers & Co., Ltd. The cable contains four cores and is loaded with inductance coils spaced about one nautical mile apart, so arranged as to permit of the use of phantom circuits. Sectional views of this cable are shown below.

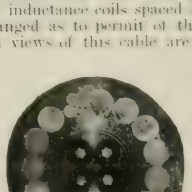


Fig. 1.—Section Through Cable.



Fig. 2. Section Showing Coils Inserted.

Since the first loaded cable was laid between England and France in 1910, practically all submarine telephone cables required by the British Government have been manufactured by this company. In addition to several cables laid between England

[illegible] Anglo-Belgian and Anglo-Irish [illegible] the continuously loaded type was laid between Ireland and Scotland. A great deal of research and experimental work has been carried out by Messrs. Siemens in connection with the design and manufacture of loaded submarine cables, and they have been brought to a very high degree of efficiency.

Although telephonic facilities between Great Britain and Holland were only made available to the public three weeks ago, communication was actually established on July 12th last, when the Assistant Postmaster-General, Mr. Pike Pease, who spoke from his room in the G.P.O., exchanged messages with Mr. Mesny, Director General of Posts and Telegraphs in The Hague.

The greater part of the land lines connecting with the cable on the English side were erected in 1914, prior to the outbreak of the war. The cable itself was also in process of manufacture at that time and was duly completed, but it could not be laid owing to the naval operations in the North Sea. It was therefore used to provide additional means of communication between this country and France in connection with the war, and the arrangements for providing a cable for the Anglo-Dutch telephone service were postponed until hostilities had ceased.

The final section of the new cable was manufactured in June last, and the *John Pender*, a cable ship belonging to the Eastern Telegraph Co., was chartered for the purpose of laying it.

The cable, which consists of four cores each of 160 lb. copper per nautical mile, insulated with "modified gutta" percha weighing 150 lb. per nautical mile, is approximately eighty nautical miles in length. The loading coils consist of iron-wire cores over which are wound coils of insulated copper wire, and they are provided for introducing inductance into the telephone circuit, to reduce the attenuation of speech currents and so render practicable the transmission of effective speech over a cable of such considerable length.

The *John Pender* left for the cable ground on Sunday, June 25th. Buoys were put down in the North Sea to mark the route, and on the morning of Tuesday, June 27th, the ship arrived off Aldeburgh, on the Suffolk coast, where the shore end of the cable was successfully landed in the presence of the Engineer-in-Chief of the Post Office, Major T. F. Purves.

Owing to the inclement weather there was some delay in laying the cable across to Holland; but by the morning of Friday, June 30th, the cable ship had arrived within three miles of the Dutch coast. After further delays due to the stormy weather, the shore end of the cable was landed at Domburg and the cable was "proved through" to Aldeburgh. This cable is one of the longest telephone cables in the world.

It is understood that at the outset communication will be limited to calls between London and The Hague, Amsterdam, and Rotterdam, as one channel only is equipped. Two other channels will be opened as soon as the additional land wires and certain necessary apparatus have been completed. The charge for a three-minutes' call will be ten shillings.

PRACTICAL APPLICATIONS OF THE JOHNSEN-RAHBEK EFFECT.

The electrical attraction effect studied by the Danish engineers, Messrs. Knud Rahbek and Alfred Johnsen, and described by them before the Institution of Electrical Engineers in May, 1921,* has many possible applications, some of them being of considerable practical interest. From a recent article in the *Elektrotechnische Zeitschrift* it is evident that these applications are being exploited on the Continent, and the matter is one with which British engineers should keep in touch.

The basic phenomenon is the marked attraction exerted on a metal plate in contact with a semi-conductor (litho-

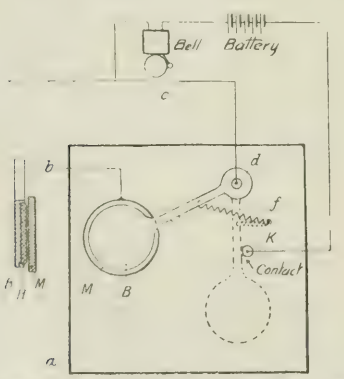


Fig. 1.—Relay Employing the "Johnsen-Rahbek" Effect.

graphic stone) when a d.c. potential difference exists between the plate and a metal covering on the other side of the semi-conductor. If a p.d. of 440 V be maintained between a brass plate of 22 sq. cm. area and the metal covering on the opposite side of a lithographic stone 20 mm. thick, a force of from 750 to 1,000 grm. is required to detach the stone. If, however, a glass plate 1.3 mm. thick be interposed, a force of 10 grm. is sufficient to remove the stone. The attraction is explained by the fact that there is such (electrical) contact resistance between the surfaces of the dissimilar materials that practically the whole applied p.d. is operative between these surfaces. If the surface of the stone be moistened with alcohol, the electrical attraction disappears and a current of 0.67 mA flows when the applied p.d. is 220 V direct current, the corresponding resistance being 300,000 ohms. As the alcohol evaporates, the electrical attraction increases and the current decreases, having reached a value of one micro-ampere corresponding to a resistance of 220 megohms. The resistance is almost entirely between the surfaces of the conductor and the semi-conductor. Under these conditions the two surfaces constitute the plates of a condenser and the relatively high attraction is due to the small distance between the plates. Because the contact resistance is so high, the connection in series of several hundred thousand ohms does not appreciably reduce the attraction.

From experimental observations of the attraction between brass and lithographic stone under various values of applied p.d. it is found (using the ordinary formula for the attraction between condenser plates) that the distance between the plates is of the order 0.005 to 0.0075 mm. Using an agate plate the attraction increases with the voltage, at first more slowly than would be expected from the condenser formula; at higher voltages, however, the attraction increases more rapidly than the cube of the voltage. If a flexible metal band be in contact with an agate cylinder for 90 deg. of arc, one end of the band being fixed and the other carrying a load of 5 kg. the latter can be raised by rotating the cylinder when the applied p.d. is 220 V and the current flowing is 0.4 mA (power = 0.08 W). In this case the mechanical load assists the applied p.d. in reducing the distance between the surfaces and the resultant electrical attraction increases more rapidly than the fourth power of the applied voltage.

The fact that relatively large mechanical forces can be exerted or controlled by the use of an extremely small current at an appropriate voltage finds many possible applications. The resistance of the leads is almost immaterial and, compared with electromagnets, the purely electrical attraction has the advantage of using much less current, and of being free from inertia. On the other hand, the electrical attraction is exerted only while the surfaces are very close together, and is affected greatly by moisture, temperature, and dust.

The principle on which relays are built for operation by currents of from 1 A to 10 micro-amps. is illustrated by fig. 1. A metal disk M is fixed in a vulcanite plate *a* and connected to one line *b*. The arm B, pivoted at *d*, is provided at H with a disk of semi-conducting material as shown in the cross section. This arm is connected to the second line *c* and, when a suitable p.d. is maintained between *b* and *c*, the plates M and H hold together. With a p.d. of 110 V, the current flowing is about 1 micro-amp., *i.e.*, the power required to hold the relay in the position shown is 0.0011 W. If the circuit *b*

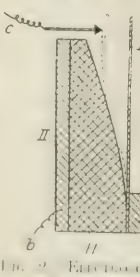


Fig. 2.—Electrolytic Self-setting Relay.

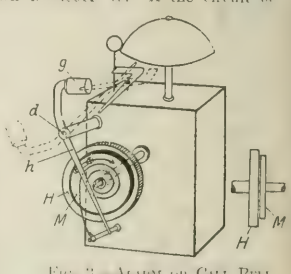


Fig. 3.—Alarm or Call Bell.

be broken or the p.d. reduced to 20 or 30 V, the spring *f* pulls back the arm B and closes the contact K in the bell circuit.

The relay shown in fig. 1 must be reset by hand (or an electromagnet can be added for the purpose), but the device

* See Elec. Rev., pp. 705, 740, 721, 722, June 3rd, 1921.

shown in fig. 2 can be used either as an electroscope or as a self-setting relay. The semi-conductor H is in permanent contact with a metal plate H whilst, on the other side, there is a flexible metal strip I clamped at *a*. On the application of suitable p.d. between *a* and *b*, the strip I is progressively drawn into the position shown (dotted). The stop *c* can be used as a relay contact or the device may be used simply as an electroscope. In the latter application the instrument is suitable for pressures of from 60 to 700 V, the plate H being connected to a point which is applied to the line, &c., to be tested, and the clamp *a* being connected to earth through the observer's body. The very small current then flowing is quite innocuous, but is sufficient to operate the electroscope.

The alarm or call bell shown in fig. 3 has a metal disk M carried by the seconds spindle of a clock; on the same spindle the disk H, of semi-conducting material, rides loosely. When a suitable p.d. is applied between M and H, the latter is held by the former and carried round with it. A pin then engages with the lever *h* and carries the latter round until the counterweight *g* passes the balance point, whereupon it falls to the left and trips the alarm catch as shown (dotted). Should the p.d. between M and H be removed before *g* reaches the balance point, the alarm is not tripped. The device can thus be used as a selective relay, the current required to operate it being only from 1 to 10 micro-amps.

Another application in which electrical attraction is used to arrest relative motion between a metal plate and a semi-conductor is shown in fig. 4, which illustrates a Morse recorder. Normally, the pen S carried by the vibrator A makes a broad record on the strip, the metal plate M being meanwhile drawn to and fro on the semi-conductor H. When the incoming signal applies p.d. between M and H these plates

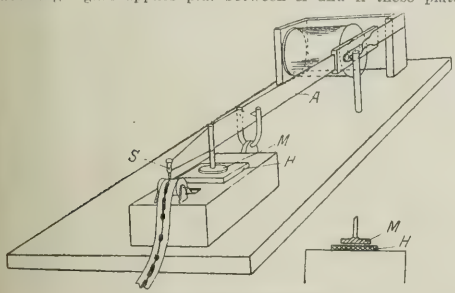


Fig. 4.—Morse Records.

hold together, arresting the vibrator and causing the pen to trace a fine line which is quite distinct from the broad record representing a space. The inertia of the moving system is small, and it is claimed that this recorder is more sensitive and can work at higher speeds than the electromagnetically operated "inker."

In many cases there is advantage in using a flexible metal band and a rotating cylinder of semi-conducting material, the small normal frictional grip between the two being increased enormously by the application of a suitable p.d. For example, the high-speed recorder shown in fig. 5 is actuated by a nickel-steel band I resting on a polished cylinder H of

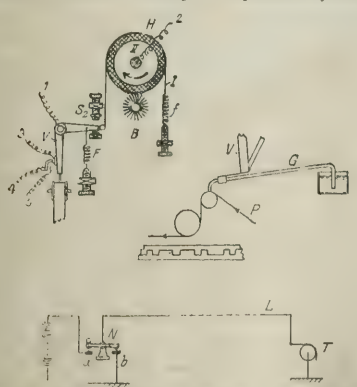


Fig. 5.—High-speed Recorder, and Line Circuit.

agate carried by the spindle H. One end of I is attached to a variable tension spring *f* and the other to a bell-crank lever V, the outer end of which carries a recording siphon as shown by the centre diagram, fig. 5. The cylinder H is rotated continuously in the direction shown by the arrow and, when a signal impluse reaches the terminals 1, 2, the band adheres to the cylinder and V is drawn up against the stop S. When the signal ceases V is returned to its normal position by the spring F, a stepped record being thus produced. If the maximum p.d. required to produce adhesion between H and I be 70 V, this potential is applied permanently and the spring *f* is adjusted until H just slips freely within the band. The pressure required in the signal circuit to produce adhesion is then about 10 V. In other words, instead of requiring 70 micro-amps. at 80 V in the signal circuit, there is only needed 10 V, and the small current corresponding to this supplementary p.d.

If required, the lever V may carry a small arm connected to the line 3 and moving between the contacts 4, 5, for the automatic resending of the signals received.

The general arrangement of the line circuit is shown in the lower diagram, fig. 5. The recorder can be set to receive

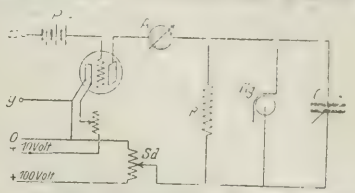


Fig. 6.—Recorder Adapted for Wireless Reception

from 400 to 2,000 letters per minute by a single lever which adjusts the speed of the agate cylinder and paper strip, and also the amplitude of the recording arm and contact relay. Resistances of 1 megohm or more do not affect the operation of the recorder; hence the section of the line conductor may be reduced to the minimum required for mechanical strength.

For the reception of wireless signals, the recorder may be connected as shown in fig. 6. A polarising potential is applied to the recorder Tg and adjusted by the potentiometer Sd and the resistance R. Incoming signals pass from the terminals *xy* to the amplifying valve, which then augments the p.d. on the recorder and produces the corresponding record.

Another application of the agate cylinder and metal band is to the operation of a loud-speaking telephone. One end of the metal band is attached to the centre of the telephone membrane and the other to an adjustable tension spring. Microphone currents, amplified if necessary, bring about adhesion between the rotating cylinder and the band so that the membrane can be vibrated with any desired mechanical power within reason. The polarising voltage applied in this case must be such that the controlling device operates on the linear part of its voltage-force characteristic, otherwise distortion of speech is produced.

DUPLEX WIRELESS TELEPHONY.

Recent Experiments.

While simplex wireless telephony is serviceable when messages are transmitted by trained operators, the necessity of continually manipulating the equipment for alternate transmission and reception makes the system unsuitable to the general public. The initial incentive for the development of a satisfactory duplex system lay in the desire of steamship passengers to converse by telephone with persons on land, and an article in the *General Electric Review*, from which the following details are abstracted, describes tests that were recently conducted with this end in view. Their successful results are highly gratifying to the participants: the Radio Corporation of America, the American Telephone and Telegraph Co., the Western Electric Co., and the General Electric Co.

True duplex radio telephony permits the operator to send and receive simultaneously as with the ordinary telephone. Unless one conversant can at any moment interrupt the other, a conversation may lose coherence and the transmission of a long message may often entail irksome repetition. Moreover, ship to shore telephone communication, in order to render the maximum amount of service, must be capable of being linked up with the regular wire telephone system.

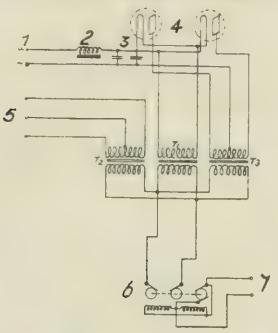
During the months of February and March a number of tests were made on the s.s. *America*, and their results are indicative of the future possibilities of radio telephony. The shore station, where the radio and land lines were linked together, was located at Deal Beach, N.J., and was connected by a toll line to a telephone switchboard in New York City. By means of this arrangement communication could be carried on from the ship to any point reached by the regular wire telephone system.

The input to the antennæ on the *America* was approximately 750 watts; the Deal Beach station uses an antennæ input of about 1,500 watts, and duplex telephony was carried on over a maximum distance of 1,600 miles at night range under atmospheric conditions. During the daytime reliable conversations were held at distances of between 400 and 500 miles.

When it is desired to call a party on shore, the same practice used for a toll call in wired telephony is followed. A

regular desk telephone was installed in Capt. Rind's quarters on the *America*. When he desired to talk to someone on shore he called the ship's radio operator, who, after ascertaining the telephone number, or the name of the party desired on shore, established communication with Deal Beach. The operator at Deal Beach transferred the call to the New York toll line, thus completing the circuit between the *America* and the switchboard operator at New York, so that both operators could exchange information regarding the call. When New York had the party at that end, the ship's operator called Capt. Rind and he conversed from his extension in the same manner as if he were using an ordinary telephone system.

For reception a highly selective receiver was used in conjunction with an anti-resonant circuit, and transmission thus took place at a frequency of 800,000 cycles (375 metres).

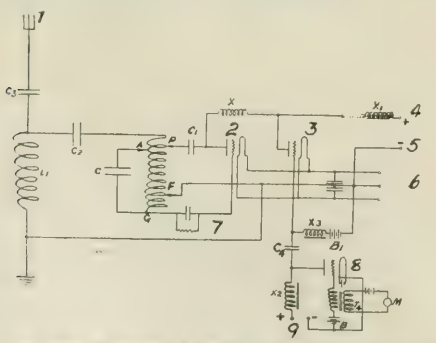


1, 10,000-V. d.c. supply; 2, filter reactor; 3, filter condenser; 4, kenotrons; 5, radiotron filament supply; 6, 120-V., 500-cycle motor-generators; 7, ship's d.c. supply.

Fig. 1.—Kenotron Circuit Diagram.

Modulation, or speech control, of the transmitter output took place either at the operator's control unit or at the extension station. While conversations were being carried on the transmitter oscillated continuously into the antennæ system.

The apparatus used for the tests is as follows:—The duplex transmitter direct-current supply at 10,000 volts for the plate circuit of the tubes is obtained by means of a full-wave single-phase 500-cycle kenotron rectifier. The plate and filament energy for the kenotrons is obtained from a 500-cycle generator operating on the 125-volt direct-current ship mains. Two kenotrons are provided and a schematic circuit diagram of the kenotron panel is shown in fig. 1. The motor generator is started by a push-button in the operator's control unit. The transformers T_1, T_2 and T_3 have their primaries connected to the 120-volt 500-cycle supply. The kenotron filaments are heated by transformer T_1 at a potential of 11 volts. In like manner transformer T_2 delivers a secondary voltage of 11 volts for the radiotron tube filaments mounted in the radio unit. The plate transformer T_3 delivers a secondary voltage of approximately 25,000 between outside terminals. It will be observed that these terminals connect to the plates of the kenotrons. This results in full-wave rectification of the trans



1, r.f. [illegible]; 2, oscillator; 3, modulator; 4, filter reactor in kenotron [illegible]; 6, 11-V. a.c. supply with neutral wire in centre; 7, [illegible]; 8, [illegible]; 9, 12-V. supply.

Fig. 2.—Radio Panel Circuit Diagram.

former output, producing a pulsating direct current which is smoothed out by the filter condensers and filter reactor. Three rheostats control the motor speed, alternator voltage, and filament voltage. A filament voltmeter is provided, and is the only meter that requires supervision on the part of the radio operator.

The radio panel provides for the generation and speech control of high-frequency energy over a frequency band of from 1,000,000 to 375,000 cycles. This corresponds to a wave-length range of from 300 to 800 metres. A six-position wave-change switch and a signal switch are provided, so that telephony and continuous-wave or interrupted continuous-wave telegraphy may be used if desired. The anti-resonant circuit is tuned by a small knob on the lower section of the panel. The motor-driven chopper gives a 1,000-cycle note when interrupted continuous-wave telegraphy is being used. Two radiotrons are used, one of which operates as an oscillator and the other as a modulator. A radiotron is also used as a speech amplifier. The current flowing in the antennæ system is indicated by a radiation ammeter.

The fundamental circuit arrangement of the radio panel is shown in fig. 2. The oscillator tube draws its plate supply through a radio choke coil X. A shunt circuit for coupling the plate radio frequency to the antennæ circuit consists of the condenser C_1 and the turns in use on the inductance L between points P and F. The radio choke is used in order to prevent the plate radio frequency from flowing back into the 10,000-volt direct-current supply. Excitation for the oscillator grid circuit is furnished by the voltage built up between turns F and G. The frequency of the oscillations is determined by the condenser C and the inductance between turns A and G. This oscillating circuit is loosely coupled to the antennæ circuit through the condenser C_2. Sufficient turns are used on the loading inductance L_1 to bring the antennæ circuit into resonance with the intermediate circuit. One of the major requirements of this system of duplex transmission is that the frequency of the radio output of the transmitter shall not change, due to the swaying of the antennæ. This is accomplished by using such a low value of capacitance in the coupling condenser C_3 that variations in antennæ constants cause only a detuning effect and do not greatly react on the frequency setting circuit L C.

The method of modulating the high frequency output of the transmitter in accordance with the voice vibrations is accomplished by means of the "constant-current" system. It will be observed in fig. 2 that the plate of the modulator tube is connected to the transmitter side of the filter reactor. Upon speaking into the microphone M variations take place in the primary current of the transformer T_4. This transformer has a step-up ratio, and therefore increased variations are applied between the grid and filament of the speech-amplifier tube. A biasing battery B is used in the grid circuit of this tube in order to provide a linear operating characteristic. The plate circuit of the speech amplifier tube contains a reactor X_2. Due to the audio-frequency changes in grid voltage, amplified variations are built up across X_2 and are transferred to the grid circuit of the modulator tube through the condenser C_4. The grid of the modulator tube is biased by means of a battery B_1, and is also provided with a choke X_3 to prevent the input to the grid from flowing to the filament through the battery instead of through the tube. The plate current now flowing into the modulator tube must pass through the main reactor X_1, and in doing so it builds up an electromotive force around this reactor of the same wave form as that originating in the microphone circuit. This potential is applied directly to the plate of the oscillator tube. Since the current in the antennæ circuit varies almost directly with the oscillator plate potential, it is evident that the antennæ output will be modulated in accordance with the voice vibrations applied to the microphone.

The radio receiver cabinet is built with seven shielded compartments, so that when closed the various circuits are shielded one from another. A total of eight radiotrons are used.

Filament supply for the radiotrons is furnished by a 6-volt 120-ampere-hour storage battery. Three 22-volt dry batteries are used for plate potential. The antennæ circuit is tuned by means of a variable condenser and a tapped inductor. Provision is made for accurate variation of the coupling between the antennæ and secondary circuits, all tuning in the latter being accomplished with a variable condenser. Three filament rheostats are used to adjust the detector and amplifier tubes and a wave-changing switch controls the range of the radio-frequency amplifiers. One position of this switch gives a wave-length range of from 250 to 500 metres, while the second position gives a range of from 500 to 4,000 metres. Two variable condensers are used for tuning the primary and secondary portions of the intermediate-frequency circuit, in which a variable coupling is also provided. The receiver is connected to two telephone plugs, which enable the audio-frequency amplifier to be connected or disconnected when required.

The log of the tests made from ship to shore indicates that approximately 125 people talked over the system, the majority of whom had never used a radio telephone before, but no difficulty was experienced in carrying on conversation as easily as over a land 'phone. The longest land line connection was made from New York to Washington, D.C. On this occasion Captain Rind, while 200 miles at sea, conversed with Chairman Lasker, of the Shipping Board. Mr. Lasker used the regular desk 'phone in his office. An idea may be gained of the extreme sensitivity of the receiving equipment on the *America* from the fact that two amateur stations were heard when the *America* was 2,000 miles out. When 1,100 miles out the 8.30 p.m. concert of WGY Schenectady broadcasting station was received very loudly and clearly.

A considerable amount of radio traffic is handled by the operators on large transatlantic liners. This may eventually require simultaneous telegraphy and telephony, and tests are

now being made on the *Imerica* with this object in view. It is, therefore, not improbable that in the future a passenger may be telephoning from a liner while at the same time the radio operator will be transmitting radiograms with the telegraph equipment.

ELECTRICITY SUPPLY FOR THE S. E. & C. R.

Electricity Commissioners' Statement.

The Electricity Commissioners have issued a statement with respect to the inquiry they held on May 30th, 1922, in connection with the applications (*a*) of the Managing Committee of the South-Eastern & Chatham Railways to the Electricity Commissioners for their consent under Section 11 of the Electricity (Supply) Act, 1919, to the establishment of a generating station at Angerstein's Wharf, Charlton, to contain 60,000 kW of generating plant, and (*b*) of the West Kent Electricity Co., Ltd., for the consent of the Commissioners to the establishment of a generating station at Belvedere, in the Urban District of Erith, to contain 150,000 kW of plant.*

During the course of the inquiry offers to supply the Railway Co. were made by the West Kent Co., and by the County of London Electric Supply Co.

An important factor in this case is the forthcoming grouping into one railway system of the London & South-Western, the London Brighton & South Coast, and the South-Eastern and Chatham Railways. The L. & S.W.R. Co. is supplied from its 25-cycle generating station at Wimbledon. The L.B. and S.C.R. Co. purchases its 25-cycle energy from the London Electric Supply Corporation's station at Deptford. The further electrification of that railway's suburban lines will entail a supply which will be many times in excess of that now given by the London Electric Supply Corporation, and this further supply must be given at a frequency of 25 cycles for the reason that the equipment of the company's rolling stock is designed for that frequency. The S.E. & C.R. Co. also desires a 25-cycle supply, but as its railway electrification will be on the direct-current system, a supply at a frequency of 50 cycles is also practicable.

The Railway Co.'s site is 26 acres in extent, of which 20 acres are to be appropriated to the generating station. The application is to construct immediately a station containing 60,000 kW of generating plant and the Railway Co. contended that it would be possible to extend the station to at least 150,000 kW in order to meet the further electrification of the suburban lines of the S.E. & C. Railways and of the L.B. and S.C. Railway.

Only outline plans of the station were submitted, and the principal technical witness on behalf of the Railway Co. agreed that in any case a complete modification of this design would have to be made. The Commissioners, while of opinion that the site is suitable for a 60,000-kW station, have considerable doubt whether a station of an ultimate capacity of 150,000 kW can be economically constructed on this site.

The Railway Co. expects to complete the first stage of the electrification of its lines by June 30th, 1925, and has made arrangements with the Treasury for a guaranteed loan of 6½ millions, 5 millions of which is to be expended on the electrification of the lines. This financial assistance is dependent upon the scheme being begun forthwith. From June 30th, 1925, the interest on this sum and contributions towards a sinking fund must be provided for, and unless the Railway Co. is able to rely upon a supply of electricity by that date, the working of the new system will be delayed and the increased revenue anticipated therefrom will not be forthcoming to meet these charges when they mature. The Railway Co. if it purchases electricity from an outside source, will therefore require to be protected against any loss arising from a failure to give the supply by the date required. Moreover, the Trade Facilities Act Advisory Committee is similarly interested from a financial point of view.

The Commissioners have concluded that it has been proved to their satisfaction that there are two authorised undertakers *willing* to give the Railway Co. a supply of electricity adequate in quantity and regularity to meet the present and prospective demands of the Railway Co. at a cost not greater than would have been incurred by the Railway Co. in supplying itself. The Commissioners, however, cannot refuse consent to the Railway Co. unless it has been also proved to their satisfaction that the authorised undertakers are, or will be, in a position to give such a supply.

(*a*) The West Kent Co. has prepared detailed plans for its stationon the Belvedere site, and is authorised to supply energy to the Railway Co within the West Kent area. In pursuance of the Electricity (Supply) Act, 1922, energy so supplied to the Railway Co. may be used by the Railway Co. for haulage or traction or the lighting of vehicles on any part of its system. The West Kent Co. has hitherto operated only on a small scale, and is at present dependent for its bulk supply almost wholly upon the South Metropolitan Light and Power Co. Both companies' shares are held largely by the Metropolitan Carriage, Wagon & Finance Co., Ltd., which company is prepared to find the necessary capital to equip the Belvedere station and to construct the necessary transmission lines. A director of the West Kent Co., who is also the chairman of the Metropolitan Carriage, Wagon & Finance Co., Ltd., stated that the latter company would not be a party to an agreement to guarantee payment of [illegible] of the West Kent Co. failing to give a supply by the required date, though he considered that the Metropolitan Carriage Co. would have to advance the necessary money to the Kent Co. should the latter company be found liable. The West Kent Co. intimated, however, that it would not proceed with the erection of the Belvedere station unless it secured the contract with the Railway Co. which it stipulated should be for a minimum period of 60 years.

(*b*) The County Co. holds the consent of the Commissioners for the construction of a 100,000 kW station on the Barking site, the plans have been approved by the Commissioners, and it is proceeding with the erection of the station. The County Co. *is prepared*, with or without consent for any extension of the station, to give a supply to the Railway Co., and contemplates a contract period of 25 years. Matters involving further consent and arrangements being obtained or made by the County Co. before a supply could be given to the Railway Co. are:—

(1) The construction of a cable tunnel (6 ft. in diameter) under the river Thames, and the Commissioners have satisfied themselves that no particular obstacles stand in the way of the construction of this tunnel well within the period of completion of the Barking station and the electrification of the Railway Co.'s lines by June 30th, 1925. The County Co. could also supply by an alternative route if necessary.

(2) The routes of the transmission lines for which further consent of the Commissioners is necessary. Under the Electric Lighting Order Confirmation (No. 7) Act, 1913, particulars of proposals to lay interconnecting mains between the Barking station and the areas of supply within the Administrative County of London must be furnished to the London County Council, which is entitled to make representations to the Commissioners and to be heard thereon.

(3) The extension of the County Co.'s transmission lines, (unless further powers be obtained), beyond the point of delivery at Lewisham determined by the Railway Co. to a point in the County Co.'s area of supply in Camberwell, where the latter company would be entitled to supply the Railway Co. This would involve the transmission lines being doubled back to Lewisham by the Railway Co. at the cost of the County Co.

Having fully considered these and other relevant matters, the Commissioners are satisfied that there is an authorised undertaker who will be in a position to give the Railway Co. a supply by the date when the electrification of the lines is expected to be complete, *viz.*, on or before June 30th, 1925.

Factors to which it is essential that the Commissioners should have regard in the public interest are as follows:—

(*a*) The evidence given by experienced railway engineers to the Electric Power Supply Committee of the Board of Trade (1917-18) as to the advantages of combining supply to railways, tramways, and other classes of consumers (Cd. 9062:, page 9).

(*b*) The general attitude of the railway companies represented at the inquiry into the London and Home Counties Electricity District in 1921, which was that if a sufficient supply could be afforded in time by a Joint Authority or other authorised undertaker at a cost not exceeding that at which the railway companies could themselves generate the railways would avail themselves of it.

The L.B. & S.C.R. Co., one of the future group to which the Railway Co. will belong, has purchased its supply from an authorised undertaker for many years past and the supply "had been perfectly satisfactory from an outside source." Moreover, the evidence showed that there would be a substantial saving in capital expenditure from the adoption of a combined source of supply. If the Railway Co. purchases its supply from such an outside source it will be relieved from capital outlay to the extent of over one million pounds.

In view of the foregoing circumstances the Commissioners have concluded that it would be no disadvantage to the Railway Co., and would be a gain to the public interests concerned, if the Railway Co. were to take its supply from an outside source. The evidence of the Railway Co. at the inquiry was to the effect that it was prepared to consider taking a supply from an outside source, subject to satisfactory guarantees as to cost, reliability of supply, and time of delivery. The Commissioners are strongly of the view that the Railway Co. ought to enter into immediate negotiations with the authorised undertakers and discuss the actual terms of a firm contract, including a guarantee to indemnify the Railway Co. in the event of the authorised undertaker failing to give the supply by the required time.

The Commissioners fully realise the urgency of the matter from the point of view of the early commencement of the electrification scheme, but they are of opinion that, having regard to the important interests involved the parties should be given a further opportunity of conferring together in order to arrange a mutually acceptable contract. The Commissioners have, therefore, postponed their decision to enable this to be done. The Commissioners are of opinion that if the negotiations are conducted in a spirit of mutual goodwill the terms of such a contract can be adjusted without undue delay.

* Elec. Rev., June 9th, 1922: p 799, and July 14th, 1922: p. 45.

REVIEWS.

The Induction Motor and other Alternating-Current Motors. By H. A. Behrend. Second edition. Pp. xxiii+272. London: McGraw-Hill Book Co. Price 24s. net.

This is the best example of the diary or autobiographical style of book so much in vogue, that we have met with in a technical book: and as for trumpet blowing, the blasts are so loud that any praise from a reviewer would hardly be heard above the din. Right at the outset the reader soon discovers that the author has something of a grievance in the matter of priority (reminding one of the present-day controversies in the wireless world). Though in the inordinately long preface a short sermon is preached on the text "A prophet is not without honour, save, &c." yet the admission of the author's claims entitles a writer to be called "a great savant and a gentleman." Then follows sound advice to the young reader of the present generation: "Let him not trouble his head with recognition"; but despite this, Mr. Behrend evidently finds that it is more blessed to give advice than to receive it, for no sooner do we come to the introduction than we are at it again. We now find ourselves inveigled into a fierce tussle round the invention of the circle diagram for the induction motor. Without attempting to prejudge this issue, we can at least state that to the vulgar mind the name indissolubly associated with the circle diagram is that of Heyland. One thing also we might say regarding the author's grievance against writers—it is not always the writer's fault that due recognition is not given to the true originator, for an author—especially of the age of Mr. Behrend when he first wrote about the circle diagram—often finds his paper edited without his being consulted on the matter. And, after all, if we do not always receive recognition according to our merits, many of us know full well we are not dealt with according to our sins. In addition to this, personal controversy is not becoming in a textbook, though we gladly admit that in this case the matter is both interesting and readable.

Coming to the chapters, a good deal of space is taken up with the representation of losses, &c., in the circle diagram, but the reader is not told that most of this is of little practical use. The mode of treatment is not always easy to follow.

The author's theory is troublesome in places, *e.g.*, when he writes, rotor current = e.m.f./resistance, making no mention at all of inductance—on which, among other things, the maximum torque depends. Also the method of treating the torque is antiquated, the conditions governing it being treated very meagrely. Again, in speaking of higher harmonics in the field the reader is referred to the well-known pointed m.m.f. curve of the 3-phase motor, and the author proceeds to consider therefrom a two-phase motor. Moreover, the uninformed reader would be allowed to assume that this m.m.f. curve possesses a third harmonic, for no analysis of this curve is given, and no explanation is offered how a third harmonic of flux can exist in a 3-phase motor.

In speaking of the induction generator, the author objects to Prof. Pupin's conception of a "negative resistance," which he regards as making a complicated subject more complicated by mystery. Instead of offering any alternative explanations, he winds up with: "As one never understands anything which one has not thought out for oneself, we shall leave these matters to the reader." This reminds one of the way of the consulting engineer, who when faced with some awkward point, gets out of the difficulty by specifying that the work must be carried out "in an approved manner." We might also recommend the remark to teachers as a suitable variant of "It can easily be shown. . . . .

We cannot agree with the author's sweeping assertions about the difficulty of properly calculating leakage, &c.—the views expressed would be much more correct in the first edition in 1901 than in the present edition.

This brings us to the second half of the book and to a change of subject, namely, alternating-current commutator motors. The treatment is brief, but in character is scarcely suitable for beginners. In Chapter X the reader is told that the series polyphase motor was first described by Wilson in 1888, and in Chapter XI the credit for both shunt and series motors of this type is given to Görges under date 1891. The chapters on methods of speed control and of raising the power factor are good and among the most useful in the book.

The remaining chapters are devoted to the various types of single-phase motors. In most cases the description is very brief, but we very readily acknowledge the author's attempt to give due credit to the several inventors for their work.

Summing up, we must say frankly that reading the book has been rather a disappointment. Quite apart from the personal side and from the several matters with which we disagree we cannot see for whom the book is intended. As regards those matters which appear to be little that has not already been said in the course of years ago, whilst design and construction are scarcely touched upon.

Candidly, we think Mr. Behrend has not done himself justice in the present book. Much of Mr Behrend's work has had our strongest admiration and we are glad to think that this has not been lessened by the fact that the present book does not seem to be equally meritorious.

Handbook of Commercial Geography. By George G. Chisholm, M.A., B.Sc. (Edin.).—Ninth edition. (Pp. 824+13 maps). London: Longmans, Green & Co. Price 25s. net.

If economics is the "dismal science," surely geography is the most neglected. Commercial geography—the "practical" side of the subject—plays a most unimportant part in the curricula of the majority of modern schools, although, without doubt, to a commercial nation with so many foreign connections as Great Britain the science is one of more than ordinary importance.

Mr. Chisholm's "handbook," the size of which is out of proportion to its description, represents an enormous amount of labour. Although the present edition is the ninth, conditions have so changed since the 1911 edition that rearrangements, revisions, and additions have virtually made it a new book.

The introductory portion of the work takes the form of an essay on commerce between nations, in which it is shown how each country takes advantage of its natural endowments. The delicate question of tariffs is introduced, which leads to the consideration of "key" industries, discovered by the war. The duties of consuls are touched upon; here we think the trade commissioner services of Great Britain and the United States might have received special mention instead of a passing glance. In the section dealing with economic statistics the author emphasises their value to commercial geography as helping to distinguish the important from the unimportant, and as a record of changes indicating a course for future action. A warning is uttered with regard to the use of statistical tables of trade; the fact that values are given in the absence of quantities (in any case the latter would be rather unwieldy) has a tendency to mislead the reader, and the use of index numbers is imperative. It is, however, acknowledged that even these can never be completely satisfactory owing to the lack of an absolute base.

The handbook proper commences with a study of climatic and physical conditions and their effects, and this leads up to a consideration of the treatment of the soil, the question of labour and machinery, &c. Some space is occupied by a review of the means of exchanging commodities—transport being the principal consideration. The question of the size of truck on railways is discussed, a note being made of the 80-ton coal trucks designed for use on an American line. It is stated, with truth, that legislation has considerably retarded the use of electricity for motive power in this country, but the author also considers motor vehicles a hindrance to the development of light railways and tramways. Marine transport is dealt with principally from the trade-route point of view, and methods of propulsion are not considered very fully. Telephonic and telegraphic communication is briefly mentioned. Some interesting notes appear in a section upon instruments of exchange—currency, bank notes, bills, &c.

All the above is a prelude to the main body of the book, which falls into two main parts: that embracing commodities, and a regional geography.

The former part is a concise review of the earth's staple products, and foodstuffs occupy the most important place. These are arranged according to climatic zones. Other vegetable products are included in this part, and rubber and gutta percha receive attention. Following a chapter on fisheries is a long treatise upon mineral products, in which the world's coal production and consumption is set out very clearly. The inferior and immature classes of coal are also touched upon. Iron and steel production forms the subject of several pages, in which reference is made to the ever-increasing use of the electric furnace in this connection. The sources of petroleum are then described. Copper, zinc, and tin are dismissed in a very few words, along with the less used metals, and aluminium appears in a list of "minor minerals," although it is given almost as much space as copper. The last portion of the "commodities" section covers manufactured articles, including paper, leather, glass, earthenware, and porcelain. The regional section opens with a chapter upon Europe, particular attention being paid to Continental trade routes. A chapter on the British Isles follows. In this the distribution of various industries is shown, means of communication and transport are described, and the commercial advantages and disadvantages possessed by the nation are discussed at some length; a number of useful statistics are included in this part. Other European countries follow, including Russia and the new states formed upon the conclusion of the war. The arrangement by continents is continued, but British dominions and possessions are given more space than other countries.

Appendices occupy 84 pages, and include a host of commercial statistics for four-year periods from 1871 to 1913, and a list of alternative geographical names (with pronunciation). The latter is certainly of value when such a familiar name as "Lemberg" is converted to Lwow. An index of 40 pages forms a very complete guide to the text. We must not omit to say that the maps provided render the work very complete, although most of them are designed to bring out one main feature of a region, *i.e.*, railways, coal deposits, &c.

Practical Electricity. By W. E. Ayrton, F.R.S., and T. Mather, F.R.S. Pp. 547; 300 illustrations. Fourth edition, 1921. London: Cassell & Co., Ltd. Price 15s. net.

The publication of a fourth edition of this famous text book reminds us that it is exactly a quarter of a century since Prof. Ayrton wrote his preface to the second edition. It would indeed be difficult to estimate the effect of Prof. Ayrton's life and teaching upon the generation of electrical engineers which sat at his feet at Finsbury and South Kensington; still more difficult to gauge the value of his writings to the much wider circle of students among whom the earlier editions of "Practical Electricty" gained such well-deserved popularity. The present edition has enabled Prof. Mather, who has so ably continued the work of Ayrton, to bring this standard text-book entirely up-to-date.

The symbols have been modified in accordance with the list adopted by the International Electrotechnical Commission, the sections on Dry Cells have been re-written, and that on Storage Cells amplified to include the Edison battery. The short history of the absolute unit of resistance and of the electrical standards of the Board of Trade, which in Ayrton's original work occupied a bare thirty pages, has now a sixteen-page addendum, bringing the account of the absolute measurements of resistance up to the year 1914, and referring in detail to the recent work of Mr. F. E. Smith and Prof. Mather on Electro-Chemical Equivalents and the E.M.F. of Standard Cells.

For the first-year student of electrical engineering who has good facilities for doing practical work, there can be no doubt that this book is the very best possible laboratory manual. By dealing in so thorough and quantitative a manner with the fundamental phenomena of electricity and magnetism the way is adequately prepared for the later work on dynamo-electric machinery, and all the multitude of present-day industrial applications of electrical science.

The rising generation of electrical engineers may go much farther and fare much worse than by adopting the text-book which, in its less attractive and nineteenth century form, served as the groundwork of their fathers' knowledge of practical electricity.

P. H. S. K.

The Signal Service in the European War of 1914 *to* 1918 *(France).* By R. E. Priestley, M.C., B.A. (late Major, R.E.). Pp. 359; 23 plates. Chatham: W. & J. Mackay and Co., Ltd.

The credit for the successful outcome of the four years' operations in France has been claimed by every arm of the service, and not without justice, for although the part cannot be greater than the whole the lack of a single component may render a body or organisation totally ineffective. It may truthfully be said that but for "Signals" the conduct of operations on such a scale would have been impossible; this was a lesson learned very early in the war when the signal service was considered to be merely a messenger staff, acting between G.H.Q. and battalion headquarters, It was then thought sufficient if communication between units was maintained by regimental signallers, and co-operation between artillery and infantry was effected by means of arrangements made by the former arm. Consequently, the signal service operating with the original expeditionary force was represented by 72 officers and 2,200 men, a well-trained and efficient body but inadequate to the needs of the situation. Apart from this there was no unification of command in the signal service, each separate unit acting virtually on its own initiative, although loyally co-operating when necessary with other units. The principal media of communication at this time were the telegraph and message carriers. The telephone, although highly developed in the French and German armies, occupied a subordinate position in our service, and the D Mk.I and D Mk.II field sets possessed many disadvantages, some of which, however, were eliminated in the design of the D Mk.III. The advantages of the magneto telephone failed to combat certain prejudices in spite of useful experience gained by the operation of the French civil system in occupied areas. The enormous growth of the message traffic between G.H.Q. and subordinate commands, however, rendered more speedy and efficient methods imperative and the magneto telephone appeared, and with it sprang up hundreds of new lines. This brought confusion in its wake until the introduction of the switchboard and the metallic circuit. The question of maintenance then became acute, for apart from the destruction of lines by shell-fire, the spirit of acquisition was rampant among the troops; this led to the burying of lines, and the fact that no depth less than 6 ft. was safe made the task extremely onerous, and rendered the system rigid. The alternatives often employed were the use of armoured cables and the "grid" system of interconnection. Turning to organisation, the author shows that it was not until 1916 that proper co-ordination was affected by the appointment of Deputy-Directors of Signals at Army H.Q. and officers directly responsible to them in each division. It was about this time also that the Artillery communications were taken over by "Signals"—this being gradually brought about by co-operation between individual officers of the two arms. From this time forward the history of the Signal Service takes the form of continual refinements and improvements culminating in the highly-efficient organisation existing at the close of the war.

Apart from telegraphy and telephony, the author has a great deal to say of other signalling methods. The heroism of the motor-cycle dispatch riders is given well-earned commendation. These men worked under the worst possible conditions, always exposed to danger, and their casualty list was unfortunately a heavy one. The development of the carrier-pigeon service receives mention; the part played by these birds is not generally realised. Wireless telegraphy made sporadic appearances but did not meet with general approval, as it lacked the essential of secrecy, which the best-contrived codes could not ensure. Unreliability of apparatus was another factor working against its adoption in the earlier days of the war. The "loop" wireless sets, however, had a limited use. These were light and compact, had short aerials, and employed short wave lengths (65 and 80 m.); they were of considerable value in trench signalling having a range of from two to three thousand yards. Continuous wave wireless telegraphy was also developed to some extent for artillery work. The use of the "Fullerphone" and its variations is dealt with at some length.

The author describes all these, and subsequent developments with a wealth of detail which indicates an intimate acquaintance with the subject. By means of the plates it is possible to trace the gradual growth of the signal system in various areas occupied by our troops; the appendixes give particulars of personnel, &c., of signal formations.

In conclusion, it may be said that the volume is a record of hard work, carried out in the face of many difficulties. The failure of the author to mention names in his history may detract from its interest to members of "Signals," but it has to be realised that where all concerned were worthy of special mention the selection of a few names would be invidious.

THE TRADE UNION CLAUSE IN CONTRACTS.

Mr. A. Carson Roberts, District Auditor, has given in writing his reasons for surcharging fifteen members of the Southwark Borough Council belonging to the Rating Committee in connection with a contract for printing rate books. Amongst the firms tendering one eliminated a declaration to the following effect: "".....hereby agrees that.....firm employs trade-union labour in all its departments and pays the rate of wages and observes the hours and conditions of labour recognised or agreed upon between the trade unions and associations of employers and in practice obtained in the London district, and.....do hereby undertake in carrying out my contract between.....and the Council to pay the rate of wages and observe the hours and conditions of labour recognised or agreed upon between the trade unions and associations of employers and in practice obtained in the London district; or in the absence of such recognised wages and conditions not less than the standard rate of wages paid and hours observed and agreed upon between employers and workpeople in the district where the work is being carried out, or in the absence of any such agreement, the rate of wages and hours of labour which are acceptable to the trade unions of the trades concerned, and that.....agree to a condition being inserted in the contract to carry out this undertaking."

On a tenderer striking out this declaration and sending in an altered tender form, the Rating Committee refused to consider it, and accepted one from another firm involving an extra expenditure of £293 19s. 6d. in six months.

Mr. Carson Roberts, in his written judgment, said that in 1913 a complaint was made to the Council by a trade-union officer that the Council's fair wage clause was not being duly observed by this firm, who had held printing contracts with the Council since 1900, and a sub-committee, who investigated the allegations, reported that the firm did not pay trade-union rates throughout their establishment, but that they invariably did so in connection with the Council's work. The Town Clerk was then instructed to report as to amending the existing clauses relating to the observance of trade-union conditions, with a view to amending them so that they would apply to each contractor, and he reported to the effect that such a condition could not be imposed in law.

In 1920 the matter was again taken up, when the Council adopted the declaration given above as a by-law to be imposed upon all tenderers. It was contended by those adopting this declaration that the employment of some trade-union labour in each department would satisfy the condition which the words "employs trade-union labour in all its departments" imported, and he (Mr. Carson Roberts) was of opinion that this was the true interpretation of the words used. The tenderer in this case wrote to the committee pointing out that whilst he agreed to pay the trade-union rate of wages and observe the hours and conditions of labour agreed upon between trade unions and the employers' associations, he had a few employés, some of whom had [illegible] the firm for thirty to forty years, who did not belong to a trade union, and whilst he continued to pay them the [illegible]

wages, he could not conscientiously compel them to join any trade union.

It appeared, however, that the committee did not report to the Council the financial advantages of the tender in question. In view of the documents which were before them at the time it could not correctly be contended that they found this firm unwilling to comply with the conditions which the Council had imposed or sought to impose by their declaration. If they were of opinion that these conditions did not require the exclusive employment of trade-union labour they could and should have removed the difficulty which, according to their minute, caused them to reject this tender, and if, on the other hand, they were of opinion that these conditions did require such exclusive employment, it was not incumbent upon them to observe such a condition.

Their rejection of this tender, added the District Auditor, was, in the circumstances of the case, an imposition by them of the exclusive employment of trade-union labour as a condition precedent to the consideration of the tender, and in imposing such a condition upon the tenderers to employ trade-unionists exclusively they were guided by considerations prejudicial to the ratepayers, which should not have weighed with them in discharging the duty entrusted to them by the Council, and in so doing they were imposing a condition which operated unreasonably in restraint of trade or of competition. As was shown by their minute on the subject and by the action which was taken on their behalf, there was no reason which would have caused them to reject this tender apart from the unwillingness to make a declaration which, as was shown by the letters, the tenderer understood to be to the effect that he employed trade unionists exclusively.

Mr. Carson Roberts concluded by stating that the Borough Council, as a corporate body, would have a *locus standi*, and the right to take the case either to a Court of Law or to the Ministry of Health.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

22,019. "System of exploding air bombs, &c., by wireless waves." C. R. Jamison. August 14th.
22,024. "Electric transmission systems." A. M. Taylor. August 14th.
22,055. "Electrically-operated route indicators, signs, &c." E. Lancaster and F. R. Smith. August 14th.
22,073. "Electric relay." Hasler Akt. Ges. vorm Telegraphen-Werk statte von G. Hasler. August 14th. (Switzerland, August 24th, 1921.)
22,080. "Dynamo-electric machines." W. B. Sayers. August 14th.
22,083. "Current-relay receiving systems." Western Electric Co., Ltd. August 14th. (United States, August 24th, 1921.)
22,094. "Electric battery." J. Crossfield & Sons, Ltd., T. P. Hilditch, and H. J. Wheaton. August 14th.
22,106. "Telephones." N. W. McLachlan. August 14th.
22,113. "Head lamps for automobiles, &c." A. S. Ward. August 14th.
22,118. "Timers." E. C. R. Marks (Leich Electric Co.). August 14th.
22,132. "Lamps for motor vehicles." A. E. Bullock. August 15th.
22,136. "Masts for wireless aerials, &c." H. Longton. August 15th.
22,148. "Variable electrical resistances." A. E. Taylor. August 15th.
22,150. "Induction motors." T. F. Wall. August 15th.
22,155. "Receivers for telephony, &c." M. J. Mason. August 15th.
22,161. "Electric control switches and current-regulating means for motor starters, &c." Brook, Hirst & Co., Ltd., and J. A. Hirst. August 15th.
22,162. "Switchgear for electric motors." Brook, Hirst & Co., Ltd., and J. A. Hirst. August 15th.
22,200. "Protective systems for polyphase alternating-current circuits." N. G. Langrish and Metropolitan-Vickers Electrical Co., Ltd. August 15th.
22,201. "Electric wave transmission systems." F. W. Le Tall (Westinghouse Electric & Manufacturing Co.). August 15th.
22,220. "Establishing high-voltage electric circuits." C. Dachary and L. Viguier. August 15th. (France, January 28th.)
22,245. "Electric light reflector for street name plates." E. G. Casey. August 15th.
22,251. "Valve wireless broadcast receiver." D. S. F. Adams. August 16th.
22,264. "Electric insulation." F. Hornby. August 16th.
22,265. "Inductance coils for wireless apparatus." F. Hornby. August 16th.
22,275. "Device for altering position of electric lamp, &c., suspended from ceiling." A. F. Simpson. August 16th.
22,279. "System of securing proper earth connections on electrical machinery." F. W. Rowley and A. W. Williams. August 16th.
22,309. "Electric switches." J. B. Hansell and Metropolitan-Vickers Electrical Co., Ltd. August 16th.
22,314. "[illegible]." T. I. Jones. August 16th.
22,315. "Automatic electric current systems for motor vehicles." J. B. Bianco. August 16th.
22,321. "Control systems for electric arc welding apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). August 16th.
22,322. "[illegible]." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 16th. (United States, August 16th, 1921.)
22,323. "Telegraph systems." Western Electric Co., Ltd. August 16th.
22,324. "Electric lamp-holders and switches." H. Garde. August 16th.
22,326. "Sparking plugs." F. A. Coulson. August 16th.
22,328. "Electrically-operated driving and reversing mechanism." L. H. [illegible]. Vickers, Ltd. August 16th.
22,329. "Electrical transmission devices." Cibles Automatiques Michoud Soc. Anon. August 16th. (Switzerland, September 7th, 1921.)
22,335. "High-tension transformers." F. Dessauer and Veifa-Werke Akt. Ges. [illegible].
22,367. "[illegible]." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. August 16th.
22,368. "[illegible] for [illegible] electrical machines." M. Gr[illegible]. Aug[illegible].
22,419. "[illegible]." W. [illegible]. August 17th.
22,420. "[illegible]." [illegible]-Houston Co., Ltd. (General Electric Co.). August 17th.
22,430. "Electric lighting, &c., installations on railway, &c., vehicles." A. H. Darker and J. Stone & Co., Ltd. August 17th.
22,442. "[illegible]." B. B. Johnson and Relay Automatic Telephone Co., Ltd. August 17th.
22,456. "Manufacture of electric-incandescent lamps." M. P. Pedersen and N. F. [illegible]. August 17th.
22,468. "[illegible]." F. C. H[illegible]. August 18th.
22,478. "Electrical system of railway signalling." W. Mears and T. Ruben. August 18th.
22,481. "Electric lighting and starting machines for motor vehicles." R. Bosch Akt. Ges. August 18th. (Germany, September 19th, 1921.)
22,500. "Electrically-controlled valve gears for reciprocating steam engines." O. Simmen. August 18th. (Germany, August 24th, 1921.)
22,522. "Process for capacitative compensation of alternating circuits." K. von Wysiecki. August 18th.
22,525. "Electric governor for prime movers." R. G. Jakeman and M. L. Kahn and A. H. Railing. August 18th.
22,526. "Electric governor for prime movers." M. L. Kahn and A. H. Railing. August 18th.
22,531. "Telephone transmitters." A. C. Ingle. August 18th.
22,532. "Electric cooking or heating devices." C. C. Armstrong. August 18th.
22,539. "Telephone mouthpieces." A. L. Mackay and P. S. O'Donnell. August 18th.
22,555. "Power transmission systems." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). August 18th.
22,558. "Power transmission systems." Westinghouse Electric and Manufacturing Co. August 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

3,932. "Electric arc welding." A. E. White (International Welding Engineering Corporation). February 2nd, 1921. (183,876.)
4,381. "Wireless signalling systems and apparatus therefor." British Thomson-Houston Co., Ltd. (General Electric Co.). February 7th, 1921. (183,879.)
6,483. "Water-tight electric light fittings." J. Scott, Ltd., and J. Scott. February 26th, 1921. (183,884.)
9,385. "Regenerative control systems for electric motors." J. E. A. Michel. March 29th, 1921. (183,894.)
9,752. "Thermionic valves and like electric discharge apparatus." Mullard Radio Valve Co., Ltd., and S. R. Mullard. April 1st, 1921. (183,896.)
12,118. "Portable lamps." A. J. H. Haddan (Greist Manufacturing Co.). April 27th, 1921. (183,907.)
12,211. "Electric light shade or reflectors." F. Norke. April 28th, 1921. (183,909.)
12,224. "Time-controlled electrically-operated signal." J. H. Combs. April 28th, 1921. (183,911.)
12,227. "Protective devices for use with polyphase electric currents." N. G. Langrish and Metropolitan-Vickers Electrical Co., Ltd. April 28th, 1921. (183,912.)
12,270. "Electric switches." Metallurgique Electrique. October 29th, 1920. (170,820.)
12,364. "Electrical fitting connections." J. A. McKay. April 29th, 1921. (183,919.)
12,379. "Electric lighting, heating, and ventilating installations for railway and other vehicles, and secondary batteries for use in connection therewith." J. Stone & Co., Ltd., and A. H. Darker. April 29th, 1921. (183,920.)
12,656. "Electrical boiling rings." Electric Fires, Ltd., F. L. Newhouse, and C. H. Smith. May 3rd, 1921. (183,934.)
12,776. "Telephone exchange systems." Western Electric Co., Ltd., and L. Polinkowsky. May 4th, 1921. (183,939.)
12,791. "Apparatus for separating iron and other magnetically permeable metals from flour, grain, and the like." F. King. May 4th, 1921. (183,940.)
13,245. "Windings of alternating-current machinery." British Thomson-Houston Co., Ltd., H. W. Taylor, and F. H. Clough. May 10th, 1921. (Addition to 164,046.) (183,947.)
13,279. "Cut-out devices for magneto-electric machines." R. B. North and A. Massey-Allen. May 10th, 1921. (183,948.)
13,487. "Apparatus for protecting electric supply circuits comprising aerial lines." Akt. Ges. Brown, Boveri et Cie. May 15th, 1920. (163,308.)
13,516. "Attachment for use in connection with electric lamps, lamp-holders, and lamp shades." F. W. Salway. May 12th, 1921. (183,954.)
13,619. "Cooling arrangement for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. May 17th, 1921. (163,315.)
14,067. "Protective devices for electric circuits." Metropolitan-Vickers Electrical Co., Ltd. June 9th, 1920. (164,728.)
14,194. "Miners' electric hand-lamps." A. H. Railing and A. E. Angold. May 21st, 1921. (183,959.)
14,555. "Electrical transmission over long distances." A. M. Taylor. May 25th, 1921. (183,964.)
14,672. "Electric switches." F. Lorand. May 26th, 1921. (183,968.)
15,430. "Electric switch operating mechanism." British Thomson-Houston Co., Ltd. (General Electric Co.). June 3rd, 1921. (183,978.)
15,460. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 30th, 1920. (165,782.)
15,520. "Electric measuring instruments." British Thomson-Houston Co., Ltd. (General Electric Co.). June 4th, 1921. (183,980.)
16,588. "Electro-magnetic wave-signalling systems." J. O. Mauborgne and G. Hill. June 16th, 1920. (165,038.)
16,782. "Electric relays." Siemens Bros. & Co., Ltd., L. De M. G. Ferreira, and J. Boot. June 8th, 1921. (183,990.)
17,813. "Gas impervious materials." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th, 1921. (184,012.)
17,997. "Manufacture of electric cables." J. Urmston & Callender's Cable and Construction Co., Ltd. July 2nd, 1921. (184,016.)
18,216. "Electric reactors." British Thomson-Houston Co., Ltd. (General Electric Co.). July 5th, 1921. (184,019.)
18,467. "Apparatus for suppressing arcs drawn across a given gap." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 7th, 1921. (184,026.)
18,651. "Railway signalling." F. Clarke. July 9th, 1921. (184,030.)
19,353. "Devices for raising and lowering trolleys in systems of electric traction with overhead conductors." R. Brooks, A. Priestley, and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (184,038.)
19,359. "Means for securing windings in electrical transformers." Brush Etectrical Engineering Co., Ltd., and P. W. Scholefield. July 18th, 1921. (184,039.)
19,814. "Supports for electric resistances." Credenda Conduits Co., Ltd., and F. F. D. Davidson. July 23rd, 1921. (184,046.)
24,564. "Governor for controlling an electric motor or other prime mover for operating a pump to supply and maintain pressure in a hydraulic system." J. Stone & Co., Ltd., and W. P. Watkins. September 15th, 1921. (184,083.)
25,597. "Porcelain." British Thomson-Houston Co., Ltd. (General Electric Co., Ltd.). September 27th, 1921. (184,090.)
27,337. "Key contacts for electrically-operated organs and the like." J. H. Compton and F. A. Musgrave. October 14th, 1921. (184,098.)
27,788. "Telephone systems." J. E. Pollak (Siemens & Halske Akt. Ges.). October 19th, 1921. (184,100.)
31,936. "Overload switches for the protection of motors which are started by means of a starting resistance." F. Krupp Akt. Ges. December 30th, 1920. (173,487.)
34,138. "Mercury-vapour ejector air pumps." Akt. Ges. Brown, Boveri et Cie. December 31st, 1920. (Addition to 165,400.) (173,500.)

1922.

12,771. "Train-control systems and apparatus for use therewith." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and A. F. Bound. April 28th, 1921. (Divided application on 182,259.) (184,130.)

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THERMS—AND THE GAS BILL.

THE rain of complaints respecting the increase in gas bills since the new system was introduced of charging the consumer upon the basis of the heat units "declared" by the Gas Company to be contained in the gas supplied, has now assumed the character of a veritable cloudburst. It is a reasonable inference that some legitimate grounds must exist for such well-nigh universal dissatisfaction. It cannot be adequately accounted for by the suggestion of the secretary of the Gas Light & Coke Co. that owing to special circumstances the June quarter meter readings this year cover a period of 100 days and the March quarter 80 days in many cases, because many consumers report the doubling and even trebling of the June quarter's bill this year compared with the same quarter of 1921. The gas companies have attempted various other explanations, and for some days past a sort of apologia, or manifesto, entitled "Truth about Therms," has been published in the leading newspapers by the South Metropolitan Gas Company.

Attention is drawn therein to the fact that originally gas was used solely as an illuminant; that with the introduction of the incandescent burner, the luminosity of the flame became less important than its heating power; that, as a consequence, it is more logical to base the charge for a supply of gas upon its heating value; and that since September, 1920, gas has been charged for at so much per therm (100,000 B.th.u.) and not at so much per 1,000 cubic feet. It is pointed out that owing to the many possible sources of variation in the heating value of a gas, a "declaration of quality" has been made by gas companies, and that in London the declared values are:—

South Metropolitan Gas Company	560	B.th.u.
Gas Light & Coke Company ...	500	,,
Commercial Gas Company ...	475	,,

The manifesto then goes on to say: "If a similar volume of gas were taken from the mains of each company mentioned, in one case it would raise, say to boiling point, 560 gallons of water; in another, 500; and in the third, 475. This shows how unreliable it is to speak only in terms of cubic feet."

The *arithmetic* in the above statement is quite correct, but no reference is made to the influence exerted by the degree to which complete combustion of the gas is approached, upon the volume of gas registered by the meter in effecting the rise in temperature of these quantities of water respectively. This is not a mere academic point. It is of the essence of the whole matter.

All modern appliances for heating, cooking, or lighting by gas burn a *mixture of air and gas.* The air supply to the burners is, in general, fixed. The complete combustion of the gas (*i.e.*, the effective use of the declared heating value) can therefore only be attained if

the gas be of a certain presupposed quality and supplied to the burner at a certain presupposed pressure. Those who use the incandescent gas burner for lighting will readily appreciate the delicacy of the adjustment of the proportions of air and gas for efficient luminosity (*i.e.*, efficient heating effect). The same thing applies to the burners of the gas heater and gas cooker, but, whereas the eye can easily detect a faulty mixture of air and gas in the incandescent burner, it is impracticable readily to discern a disproportion of air and gas in the burners of the heater or cooker, and in proportion as the combustion of the gas becomes incomplete, so will the number of heat units liberated per cubic foot of gas consumed decrease, and the cooker will take a longer time to effect its purpose. Not only therefore will more cubic feet of gas be consumed to roast a joint—or whatever it may be that has to be cooked—but with the lowering of the efficiency of combustion, the number of therms charged for will become increasingly disproportionate to the actual number liberated and doing useful work.

Now, it is impossible, of course, that heating and cooking appliances can work equally efficiently with gases of different calorific values. Further, if the cook has become accustomed to use the gas cooker for x minutes to grill a chop and for y minutes to roast a joint, she will continue to keep the cooker alight for the same period of time in each case whether the calorific value of the gas be 475 or 500 B.th.u., and it is scarcely to be expected that upon the increase of the declared value from 475 to 500 B.th.u. she would alter the time of grilling her chop or roasting her joint to 0.95 x and 0.95 y minutes respectively, nor, indeed, is it likely that any economy arithmetically attributable to an increase in the calorific value of the gas would be fully realisable in practice.

With the vast expansion of the employment of gas for heating and power, the difficulty of maintaining a constant pressure throughout the distributing system has certainly not diminished, and owing to the fluctuations in demand throughout the 24 hours, appreciable variations in the gas pressure at the consumers' meters at many points are unavoidable, and constitute a not unimportant contributory factor to the inefficient action of gas cookers and heaters, and to the increase of the gas bill.

In a letter from Dr. Charles Carpenter, of the South Metropolitan Gas Company, published by the *Daily Mail* on July 29th last, this authority frankly writes: "The present trouble is not due to the therm, but to the fact that in not a few instances the price charged for it has been too high." Open confession is good for the soul. It is scarcely to be wondered at that consumers are complaining at the amount of their gas bills when, added to the causes which we have above outlined, it is admitted that the value of the therm has been overestimated.

It has long since been pointed out in these columns that if one Board of Trade unit of electrical energy is consumed in an electric heater, 3,410 B.th.u. are inevitably liberated, whereas, if a cubic foot of gas is burnt in a gas-heating appliance, no one knows exactly how much heat energy has thereby been obtained.

We may perhaps usefully draw our readers' attention to a clause inserted by the Board of Trade in the various orders of the gas companies:—

"If and so often as the undertakers shall alter the declared calorific value of the gas, they shall at their own expense effect such alteration, adjustment, or replacement of the burners in consumers' appliances as may be necessary to secure that the gas can be burned with safety and efficiency, except in the case of any consumer who objects to such alteration, adjustment, or replacement as aforesaid."

This provision is eminently reasonable. Clearly, if the consumer is to be charged for *heat units* upon the indications of a meter that measures *cubic feet*, he is certainly entitled not only to expect that every cubic foot registered by his meter does, in fact, contain the number of heat units upon the basis of which his gas bill is computed by the company, but that the efficiency of his gas-consuming appliances shall be restored by the gas company if, owing to any change in the quality of the gas, or in the conditions of supply, the efficiency of such appliances is adversely affected.

It is immaterial whether the price of gas be computed on the basis of the number of cubic feet, or the number of thermal units per cubic foot. What *is* material is that the consumer be safeguarded against any modification in the conditions of supply which operate to increase the disproportion between what he pays for and what he gets.

The E.P.E.A. Schedule.

Elsewhere in this issue we give a summary of the points with regard to which the two sides of the National Joint Board have this week been in negotiation. The situation is somewhat involved, and a close study of it is necessary if one would gain a true appreciation of the difficulties of the position. A comprehensive set of revised conditions of employment and an amended schedule of salaries have been put forward by the employers' side of the Board, which are intended completely to supersede the existing conditions and schedule; it is important, therefore, to consider not only what the new proposals contain, but also what is omitted from them, in comparison with the terms of the original agreement.

The principal changes appear to relate to the Schedule of salaries, the basis of classification, and the grading of employés. On the surface, it would appear that no drastic change had been introduced in the Schedule; the range between 4,000 kW and 30,000 kW has been distributed between the four classes in a new ratio, but the remaining classes are unaltered. The effect of this proposal would be that a considerable number of men would be transferred to a class one stage lower than they are in at present, and a small proportion would be moved down two classes.

The change proposed in the basis of classification is to substitute for the total capacity of the generating plant one of two alternatives (whichever results in the lower classification), namely, the "normal continuous rated output" or the maximum demand for one hour, plus 25 per cent. Either of these bases may obviously differ considerably from the existing basis, and in general one or other certainly would fall much below the former. It will be seen that this proposal also tends to lower the position of a generating station in the classification, and consequently would further reduce the salaries of the staffs below the present values, aggravating the loss in the case of stations falling within three of the classes, and affecting many of those in the other classes. These two changes are cumulative in their effect, and may easily result in a reduction of salary of 10 or 20 per cent. basis.

But the third important change that we have mentioned is perhaps the most serious of all—for it consists in the *total omission* of any basis of grading whatever. Obviously a schedule based on grading becomes farcical when the grading is abolished. So grave an omission could not possibly be due to an oversight; it will be absolutely fatal to any prospect of agreement, and we earnestly appeal to the employers to think twice before they press their emasculated schedule upon the engineers. The essence of the existence of the Joint Board is to endeavour to solve all such questions by agreement and peaceful negotiation; but agreement to return to the chaotic conditions and the miserable remuneration which disgraced the industry of electricity supply before

—aye, and throughout—the war is impossible. If these proposals are pressed without material modification, the cause of peace will be jeopardised, and a heavy blow will be struck at the Whitley system, which has worked so well in the past and from which we hope so much in the future.

That power station engineers have been far more contented and at rest since the Schedule was adopted than before, is undeniable; that they are entitled to justice and consideration is equally unquestionable; and lastly, that they have acquired strength by combination—but have used it with discretion and moderation—is a matter of historical fact. We hope that the employers' representatives will give due weight to these considerations and refrain from provoking a conflict in a key industry, at a moment when we are all looking forward hopefully to improvement in trade and reduction of unemployment.

Broadcast Wireless Telephony.

The inauguration of the broadcast wireless telephony scheme seems to be as far off as ever. Meanwhile, the wave of enthusiasm amongst amateurs will in all probability be damped down by the delay. It is no doubt sound policy to launch a new scheme just when public interest has reached its crest, but one must beware of toppling over that crest and being drowned in the trough that always follows a wave, no matter of what sort.

The causes of delay are several. There was the initial difficulty of formulating an agreed scheme among the manufacturers of wireless apparatus, but several weeks have elapsed since the formation of the British Broadcasting Co. was announced. Its proposed articles of association have been in the hands of the Post Office authorities for nearly three weeks, but they have not yet been officially approved of.

With no precedents to guide them, except the utter confusion which has occurred in the United States consequent on the haphazard manner in which broadcasting has been indulged in there, the authorities rightly desire to scrutinise as closely as possible the conditions under which broadcasting will be allowed in this country—the articles of association must be brought into alignment with the general principles with which the Postmaster-General expects the company to conform.

Several important points are, however, still outstanding, one being the conditions under which broadcast matter should be reproduced in public places of entertainment. It is contended that such entertainments should provide a substantial contribution towards the expenses, which have been estimated at £20,000 per annum for each of the several transmitting stations that it is proposed to erect in various parts of the country, and which will not be fully met out of the percentage the Postmaster-General proposes to allow on each receiving licence issued.

Moreover, a fresh obstacle appears to have been encountered. Within the last fortnight, according to *The Times*, the manufacturers have reconsidered several points and have submitted a fresh series of articles of association which differ materially from their original proposals—modifications that may be expected to postpone still further the inauguration of the scheme.

Another aspect that is causing some concern is the Postmaster-General's agreement with the manufacturers that for two years after the inauguration of the scheme, licences shall only be granted in respect of apparatus manufactured by members of the Broadcasting Co.—a protective regulation directed against the importation of foreign apparatus with which British firms are apparently unable to compete on a price basis. But it should be pointed out that in order to avoid a monopoly, it is stipulated that any *bona fide* British manufacturer can become a member of the Broadcasting Co. by the purchase of a £1 share. In all probability, *The Times* is officially informed, this protective measure will not affect owners of home-made sets already in use, nor sets constructed for *bona fide* experimental work in the future. Nevertheless, the mere purchase and assembly of component parts with no other purpose in view than the reduction of the cost of "listening-in" will be regarded as an evasion of the regulations. "We are obliged to do this in order to get some sort of income for broadcasting," a Post Office official is reported by *The Times* to have said, but such a regulation will obviously be difficult to administer, and its justice is doubtful. The type of message that it is apparently proposed to transmit broadcast will only appeal to the amateur who in the vast majority of cases has no inclination, if indeed he has the means, to purchase an expensive receiver. It is the novelty of the thing which appeals to the general public, and the success of the scheme would therefore appear to depend on the cost of purchasing and installing a receiving outfit being kept as low as possible.

Railway Accidents and Research Work.

The terrible accident at Gravesend which recently formed the subject of an official inquiry presents—from the point of view of a signal engineer—no new feature. The evidence adduced was practically a repetition of that given at other inquiries in the past, touching the cause of previous similar disasters. It retold an old and oft-repeated story of one train being unexpectedly prevented from running according to the time-table and a following train crashing into it—in spite of the protective signal. As usual, the cabinman swore that this signal was "on," while the driver swore that it was "off."

A standard text-book on Railway Engineering states that "Two solid bodies cannot occupy the same space at the same time; and that the duty of a railway signalling engineer may be said to be to endeavour to prevent two bodies which are moving at high velocities from seeking to violate this law of Nature."

Writing to us on this subject, Mr. A. E. McCloskey, a member of the Institute of Railway Signal Engineers, points out that in America there is a "Safety Board" which examines and develops new ideas for the prevention of railway accidents. In England such a Board is unfortunately still an unfilled want, as is shown by the following case: A Colonial railway engineer brought a new patent to the notice of the Minister of Transport, who informed him that the selection of systems of railway signals was practically left to the individual discretions of the general managers. After much correspondence and delay, the Colonial engineer succeeded in obtaining an interview with a general manager, who said that he was sorry no funds were available for experimental work, but he would be very pleased to go into the matter again if and when the invention had proved successful—*on some other railway*. But the inventor's leave of absence had expired, and the benefit of his new invention was lost to the State.

At a recent inquiry the Attorney-General asked whether the War had had the effect of apparently lessening the value of human life in the eyes of public carriers and their subordinate officials; and in a paper read before the Institution of Civil Engineers the author made the following significant remarks: "Signalling improvements have not been, curiously enough, generally introduced until the stipulated number of years of life of the various patents have elapsed. Although this may appear a strange coincidence, yet it can be accounted for by the general hesitation of managers and other responsible officers to enter upon what appears to them to be an experiment or new departure."

The Medical Association recently replied to a well-known philanthropist who had offered £10,000 as a prize to anyone who could discover a cure for cancer, that what was really required was not a "prize" but a fund to provide food and clothing for the scientists while they were engaged on the scientific research work, necessary to the attempt.

And in the case of the repeated fatalities on our railways the parallel is obvious. Under present conditions no one can afford to do scientific research work.

D

NOTES ON THE ELECTRIFICATION OF THE YENANGYOUNG OIL FIELD.

There are few industries which have attracted more general attention during recent years than that devoted to the recovery of petroleum. The rapid increase in the use of mechanically-propelled road vehicles, the application of oil fuel for ship propulsion, the advance in Diesel engine design, and the startling developments in aerial craft have stimulated this interest and impressed the mind of the public with the importance of the oil industry in their own lives, and the big part it plays in our modern civilisation.

Unfortunately the supplies of crude oil are not inexhaustible. There is much speculation and doubt regarding the life of existing fields if the recent increase

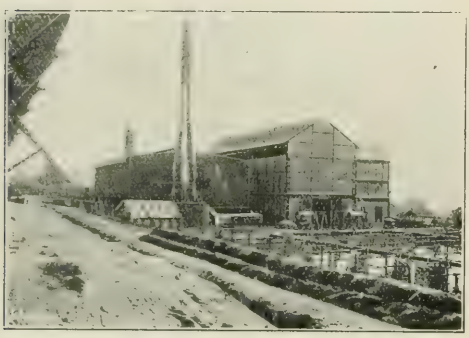


Fig. 1.—Power House, Approaching Completion.

in the rate of demand continues, and any considerable diminution in the supply of oil would be hardly less than catastrophic at the present stage of the world's material progress.

The situation calls for increased attention to the economical operation of the fields themselves. The recovery of crude oil in the past was generally effected with little regard for this point, and the percentage of oil consumed to oil recovered was iniquitous, in view of the potential value this oil possesses to-day.

It would have been natural to expect that electricity would have been brought early to the aid of the industry in this connection, but it has been slow in making headway, and has only embraced the standard cable tool system of winning the crude oil within comparatively recent times. Most engineers are familiar with the prejudices that in the past proved an obstacle to the development of electricity in coal mining. The situation of the oil industry has been somewhat similar; the supplies of fuel were seemingly unlimited, and the prodigal waste of crude oil was overlooked, or deemed of little importance, in view of the profits a successful company made. Indeed, there was some justification of the oil owners' former attitude because the ordinary industrial motor was in many cases not found suitable to the varied requirements of oil field operation. This situation is now rapidly changing. The problem of adapting the electric motor for pumping and drilling purposes has been successfully overcome, and to-day there are some thousands of electrical equipments installed on various fields.

A most interesting and notable recent development in the application of electricity to the petroleum industry is the power scheme which the Burmah Oil Co. are inaugurating on their Yenangyoung Field. This oil-bearing territory has been one of the most prolific for its size in the world, and has suffered in common with other fields from uneconomical methods in the past. The conversion of all wells to electrical drive was first studied in 1910. At that date—in this field as unhappily still to-day in the bulk of the oil fields of the world—the pumping and drilling plant consisted in the main of some hundreds of small relatively inefficient steam, and to some extent gas, engines, the steam engines being supplied with steam from numerous unlagged portable boilers burning crude oil fuel, and sometimes natural gas. The steam piping, often of considerable length, was generally unlagged also. It needs no figures to demonstrate how wasteful this system was. The important economies and valuable conservation of oil which could be effected by replacing these small steam units by central station plant, designed on modern lines, were apparent. The problem of converting this plant at that date was, however, not without its difficulties, and it was evident from the outset that the mere substitution of the ordinary industrial motor for the steam engine would not meet the requirements of the oil well operators, particularly as the standard cable tool system of petroleum recovery was in use on this field.

It was about the same date that the problem was being seriously tackled on some of the American oil fields, where the conditions of operation were very similar. After considerable experimental work, and largely due to the enterprise of the General Electric Co., of Schenectady, and the Westinghouse Electrical Co., of Pittsburg, a type of motor was eventually evolved which met all the requirements of oil well work, both for drilling and pumping purposes. A small trial installation was supplied to the Burmah Oil Co. in 1914, and the results, both with drilling and pumping equipments, were so satisfactory that the directors decided to accept the principle and immediately set about the conversion of the whole of their wells in the Yenangyoung Field to electrical operation. This important project was held up due to the outbreak of war, but as soon as peace was re-established, matters were put in train and the scheme is now approaching completion.

The Yenangyoung Oil Field is situated on the east bank of the river Irrawaddy, approximately 300 miles from its mouth. The area of the field actively producing is only two-and-a-half miles long by half-a-mile in



Fig. 2.—Water Pumping Station

width. In this area there are, at the present date, approximately 1,000 wells belonging to various oil companies, a number of workshops, auxiliary pumping plants, and the miscellaneous apparatus attendant on any large industrial scheme. At present the motive power on the field is obtained from small steam or gas engines as described above.

With a view to providing electrical power for the operation of this field, the Burmah Oil Co. have erected a power station at a place called Thittabwe, about two-and-a-quarter miles distant, and in close proximity to the river. Fig. 1 shows the first installation of the power station buildings approaching completion.

Engine-room and Annexe.—The engine-room and switchgear annexe are steel structures filled in with concrete blocks.

The station is being equipped with four 4,000-kW, 6,150-kVA, three-phase, 50-cycle turbo-generator units generating at 3,300 volts and four 6,150-kVA oil-cooled transformers for stepping-up the machine pressure to 13,200 volts. The transformers are placed in separate compartments, and are tied to the machine terminals without the intervention of any switchgear, so that the turbo-generator and transformer form virtually one unit. The 13,200-volt terminals of the transformers are coupled to switches mounted in moulded stone

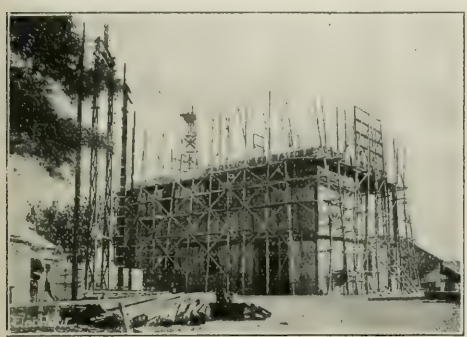


Fig. 3.—Main Receiving Sub-station, in Course of Construction.

cubicles built in an annexe of the engine-house. The switchgear is arranged in two tiers: on the first floor the cubicles contain the h.t. switching apparatus, current and potential transformers; and on the second floor are the busbar chambers, busbar isolating switches, &c. The board is arranged with duplicate busbars, each set of busbars being carried in its own separate compartment. All the switches are electrically operated from a control board of the usual bench-board design, which is situated on the second floor overlooking the engine-room.

There are two 13,200-volt outgoing feeders for the supply of energy to the oil field, each of the overhead split conductor type. In addition, duplicate outgoing h.t. feeders of the plain type provide for the local requirements of the Burmah Oil Co. at Nyaunghla. Provision is also made for additional feeders of the same description should the developments of the scheme in the future require it. All outgoing overhead feeders are protected by oxide film lightning arresters, and are carried through the roof of the annexe building by means of special porcelain roof bushings. The conductors are carried from these bushings to a specially designed steel roof structure, and from thence to the various transmission line towers.

The turbo-generators exhaust to low level jet condensers, placed in the basement immediately below the turbines. The condenser cooling water is drawn from a culvert running between the engine-house and boiler-house. This culvert leads to a large storage and settling tank at the north end of the building. Under normal operating conditions this tank will be supplied with water from the river by means of two electrically-operated 14-in. centrifugal pumps, having a capacity of 5,000 gallons per minute, placed in a pumping station on the river bank, fig. 2; it will function mainly as a means of settling the fine deposit which is carried in suspension in the river water. Owing to the vagaries of the river, however, it may prove difficult to pump the required amount of water during a low-water period, and if this contingency arises, provision has been made for utilising the tank as a spray cooling pond during such time as water is unobtainable from the river in sufficient quantity.

Boiler-house.—The boiler-house is a steel structure covered with corrugated sheets. The present plant consists of four Babcock & Wilcox land type water-tube boilers, each capable of evaporating 30,000 lb. of steam per hour under normal duty, or 37,500 lb. of steam under overload conditions. (Two additional boilers of the same capacity and design are now on order, so that the completed plant will consist of six units.) The boiler pressure is 200 lb., and the steam is superheated to a total temperature of 650 deg. F. by means of superheaters integral with the boilers.

Each boiler is provided with 12 oil fuel burners designed on the pressure atomising system, and also 12 gas burners for burning natural gas. It is anticipated that under normal working conditions, the natural gas obtainable on the field will supply all the requisite fuel at the present time.

Each boiler operates in conjunction with a Green economiser consisting of 256 tubes, and the gases from each pair of boilers are carried to a separate self-supporting steel chimney having an overall height of 150 ft. This chimney is provided with an electrically-operated induced-draught fan, which will be required when dealing with the maximum evaporation of the boilers, but it will be possible to operate under natural draught with a corresponding decrease in boiler output.

The pump room contains two steam-driven vertical Weir feed pumps, each capable of supplying 9,000 gallons of water per hour, and one electrically-operated turbine feed pump of Worthington-Simpson manufacture. There are also two Worthington steam-driven oil fuel pumps, each suitable for supplying oil fuel to three boilers at a pressure of 200 lb. per sq. in., and one electrically-operated pump of similar design and capacity.

Transmission Lines.—Electrical energy will be conveyed to the field by means of two transmission lines, each approximately 12,500 ft. in length. The lines are being conducted along separate routes, so as to avoid,

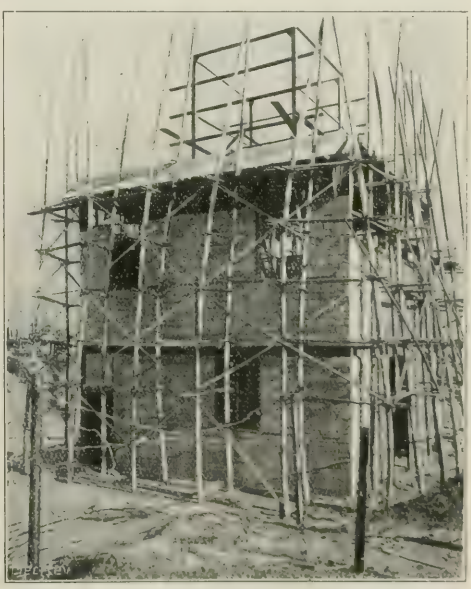


Fig. 4. Typical Field Sub-station, under Construction

as far as possible, the contingency of both being interrupted at the same time. In case of emergency, either transmission line will be capable of carrying the total load.

Each transmission line consists of six No. 0 B. & S. stranded wire conductors carried on galvanised steel towers built by Messrs. Milliken Bros. Ordinary pin type insulators are provided for the intermediate towers, but the line will be anchored by means of Hewlett strain type insulators at frequent intervals. An overhead stranded steel earth wire $\frac{3}{8}$ in. in diameter will be

carried the whole length of the line. In order to avoid the interruptions which are liable to occur with an overhead split conductor system when birds cause a temporary earth to the cross-arms of the towers, the pin type insulators are raised considerably higher than is usual in ordinary transmission-line practice.

Main Receiving Sub-station.—The two transmission lines are run to a main receiving sub-station centrally situated on the western side of the field (fig. 3). This sub-station will act as a distributing centre for the whole of the oil fields, and is equipped with electrically-operated remote-control high-pressure switchgear of similar design to that provided in the power station. The building is a steel and concrete structure, and it will also serve as the headquarters of the field's electrical engineering staff.

High-pressure Ring Mains.—The main receiving station will feed two split conductor ring mains which encircle the more active part of the oil field. These ring mains will be tapped by 12 sub-stations, also confined to the outskirts of the field. Owing to the very congested nature of the oil well area, it was thought desirable to keep the entire h.t. system outside it.

The ring mains are carried across each sub-station on overhead steel structures which form a series of anchor towers. Alternate sub-stations will be tapped off different ring mains, and between every sub-station, split conductor protection will be provided. These ring mains are carried on galvanised steel towers of identical design to the main transmission lines, except that the cross-arms are extended so as to carry a total of 12 conductors instead of six. If any fault occurs on the ring main between any two sub-stations, it will result in this portion of the line being cut out automatically without interrupting the supply of energy to any of the sub-stations. Moreover, if either ring main were to fail in two places and thus interrupt the circuit entirely, the remaining ring main would still be capable of supplying energy to all the alternate sub-stations round the field, and by means of interlinking the low-tension distributors, a supply could still be maintained at every well. These unusually elaborate precautions have been deemed necessary in view of the paramount importance of maintaining a supply of energy on the oil field in all possible circumstances.

Sub-stations.—The sub-stations are rectangular steel structures approximately 26 ft. square, with 9-in. walls of concrete block or brick (fig. 4). They are built with two floors. The upper floor contains the h.t. cubicle switchgear and lightning arresters, and the ground floor the l.t. switchboard and transformers. At present each sub-station will be equipped with one 500-kVA, three-phase transformer reducing the line pressure of 13,200 volts to 460 volts for distribution on the field. Provision has been made for a second transformer of the same size, so that the ultimate capacity of each sub-station will be 1,000 kVA.

Low-pressure Distribution.—From each sub-station will radiate the low-pressure feeders providing actual energy to the individual wells, and to the auxiliary plant on the field. Each distribution feeder will consist of six No. 0000 B. & S. stranded copper conductors carried on 35-ft. Bates expanded steel truss poles. The conductors will be run two in parallel, and the length of each distribution feeder will be kept as short as possible. The provision of parallel conductors and the short length of the feeder has been rendered necessary in order to reduce the reactance of the low-tension system, and to provide reasonably close regulation at the motor terminals. Each sub-station will supply a comparatively small area, and under normal conditions the low-tension distributors will not be interconnected, so that if any mishap were to occur at any one sub-station, the portion of the field affected would be limited to a comparatively small area. Provision has been made, however, for coupling the low-tension feeders of one sub-station to the low-tension feeders of the adjacent sub-stations, so that in an emergency it would be possible to feed through. The service lines are tapped off the overhead distributors and conveyed to pole line oil switches mounted on the distribution poles. From the oil switches the service lines are carried to groups of two or three wells. In case of fire on the field it is possible to disconnect any individual service and make the line entirely dead. These service lines are carried on a similar design of Bates pole, somewhat lighter than that employed for the main distribution feeders.

Oil Well Equipments.—The actual service connection to the motor equipments is made by means of an insulated cable carried on porcelain insulators and brought into the motor-house through porcelain bushes. This service is taken to three ironclad fuses and thence through a three-phase unbalanced integrating wattmeter, and so to the terminals of the oil switch controlling the motor which operates the well.

The well equipments themselves are of two distinct types, *viz.*, for pumping and for drilling purposes. The pumping equipments consist of two-speed motors rated at 30/12 h.p., running at a synchronous speed of 1,000 or 500 r.p.m. The drilling equipments are single-speed machines rated at 75 h.p., running at 750 r.p.m.

Both pumping and drilling motors are designed and installed so as to reproduce, as closely as possible, the conditions which exist with the steam engine drive; thus, beyond the fact that a different type of prime mover is being used, there is practically no modification in the operation of the wells. This greatly facilitates the conversion and enables the present operators to become acquainted with the handling of the new plant with the minimum of difficulty. This remark applies particularly in the case of the drilling equipments. The controllers for varying the speeds of the motors are operated by means of a steel wire rope from the "headache" post of the rig in exactly the same manner as the throttle of the drilling engine—in fact, the driller might hardly know that he was not controlling the usual steam engine, as the motor plant is out of sight and he secures precisely the same results on his drilling line in the manner he has always been accustomed to.

The fact that each well, whether pumping or drilling, is provided with an integrating wattmeter will form a most valuable aid to the economical operation of the plant. In the case of a pumping well, it will be possible to determine accurately the stage at which the pumping becomes unremunerative. It is generally anticipated, and forms one of the arguments in favour of electrical operation, that it will prove remunerative to pump a well to a much greater degree of exhaustion than is possible under the existing system.

Miscellaneous Applications.—The economy which can be effected on an oil field such as Yenangyoung is not limited by the application of electricity to the wells alone. In the present instance electrical drive will also be employed on auxiliary plant of a very varied nature. The more important installations of this character are:—

1. The main line oil pumping station.
2. Water service to the fields and for domestic purposes.
3. The oil collecting and pumping stations on the field.
4. The various workshops.
5. Rope-way.
6. Ice-making plant.
7. Lighting and fans for bungalows, and
8. The actual illumination of the oil field area and individual rigs.

When the scheme is finally complete, all these services will derive their power from the main central station at Thittabwe, and numerous isolated boiler plants and small lighting sets will be superseded. This will form by no means an unimportant factor in the operating economy of the whole field.

It is worthy of note that the benefits of this very important project will not be confined to the Burmah Oil Co. alone. Although the Burmah Oil Co., Ltd., are providing all the capital cost and carrying the entire

risk of exhaustion of the field, they have invited and secured the co-operation of the numerous other oil companies who operate on the same territory, as co-operative consumers, the Burmah Oil Co. undertaking to provide them with electrical energy at cost *pro rata* between themselves and all other consumers. There is therefore no opportunity of rival supply schemes on the same field, which, in view of the small area and congested condition, would not only have made the engineering work much more difficult, but might have been a fruitful source of friction between the various oil interests concerned.

In conclusion, it should be stated that the whole of the power scheme described in these notes has been carried out by the Burmah Oil Co.'s own engineering staff in London and Burma, under the direction of Mr. C. McCarthy-Jones, M.I.Mech.E., M.I.E.E., consulting electrical engineer, London.

The chief contracts for the main plant were placed as follows:—

Main station buildings ...	Armstrong, Main & Co.
Boilers	Babcock & Wilcox, Ltd.
Turbo-generators and switch-gear	British Thomson-Houston Co.
Condensers and pumps ...	Worthington-Simpson, Ltd.
Transformers	The B.T.H. Co., Ltd., and International General Electric Co.
Oil well equipments	International General Electric Co.
Transmission line towers ...	Milliken Bros.
Cables	Callender's Cable & Construction Co., Ltd.

HIGHER STEAM PRESSURES - OR PULVERISED COAL.

Under this title in a recent issue of the *Journal* of the American Institute of Electrical Engineers, a paper by Mr. F. A. Scheffler discusses whether for the boiler-house of a 10,000-kW power station it is likely to be more economical to operate the boilers at 250-lb. pressure and 600° F. total temperature or at 400-lb. pressure and 700° F. total temperature, and whether in each case it is cheaper to use mechanical stokers or pulverised coal. The author's association with the Fuller Engineering Co. of New York, which manufactures burners for pulverised coal, is clearly shown, but any risk of a charge that the advocacy takes the form of a strained special pleading is discounted by the frankness with which the various figures are put forward, no less than by the excellent manner in which, in an appendix, the boiler tests are scheduled.

The paper is mainly commercial, but before we look to the comparisons of capital outlay and running costs, it is best to refer to the appendix for figures of thermal efficiency. These results are in no degree abnormal—we cite some of the salient figures. The boiler was of the water-tube type, having a water-heating surface of 13,057 sq. ft. The durations of two tests exceeded 48 hours by 8 minutes and by 50 minutes respectively. The fuel was a powdered Illinois coal, of about 11,950 B.th.u. thermal value per lb. of dry coal, containing from 13.137 to 13.567 per cent. of ash and refuse per unit of dry coal:—

	Test No. 3 Average.	Test No. 4 Average.
Steam pressure, lb.	263.8	267
Temperature of superheated steam, ° F.	583.5	598.4
Equivalent evaporation per hour per square foot of heating surface from and at 212° F.	4.74	7.00
Thermal efficiency of boiler furnace and superheater, based on coal as received ...	82.8%	82.23%
Thermal efficiency of boiler furnace, superheater, and economisers based on coal as received	87.9%	88.38%

These efficiencies, while good, do not in any way suggest inaccurate optimism—indeed, we have known somewhat higher thermal efficiency with water-tube oil-fired boilers.

It is not so easy at this distance, in days of unstable prices, to certify as to the likelihood of accuracy of the author's estimates regarding the difference in the capital outlay on the boilers, economisers, steam pipes, turbines, &c., for the two conditions of 250 lb. steam at 600° F. and 400 lb. steam at 700° F. The author estimates this at 776,400 dollars, or $7.764 per kW of plant installed.

For stokers and accessories the author estimates a total capital outlay of 422,400 dollars, and for the pulverised coal-burning equipment and accessories a capital outlay of 476,000 dollars.

In arriving at operating costs as distinguished from fixed and maintenance charges, Mr. Scheffler assumes the following conditions:—

Turbine steam consumptions, 10.75 lb. per kWh for 250-lb. pressure, and 10.0 lb. per kW for 400-lb. pressure, plus in each case an allowance of 5 per cent. for additional power or steam for auxiliaries. In each case also the annual load factor is taken at 40 per cent., and the coal is assumed at 13,000 B.th.u., with 8 per cent. ash. This coal is taken at $5 per long ton. As regards boiler efficiency, this is assumed at 78 per cent. for the stoker plant and 85 per cent. for the pulverised coal equipment. (This seems the one point in the paper upon which further light is needed. We grant that under full-load conditions a thermal efficiency of 85 per cent. is easily conceivable for a boiler burning pulverised coal, but this is not nearly so conceivable when the average working load factor is down at 40 per cent., which means periods of easy steaming or the equivalent of banked fires.)

We omit the dozen or more items on which the daily costs are based, and, reciting the author's conclusions, give the daily totals:—

		Total daily costs.	Fuel costs only.
250-lb. steam pressure and 600° F. temp.	Stoker fired ...	$3273.80	$2928.00
	Pulverised coal fired ...	3032.20	2683.00
400-lb. steam pressure and 700° F. temp.	Stoker fired ...	3428.05	2810.40
	Pulverised coal fired ...	3162.07	2547.60

The author therefore concludes:—

(*a*) It will cost a great deal less money to equip and use pulverised coal in power plant in order to obtain the highest efficiency and the lowest operating costs than it would to use a high pressure of 400 lb. and high superheat of 700° final.

(*b*) That lower B.th.u. per kWh and high over-all thermal efficiency will be obtained by substituting pulverised coal-firing in lieu of any other known method using the moderate high pressure and superheat in common practice to-day, compared with high pressures and temperatures.

(*c*) That the benefits accruing from the net difference in station water rate between the present practice as to pressures and temperatures and the higher pressures and temperatures are comparatively small, and do not warrant the excessive additional first cost and yearly fixed charges for the higher pressures and superheat.

(*d*) That the cost per short ton of coal handled and burned by stokers in the 250-lb. pressure plant (exclusive of the cost of the coal) will be 52 cents, and with pulverised coal 58 cents. For the 400-lb. pressure plant this cost would be increased to 95 cents per ton with stokers, which increase is due principally to the additional fixed charges over the 250-lb. pressure plant.

International Road Congress.—The *Board of Trade Journal* states that the fourth International Road Congress will meet at Seville in May next year.

Among the papers to be presented are: "Laying Tramway Rails on the Various Kinds of Road Surface," by Mr. A. Brodie, M.Inst.C.E., City Engineer, Liverpool; and "The Problem of Traffic on Congested Roads and Streets of Towns," by Messrs W. Rees Jeffreys and A. E. Cave.

BAD BUSINESS.

By H. R. TAUNTON.

The electrical contractor is sitting in his office. He has been sitting there, off and on, for a year or more. Moss is growing on him in patches. To him enters a traveller. He has noted the empty showroom, the diminished staff knitting a jumper, the careworn creases in his customer's countenance as he sits moodily "writing down" his stock-list. "Business is bad here!" thinks he. So, knowing that nothing will please the contractor more, he assures him that business is bad everywhere.

"Haven't taken an order to-day. You're my last hope. Let me show you this new——."

The contractor brightens up perceptibly—though not often to the point of placing an order. Half a dozen more travellers come along and tell him the same tale; and by the end of the day he is comparatively cheerful. He almost chuckles as he reprices his ceiling roses at 2s. a dozen.

"General trade depression! It isn't as if I was the only one! Can't expect to get orders while business is so rotten—must just wait till things improve." And another little clump of fungus sprouts upon him.

He's quite right, of course, in saying business is bad. It is, for him and hundreds like him—such is the power of Monsieur Coué! And business is likely to remain bad until contractors scrape off the mildew and get out into the sunshine. In the words of the American poet, "He who woos success should have his eyes on the stars, his ear to the ground, and his nose on the grindstone."

The expression "Business is bad!" simply means that there is a scarcity of ready money in the community; so that the public, after spending so much on the essentials of existence, has only a relatively small surplus wherewith to buy non-essentials. But there *is* always a surplus. What it is spent on is a matter of individual taste, influenced by social environment, and the fashion of the hour. The dilettante spends his surplus on artists' proofs and first editions; the *bon viveur* on wines and cigars; one will buy a motor car or a pianola, and another furs and jewellery.

There is always plenty of money floating about to be spent on pleasure of one kind or another. Why should not some of it be diverted into electrical channels, to the benefit of contractors and the industry at large?

The price of a pianola would equip an electrical kitchen. That of a sable coat or a pearl necklace would cover the cost of an elaborate installation. But sables and so on are fashionable; electricity is not. The fault is that of the ill-organised electrical trade. Fashions can be made: they are largely the result of judicious publicity and subtle propaganda.

There are two possible ways by which some of the money in circulation can be switched into an electrical circuit: either by making electricity a fashion, so absorbing some of the surplus available for luxuries; or, better still, by making it a necessity, so that it taps the stream of expenditure before it dribbles away in non-essentials.

Let the manufacturers, factors, supply companies, and contractors co-operate in aggressive advertisement and salesmanship; let them educate the public to look upon electricity as a desirable luxury which should have first call upon their spare income. Make the electrically equipped home "the thing": so that Lady de Vere will be as ashamed of a gas cooker in her kitchen as she would have been, thirty years ago, of gas light in her drawing room: so that Mrs. Newrich, to be in the mode, must have electric radiators in every room: so that Suburbia will emulate Belgravia in electrical equipment, and "swank" in Board of Trade units.

Alternatively, if it be argued that electricity is too utilitarian ever to be fashionable, the public has still to be convinced of its utility; and the same advertising energy can be—and probably more usefully—directed to preaching electricity and its applications as necessities, essential to existence, or at least to comfort.

Electrical contracting should be one of the last businesses to be seriously affected by trade depression. One never hears the baker, in the worst of times, complain that business is bad. Bread is a necessity. So ought to be electricity. The remedy for bad trade is for it to be made a necessity by contractors and the industry at large.

Yesterday's luxury is to-day's necessity. Electric lighting, some thirty years or more ago, was the toy of a few rich men. To-day, millions of people in private houses, public buildings, shops and factories are dependent upon it as their only means of illumination. Lamps, at least, are a necessity to them; and, however bad be trade, a certain minimum of repairs. If the contractor nursed and educated his public properly, that minimum would be much larger, and not only repairs, but improvements and extensions would be considered indispensable.

To those who have once tried them, electric irons, kettles, and other domestic appliances are reckoned essentials to comfort. It should be the mission of the electrical contractor to make those who have not tried them do so. Obviously, the more people who are taught to regard certain articles as necessities, the more of those articles will be sold. The field of electrical appliances widens automatically every day; but contractors should not be content with "automatically."

In the Stone Age man ground his corn by hand. Later he trained animals, and harnessed wind and water to do his work. Later came steam, to be supplanted in modern times by the electric motor. Electricity is to-day the silent, but gigantic driving force of the world. If every electric motor in the country were to break down simultaneously, it is no exaggeration to say that industry would be paralysed. To keep them going means so much work for the contractor—if it is only to supply new brushes. More necessities.

In a sound contracting business the mainstay should be maintenance and repair work, small supplies and cash sales. However bad be business generally, the turnover on these should yield enough profit to pay standing charges, or the bulk of them. To take a simple example: if a contractor could count on selling every lamp bought in his particular town, he could laugh at hard times—simply because lamps are a necessity. It is for every contractor to get as near that ideal as possible, and to supplement the lamp necessity by other electrical necessities by educating an ever-widening circle of the public to consider an ever-widening range of electrical conveniences as essentials to twentieth century existence.

He can only do this if he be loyally supported by the rest of the electrical industry. He has been put in the forefront of the preceding argument because he is obviously the front line of the offensive against the public; and because the attack upon their ignorance, conservatism, and deep-rooted prejudices can be best made by the manufacturers and supply authorities backing up the man who is closest in touch with the "enemy." At present he is sorely handicapped.

He has no effective headquarters' staff. That is largely his own fault, inasmuch as he does not adequately support the E.C.A.—the only organisation that can secure him the advantages he needs.

He fritters away much of his energy in suicidal price-cutting and jealous competition with other con-

tractors. A degree of local co-operation is the obvious remedy.

He has to face the unfair competition of supply companies, who run elaborate and expensive showrooms. If they did that to assist the small contractor, who cannot afford to do it for himself, it would be a step in the right direction. But they don't. They do their best to starve him out by selling direct to the consumer. Worse than that, they actually, in many cases, compete with him in installation work. Their sole object being to supply electricity, they are quite prepared to, and usually do, carry on their contracting department at a loss, happy in the assurance that it will be met from the pockets of the ratepayers, including the contractors themselves. Unfair and foolish are words too mild for such a policy. It is dishonest, immoral. What an outcry there would be from the drapers, say, if a provincial Corporation started a haberdashery store, selling ribbons and laces at cost price!

Finally, contractors are harassed by the desultory sniping of the manufacturers in their rear. Contractors naturally would prefer manufacturers to sell to the public only through them. That is, for many reasons, an impossible ideal. But there is plenty of room for a closer approximation to it; and there is crying need for a definite ruling as to who may buy and what may be bought direct from the works.

Manufacturers are too fond of flirting with the non-trade discount-snatcher. To accommodate the jerry wireman, the plumber, and the toyshop dealer, who only order against sales, they are too apt to stretch their terms to the same limit as they accord to the genuine contractor who advertises, stocks, and shows their goods. They are too prone to tout for direct orders, which left alone, would reach them eventually through a contractor.

The members of the E.L.M.A. are perhaps the gravest offenders in this respect. Their travellers in every large town canvass the chief institutions, factories and shops. They book orders for grosses of lamps, at "trade user's" discounts, without reference to the local contractors, to whom the order would otherwise have gone, with the benefit of the difference in terms. Incidentally, they teach the potentially best customers of the contractor to ignore him and go direct to suppliers for all their other electrical requirements.

If a lamp traveller is tackled on the point, he urges that he does it in self-defence. If he, A, doesn't do it, B or C will. The inference is that if A, B, and C abstain from touting, the consumer will, in some miraculous fashion, avoid buying any lamps at all: whereas the fact, of course, is that, when he wanted them, he would order them from a local contractor. In short, the apparent policy of the E.L.M.A. is to tie up the contractor securely with arbitrary restrictions, and then fight behind his back for his legitimate profits.

If the individual members of the E.L.M.A. are so anxious to secure orders for themselves, and cannot trust the contractor to get them for them, let them tout by all means. But in all fairness, any orders they obtain should pass automatically through the hands of those local contractors who have signed the E.L.M.A. agreement. As it is, it is no secret that the Lamp Ring is, by reason of its methods, more unpopular with contractors than any other of the price-controlling combines.

But they are not the only ones who fetter the contractor with an agreement and then ignore his interests. Anybody, for instance, can buy a motor at trade price; and it is a very elastic line indeed which defines the conditions under which a shop or factory can buy cables or switchgear on the same terms as contractors.

Contractors are not all so unreasonable as to expect, to take an extreme case, preferential terms over a railway company. But they can, and do, object to the pork butcher next door getting the materials for his electrical sausage machine at trade prices.

It is not within the scope of this article to suggest a remedy for this state of affairs. Something is already being done to come to a better understanding with manufacturers. More would be done were the E.C.A. stronger; and it is largely the fault of the contractors themselves that it is not.

The essential point all parties have to bear in mind, if "business" is not to remain "bad," is co-operation. The contractor has to look to the manufacturers, with their larger organisation and capital resources, for the sinews of war the intensive propaganda work: circulars, pamphlets, and press advertisement. In return they must be prepared to allow them freedom of action, within defined limits, to exploit fields and open up prospects, larger and wider than the smaller resources of the average contractor can adequately handle. The selling of a gross of lamps, by the way, does not fall within that definition.

Manufacturers, on the other hand, should realise that the contractor, with his local connection and intimate knowledge of the public's requirements, is better able than they to keep in touch with possible developments. Let them assist him loyally, nor seek to deprive him of the small profits that keep him in action. It is surely obvious that it is better he should have what discounts are going, and so keep profits in the industry, than that they should be given to outsiders, and so lost.

The manufacturers are the big guns, the heavy artillery; the factors and the supply companies are the commissariat; and the contractor—not the jerry wireman or the side-line dabbler—should be looked upon as the infantry: all engaged in the attack on the lethargy of the public. The artillery are not expected to rush forward, to try and seize strongholds of trade for themselves; their rôle is to put up a barrage of propaganda and put over the munitions. The commissariat are all wrong if they feed the "enemy" with trade discounts, or starve their "front line" by subsidised competition. The infantry—often all too lightly equipped—bear the burden of the attack. If they—if the contractors—cannot count upon the co-operation and the loyal support of the other members of the industry, the attack will fail, and will continue to fail; and "Business is bad!" will become a truth instead of being, as now, a possibility to be avoided.

REMOTELY-CONTROLLED SUB-STATIONS.

The Maidstone Example.

The success that has attended the development of semi-automatic and completely-automatic sub-stations in the U.S.A. in recent years has attracted considerable attention and, incidentally, remote control has made it possible to utilise a considerable number of small water powers that otherwise could not have been developed on account of the cost of operating labour.

Automatic equipment is chosen in consideration of the economy that it facilitates by reason of the elimination to an appreciable extent of the light-load losses and of the reduction in labour cost that it affords. Several of the American automatic stations are of considerable size, and some of them seem to be quite the nearest approach to a reasoning mechanism that has as yet been devised.

In this country, however, progress in this direction does not appear to have been made to any extent. Nevertheless, a small sub-station that is partly remotely controlled has been in operation quite successfully at Maidstone, in Kent, for the past 15 months. The sub-station, an interior view of which is reproduced in fig. 1 and for which all the equipment was furnished by the General Electric Co., Ltd., is located about three-quarters of a mile from the generating station; electricity is received by means of a 0.15 sq. in. 3-core, 6,600-volt underground cable, and about 1,000 h.p. is distributed at high pressure, being transformed down on the consumers' premises; the 3-phase e.h.p. switch-

board is not shown in the illustration, but it consists of a machine panel, an instrument-transformer panel, three outgoing and two incoming feeder panels, and is of the cubicle type.

The d.c. load is carried by the rotary converter and switchboard shown in fig. 1: the former is capable of an output of 500 kW at 500 volts and 1,000 r.p.m., and the latter is composed of one machine panel and four feeder panels, both being of standard type.

The feature of the sub-station is the fact that it does not require anyone to be in constant attendance. The machine is started up and put on load by hand in the ordinary way in the morning, after which the attendant is free to leave and attend to other duties. The load on the machine is indicated at the generating station by an ammeter, and when the time arrives to shut down the converter, the operation is carried out from the generating station by means of a pilot cable that is arranged to trip the d.c. and a.c. machine circuit-breakers at the sub-station—a simple scheme that has functioned well.

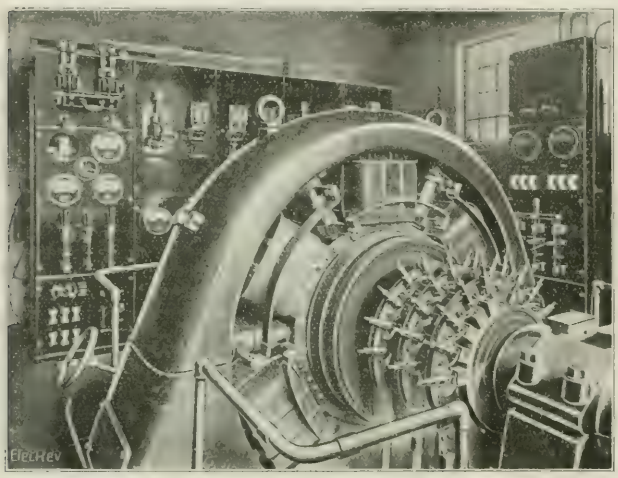


Fig. 1.—A Remotely-controlled Rotary Converter.

In conclusion, we have to thank Mr. E. E. Hoadley, M.I.E.E., engineer and manager of the Maidstone electricity undertaking, for permission to inspect the installation and to publish details thereof.

DOMESTIC LABOUR SAVERS.

By Margaret Partridge, B.Sc.

A great deal has been said and written about the need of educating the public up to the advantages and uses of electricity as a labour saver, and not one word is exaggerated.

It is difficult for the manufacturing or technical engineer to realise the extent of the ignorance of ordinary householders about electricity; 45 per cent. are genuinely afraid of it, 15 per cent. assume a swaggering familiarity and "do their own repairs," *i.e.*, put in heavy copper wire ("electric wire" they call it) when a fuse goes, and the odd 10 per cent. make the best use of their electricity because they take the trouble to master a few simple facts. That is the engineers' point of view.

The housekeepers' point of view is not so often published. It is, as a rule, rather nebulous and indistinct and is mixed up with £ s. d. It might be expressed thus:—"If I were to start trying labour savers, I should always be in the hands of the electrician and I should be ruined before I had tried half the things I have been told are good."

There is truth in the statement too. The housekeeper has two genuine grievances: (1) There are on the market far too many expensive accessories, each capable of doing one thing, many of them only useful on infrequent occasions and disappointing to the overdriven housewife who is expecting material help from them. (2) Electricians and salesmen are not always to be relied on to give instructive and illuminating information to the purchaser who habitually thinks in terms of pounds, pints, and pence. If we can find the cause and remedy for these two ills we shall have gone far towards making every household "electrically driven."

Household accessories may be divided into two classes—heat-producing and power-producing. The former class include irons, toasters, haircurlers, grillers, various kinds of hot-plates, immersion heaters, electric saucepans and kettles, ovens and frying-pans, and innumerable types and sizes of radiators; a regular army of useful trifles, each needing a little knowledge and experience to get the best out of it. This is where most of the trouble lies: the purchaser doesn't know how much heat she may expect from her purchase, and in most cases she is unable to regulate it to suit her requirements unless she buys a cumbersome stationary cooker.

A lady of my acquaintance bought a large hot-plate, hoping to boil coffee and milk on it—and then complained that electricity was no good. Why? The hot-plate was only meant to keep dishes warm.

In the first place, the makers should be compelled to mark articles so as to indicate clearly the current they are meant to take, and in the second place, all travellers who go from town to town saying: "This article consumes 1½d. an hour" irrespective of the supply rate of the town they are in, ought to be electrocuted.

One day an intelligent designer will revolutionise the whole situation by putting on the market false-bottomed utensils and a standard range of heating units which can be slipped in at will, and it will be possible for a cook to "boil for ten minutes and then simmer for an hour," or to tell at a glance if her unit is suitable to fry an omelet, or only to warm a plate, and the purchaser will be saved the necessity of buying separate and expensive articles for every culinary operation.

The situation with regard to the power-producers also shows room for improvement. The accessories now in use include fans, vacuum cleaners, sewing-machine motors, buffing machines of all sorts, mincing machines, pudding mixers, and washing machines of all sorts, all expensive, and most of them rather alarmingly complicated to the ordinary housekeeper.

With the exception of the vacuum cleaner, none of these machines is in daily use in the average household, yet each would find its place there if it were simpler, cheaper, and if the housekeeper could be persuaded that it would really be of use to her. An improvement which will come some day will be a universal motor with attachments for nearly all the small-power machines used in the household, so that it will no longer be necessary to buy a motor with each machine. Meanwhile, however, much can be done in the way of assisting the housekeeper in the matter of choosing and using the articles now at her disposal.

Take the case of the vacuum cleaner: At the last Ideal Home Exhibition there were thirteen firms exhibiting electric vacuum cleaners, and each was "the only one of use as a cleaner." The other day a salesman said to me: "Within the last month I have been

instrumental in sending four vacuum cleaners of other makes to auction sales. I proved that they were useless when compared with this." Splendid! No doubt that man is worth a fortune to his firm, but salesmanship which owes its success to proving other articles of no use does more harm to the electrical industry than good to the firm. The recent correspondence in the Electrical Review gave indications of the state of affairs where cleaners are concerned, and there is no doubt that the poor harassed housewife wanting to buy a vacuum cleaner will be told that one make is too heavy to lift, another will wear out the carpet, a third will not pick up the dust, and so on. In the end it will not be surprising if she decides that it is too great a risk to buy a cleaner at all.

Perhaps there is not so much competition over the other power-producers, but even here harm is being done by over-enthusiasm on the part of the salesman. If there are genuinely bad machines, it should not be left to the opposition salesman to point them out.

The electrical industry would be materially assisted if standard tests were instituted and accessories were awarded prizes or certificates for fulfilling their various functions satisfactorily. There is a Bureau for Housewives which does a little towards helping with advice; machines have to pass a stiff test of "domestic efficiency" before being put on its list of useful accessories, but the mechanical and electrical aspects of the case are ignored. Unfortunately, this Bureau is not very widely known, and in any case certificates of merit should not be granted without regard to engineering efficiency and reliability as well as to domestic utility. If a widely-recognised authority were to inaugurate an examination which took account of every aspect of the case, and an article which was awarded a first-class certificate by such a body were known to have passed tests which would satisfy the housewife as well as the engineer, then no doubt there would be less reluctance on the part of the householder to embark on a course of electric labour saving.

THE BRITISH ASSOCIATION.—I.

After the long interval of sixty-nine years, the British Association for the Advancement of Science has again met at Hull for its annual conference. The varied features of the city, which as Kingstown-upon-Hull received a charter from Edward I in 1299, make it of interest to nearly all the Sections comprising the Association, but perhaps most of all to geologists. As a highly-developed industrial and commercial city it can claim the attention of engineers. It is unique in at least one respect, *i.e.*, it is the only town in the United Kingdom with its own telephone system. This has been held up as an example of efficient management and as a testimony to the success of municipal ownership. A net profit of £4,000 was realised during the past year, and altogether £74,000 has been paid in royalties to the State, including £10,000 in 1921-22. The system has over 12,000 subscribers. The city has another profitable undertaking in its tramways, which provide adequate services for the city's 300,000 inhabitants as well as for those in outlying districts. An attempt to brighten the city by means of artistically-decorated cars was essayed last year. The system has its own generating station, with a plant capacity of about 3,000 kW. The electricity undertaking which supplies power over a wide and important area has a plant capacity of over 15,000 kW; further plant to the extent of 10,000 kW is being added; this will rank the undertaking among the largest in the country. As in many other cases, the coal stoppage had an adverse effect upon the undertaking, but the supply was maintained by the use of oil fuel, which, although a costly method, enabled the dependent industries to be carried on.

The headquarters of the Association are at the Guildhall, and the various Sections are housed as follows:—A.—Mathematics and Physics, Central Hall; B.—Chemistry, Waltham Street Wesleyan Hall; C.—Geology, and H.—Anthropology, Royal Institution; D.—Zoology, E.—Geography, K.—Botany, and M.—Agriculture, Municipal Art School; F.—Economics, Queen's Hall; G.—Engineering, City Hall; I.—Physiology, Church Institute, Albion Street; J.—Psychology, Albion Hall; and L.—Education, Lecture Hall, Jarratt Street.

This year's president is Sir C. S. Sherrington, G.B.E., &c., President of the Royal Society and Waynfleet Professor of Physiology, Oxford. Among the many services rendered to the public by Sir Charles may be mentioned his membership of the Home Office Committee on the Lighting of Factories and Workshops, and his chairmanship of the Industrial Fatigue Research Board. He has held numerous important posts in the sphere of physiological education, and his services have been recognised by many British and foreign learned societies.

Prof. T. Hudson Beare, president of Section G—Engineering—is Regius Professor of Engineering at Edinburgh University, and is a recognised authority on the Australian railway problems which form the subject of his address.

The proceedings proper opened on Wednesday evening with the delivery of the presidential address. The subject was somewhat beyond our scope—"Some Aspects of Animal Mechanism"—although many striking analogies between living bodies and machinery were brought out.

On Thursday morning each Section commenced upon a very full programme. In Section A—Mathematics and Physics—the first item was a discussion on the "Origin of Magnetism." Prof. P. Langevin, of Paris, opened with a short paper, and the speakers included Prof. P. Weiss (Strasburg), Principal Sir J. A. Ewing, F.R.S., Dr. A. E. Oxley, and Mr. L. F. Bates. In the afternoon Sir William Bragg, F.R.S., lectured on "The Significance of Crystal Analysis." Principal J. C. Irvine, C.B.E., opened the proceedings of Section B—Chemistry—with his two-part presidential address, "The Organisation of Research" and "Some Research Problems in the Carbohydrates." The first part of the address sounded a warning against the employment of investigators who had not received a sound training. This did not necessarily mean that intellectual freedom would be lost; a proper training gave a direction and prevented the waste of time in unprofitable by-paths. Sympathetic supervision was necessary; it was easy to use the technical skill of a graduate to carry out the more laborious and mechanical parts of one's own researches, but the outcome of such a policy needed no elaboration. The speaker dealt with many other points of value, and in conclusion advocated for each institution a board or standing committee entrusted with the supervision of research and the supply of the requisite materials, funds, &c.

In Section F—Economics—Mr. J. L. Cohen read a paper on "The Future of Unemployment Insurance." He considered the fundamental principles of the British scheme of insurance as sound, but inadequately applied. Among the points raised were:—"Should industries bear the cost of maintaining their own unemployed?" and "Can insurance be so organised as to reduce the amount of unemployment?"

The whole of the attention of Section G—Engineering—was absorbed by the study of the strength of railway bridges; Messrs. A. G. Cookson, J. S. Nicholas, Conrad Gribble, and J. S. Wilson, and Prof. B. P. Haigh made contributions to the symposium. The morning was occupied in Section J—Psychology—by papers and discussions on various phases of the application of the science to industry. Dr. C. S. Myers, the

president of the Section, read a useful paper defining the psychologist's attitude to the efficiency engineer. This is reproduced in abstract below. "Practical Applications of Vocational Tests" was the subject of a paper by Mr. J. Seebohm Rowntree, Jr. In Section L (Education—the programme commenced with the delivery of his presidential address by Sir Richard Gregory. This address, which contained much food for thought for those responsible for the teaching of science in elementary and secondary schools, is given in abstract form below.

The Efficiency Engineer and the Industrial Psychologist.

Presidential Address by Charles S. Myers, C.B.E., M.D., F.R.S. (*Abstract.*)

Section J.—Psychology.

This paper is in the nature of a sequel to that contributed by Dr. and Mrs. F. B. Gilbreth to the Barcelona Meeting last year of the International Conference of Psychotechnics applied to Vocational Guidance. The author considers that Dr. Gilbreth, in his methods and nature an engineer, is the true successor of F. W. Taylor. The Gilbreths' paper addressed the industrial psychologist from the efficiency engineer's standpoint; the present paper reverses their positions, and points out to the efficiency engineer the limitations of his work unless it be carried out with due regard to its psychological complications. The psychology of the worker differs according to social and other conditions, but in no circumstance is it justifiable to tell a worker, as Taylor did, that "a high-priced man has to do exactly as he's told from morning to night." That is precisely what a worker fears will result from the application of motion study. If experts, appointed solely by the employers, are to go round a factory observing, codifying, and standardising the most efficient methods of operation, the worker suspects that he will be robbed of his craft skill and will be treated as a mere piece of machinery. The Gilbreths insisted that the psychologists should understand that the "quest of the one best way" was the crux of the present industrial problem. To this, the adequately trained psychologist retorts: "There is no one best way"; the psychological and physiological differences between individual workers are such that it is impossible to train and expect all to adapt themselves to perform operations in precisely the same way. Such an aim is harmful, discourages initiative, and is impossible of achievement. Thus the industrial psychologist is diametrically opposed to Taylor's ideal of "scientific management" that under present usual conditions "the managers . . . . assume the burden of gathering together all the traditional knowledge which in the past has been possessed by the workmen." Whatever information of this kind is obtainable can only be satisfactorily collected with the full understanding, consent, and co-operation of the workers. Secret timing is a flagrant violation of the principles of industrial psychology. The experience of the National Institute of Industrial Psychology has been that the workers' confidence and collaboration *can* be obtained; this would be impossible in an atmosphere of suspicion and unfriendliness.

The efficiency engineer commonly proceeds by analysing a given operation into a number of different parts, observing and tabulating the movements of those operatives who perform each of those parts in the quickest time, finally collecting into one series the quickest and best movements as the "one best way" which is then stereotyped and forced on every worker. The individual has characteristics which are not to be found in his individual parts and his best mode of movement is not to be derived from a combination of more elementary movements selected from different operatives on a basis of speed. Nor, indeed, is it justifiable to conclude without adequate evidence that the speediest or shortest movements are necessarily the least fatiguing. The "minute divisions of motion study" enumerated by Gilbreth have no psychological or physiological interest or basis whatever. It will be a bad day for industry if the worker comes to believe that discovery and construction are considered by the management to be outside his scope, and that his function is that of an automaton.

According to Taylor, "No worse mistake can be made than that of allowing an establishment to be looked upon as a training school, to be used mainly for the education of many of its employés." The industrial psychologist insists that an establishment depends for its very life and efficiency on the extent to which it is utilised as a training school and as a means of properly educating those who work there. Can anyone suppose that the best mode of getting the best work out of an employé is by bidding him, in Taylor's words, to "bear in mind that each shop exists, first, last, and all the time, for the purpose of paying dividends to its owners?" Instead of trying to appreciate the various emotional influences and incentives which affect the worker's efficiency, the efficiency engineer is led by his mechanistic interests rather to determine and set the task which may be expected of an efficient worker, and to devise some elaborate scheme of payment which, in his blind assumption that wages are the best incentive to production, will induce the worker to give his best. From the same standpoint the Engineering Correspondent of the *Trade and Engineering Supplement* (*sic*) of *The Times* insisted that the sole function of industrial psychologists was to give "a plain and uncoloured statement of the facts they are asked to measure and not to concern themselves with either the ethical or the economic aspects." This seems to imply that the psychologist is debarred from inquiry into the existence and origin of factory worries and discontent, and that he can always satisfactorily "measure the facts" without investigating other, widely remote, complicating conditions of a psychological character. In actual practice his scope must often be extended in this way, and if the confidence of the employer and the employed can be obtained, he should be at liberty to so extend it. From his mechanistic standpoint the efficiency engineer expects man to behave like a machine, turning out a constant hourly output. The industrial psychologist recognises and investigates the various factors that inevitably enter into, and influence, the form of the work curve. The laboratory investigations carried out by the "pure" experimenter, with ergographic and mental work tests, are not directly applicable to actual conditions. With regard to vocational tests, these must be considered as the servant, not the master of the industrial psychologist; they promise to be of the greatest value but always require interpretation in the light both of the individual tested and of the industrial, psychological, and physiological knowledge and experience of the observer. The numerical data afforded by such tests can only assist, they can never solely determine an appreciation of an individual's special aptitudes. Not only must what a person does at a test under given conditions be considered, but also how he carries out that test, and also his entire personality.

The author does not deny that there are many improvements in the factory which are independent of physiological and psychological knowledge and can best be carried out by the efficiency engineer. But there are many other, even more important, improvements which devolve on the industrial psychologist, either alone or in co-operation with the efficiency engineer. There is a wide borderland in which the best results can be obtained by intimate co-operation, each recognising his limitations and availing himself of the expert qualifications, the natural interests, and the different outlook of the other.

Education and School Science.

Presidential address by Sir Richard Gregory, F.R.A.S., F.Inst.P. (*Abstract.*)

Section L.—Educational Science.

The Educational Science Section of the British Association was established twenty-one years ago with the object of introducing scientific conceptions into every sphere of educational activity. The essential attribute of all scientific investigation is the spirit of discovery, and the standards by which the results are judged are not necessarily those of practical application. Teachers too often forget this when contributions to knowledge of mental processes are brought before them. Education may be defined as the deliberate adjustment of a growing human being to its environment; and the scope and character of the subjects of instruction should be determined by this biological principle. The resources available for teachers provide better opportunities at the present time than ever before. While art and literature remain practically unchanged, science has transformed the whole landscape entrusted to it and the realm of its productivity is continually extending. School instruction in science is not intended to prepare students for vocations but to equip them for life as it is or may be, to give them an intelligent view of things in general. The science taught in primary and secondary schools should be science for all, not for embryonic engineers, chemists, or even biologists. Most of the science courses in these schools are suitable enough as preliminary studies of a professional type, but they are too specialised for general benefit. The needs of the many are sacrificed to the interests of the few. Exceptional students may profit by the study, but to the others it often appears trivial or sordidly practical, and is usually spiritless. Advocates of both literary and scientific studies are agreed that science should be integrally and adequately represented in the education of all pupils up to the age of sixteen, and the Headmasters' Conference has subscribed to the view that this should be generalised and that after the age of sixteen students desirous of taking up a special subject should be able to do so. A study of the present conditions suggests that general scientific teaching is almost non-existent. Pupils often leave school when their only introduction to science has been the study of mechanics and heat, and without the slightest knowledge of such a common instrument as an electric bell. One or two examining bodies have introduced general science syllabuses covering the rudiments of physics and chemistry as well as of plant and animal life, but as in most cases these subjects must be studied experimentally, few schools find it worth while to cover such schemes of work. The educational value of the usual science course in secondary schools is small as

it is generally confined to quantitative work in physics and chemistry; much of the work described as physics really belongs to mensuration. By the prevailing obsession with regard to quantitative work the pupil is made the slave of the machine. The ideas of Herbert Spencer, John Dury, Locke and Rousseau, which may be summarised as teaching as little as possible to pupils but inducing them to discover as much as possible, were admirably utilised by Prof. H. E. Armstrong in drawing up detailed schemes of work—on what has since been termed the "heuristic" system. A necessary condition of the research method of teaching science is that the pupils themselves must consider the problems set before them as worth solving—not merely laboratory exercises. The difference between subject and method must be considered. The mission of school science is not only to provide training in scientific method, valuable as this is, but also to provide pupils with a knowledge of the nature of everyday phenomena and applications of science, and of the meaning of scientific words in common use. One reason for the rarity of general science instruction in secondary schools is due to a great extent to the fact that the teachers themselves are specialists with little knowledge outside their particular territory. Where, however, the general science teachers exist they are compelled to conform to syllabuses which restrict their scope. A third reason is the necessity for apparatus and equipment; it would be impracticable and educationally ineffective to provide the means by which all students could observe for themselves a wide range of unrelated facts and phenomena in both biological and physical fields. It is very difficult, however, to devise a laboratory course which shall be both coherent and educative; in other words, extensive in scope and intensive in method. The main thing is to avoid the limitation of science teaching to what can be done practically; for no general survey is possible under such conditions. It has to be remembered that science, like art, is long while school life is short, and that though practical familiarity with scientific things must be limited, much pleasure and profit can be derived from becoming acquainted with what others have seen or thought.

The address is a plea for the expansion of scientific instruction in this humanising spirit, for widening the gateway into the land of promise where the destinies of the human race are shaped.

POWER STATION ENGINEERS' SALARIES.

The Employers' Side of the National Joint Board of Employers and Staff Members (Electricity Supply Industry) has formulated a series of proposals which the Electrical Power Engineers' Association describes in its August journal as "in effect, a complete revision of the existing schedule." In the *Electrical Power Engineer* the proposals appear *in extenso;* we give below some of the principal changes, with, in some cases, amendments to the schedule suggested by the E.P.E.A.

The chief alterations are those made in the "plant capacity" headings of the salaries schedule which determine rates. In the existing schedule the following arrangement of classes is adopted: A, 1,000 to 2,000 kW; B, 2,001 to 4,000 kW; C, 4,001 to 6,000 kW; D, 6,001 to 8,000 kW; E, 8,001 to 10,000 kW; F, 10,001 to 30,000 kW; G, 30,001 to 50,000 kW; H, 50,001 to 100,000 kW; J, 100,001 kW and over. The employers' proposals leave classes A, B, G, H, and J untouched, but the remainder are altered as follows:—C, 4,001 to 7,000 kW; D, 7,001 to 11,000 kW; E, 11,001 to 18,000 kW; and F, 18,001 to 30,000 kW. The E.P.E.A. has presented a proposal varying the schedule from Class F onwards, and adding two more columns relating to stations of from 100,001 to 150,000 kW, and to those with a capacity of more than the latter figure. Certain spaces left blank in the schedule, relating to the salaries in Grades 1 and 2, have been filled in. The E.P.E.A. also proposes the addition of grading for undertakings of below 1,000-kW capacity, and the alteration of the extra 5 per cent. in the case of London undertakings to 10 per cent. Owing to the many anomalies which have arisen under the present schedule, both with regard to inside and outside staff, the Association has submitted a complete revision of Section 10, which deals with basic salaries. An endeavour has been made to cater for those cases of all grades where duties are performed which are additional to those normally undertaken by an employé in a particular grade.

The employers propose to amend Section 1 of the schedule by substituting for "generating plant—100 per cent. of the rated "output in kW" two clauses: (*a*) The "normal continuous rated output" and (*b*) the maximum demand, including electricity used for auxiliary purposes, during any continuous period of one hour, under normal conditions, in the financial year immediately preceding the current year after adding to such demand 25 per cent. The smaller figure is to be taken in the classification of the station. The additions to be made in respect of converting and transforming plant used for bulk supplies remain the same except that "kW" has been substituted in the expression "rotary converting plant—40 per cent. of the rated output in kVA." A proviso has been added that "the capacity of a station receiving bulk supplies shall not be deemed to be increased as mentioned . . . . . except in relation to employés who are required to perform increased duties or to assume greater responsibilities by reason of such bulk supplies." It is also provided that where an area is divided into districts the station capacity shall be apportioned *pro rata* to their responsibilities amongst the employés whose duties are not performed in the station; Class A is exempted from this. The E.P.E.A. has submitted revisions of Sections 7 and 8. The bulk supply clause in Section 7 is transferred to Section 8. The latter section, which prescribes percentage reductions of salaries to be made in special cases, *i.e.*, where steam is supplied wholly from outside, in water-power stations, in waste-heat stations supplied from another source, &c., has been amended so that the reductions will apply to the generating capacity and *not* to salaries. Section 2, which deals with temporarily increased responsibilities, has been reworded by the E.P.E.A. to give clearer definition. The employers propose to alter the holiday clause by making the maximum period, apart from Bank Holidays, fourteen consecutive days.

The E.P.E.A. proposes amendments to Section 1, which, in the case of shift duties, will ensure the consideration of overtime caused by the resignation of an official as well as by sickness, &c. The "Day Duties" clause is altered to cover mains assistants and other members of the outside staff more definitely. In connection with this clause the employers put forward an addition that "an employé engaged in day duties in charge of workmen shall work such hours as are necessary for him to effectively supervise such workmen."

The employers' proposals contain nothing defining grades, whereas in the original schedule Grades 1, 3 and 8 are specifically set out as basic grades. As the preamble to the proposals definitely states that they are to supersede the 1920 schedule, it would appear that grading is totally excluded from their scope. With regard to the "illness" clause the new proposals leave the matter of payment to be mutually agreed between employer and employé, instead of fixing a definite scale, as in the 1920 schedule.

There are many other smaller revisions and amplifications in both lists of proposals. We understand that a meeting of the N.J.B. is being held this week to consider the amendments put forward by both sides. The matter is referred to in our leading columns to-day.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Freezone" Refrigerator.

A useful form of refrigerator-cupboard is made by British Engineering Units, Ltd., of Coventry. The arrangement is shown in the accompanying illustration (fig. 1). In the

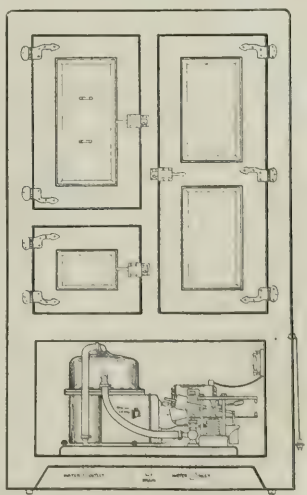


Fig. 1.—The "Freezone" Refrigerator.

upper left-hand compartment is a brine tank containing coiled copper tubing. Mounted on a substantial cast-iron base in the lower compartment is a small electric motor, compressor, condenser, water valve, and an automatic motor switch,

which is actuated by a thermostat situated above the small food compartment shown on the left of the illustration. When the temperature of the food compartments has been reduced to a predetermined point the motor is stopped and the brine circulation ceases. Conversely, when the temperature rises above the limit the motor is started up. The large food compartment on the right hand side of the "Freezone" is provided with five shelves. The overall dimensions of the equipment are: height, 68 in.; width, 39 in.; and depth 25 in.

The "Ceag" Pillarless Lamp.

The "Ceag" pillarless lamp has been introduced with a view to increasing the amount and distribution of light, and has been approved by the Home Office for use underground, after exhaustive tests in mines over a period of two years.

The lamp consists of a standard miners' lamp fitted with a special reflector carried by a bridle, capable of swivelling in a larger bridle from two points at the side of the lamp top. The large bridle is secured by heavy screwed pins entering strengthening lugs riveted to the lamp top. The

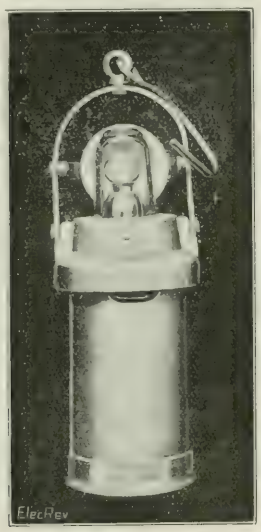


Fig. 2.—The "Ceag" Pillarless lamp.

remaining portion of the lamp is built up of standard parts, interchangeable with the existing standard "Ceag" miners' lamps.

The advantages claimed for the pillarless lamp are as follows:—With the reflector down an increase of light of 70 per cent. is obtained. There are no dark shadows caused by the lamp pillars, and a clear beam of light over an arc of 160 deg. is thrown forward.

The illustration (fig. 2) shows the lamp in front elevation; it will be noticed that the reflector can, if necessary, be placed completely over the wellglass of the amp.

It is made by the "Ceag" Miners' Supply Co., Ltd., Queen's Road, Barnsley.

A New Electric Rivet Heater.

The advantages of electric rivet heating, in addition to those associated with electric heating in general (*i.e.*, cleanness, absence of smoke, fumes, sparks, &c.) are many. The ordinary portable hearth leads to overheating, is comparatively slow, and a certain amount of oxidation of the metal takes place. The electric rivet heater is being increasingly used in portable types to replace portable hearths, and in semi-portable types to replace large oil, gas, coal or coke fired furnaces.

A special feature of the new electric rivet heater (fig. 3), manufactured by the M.P. Electric Welding Machine Co., 28, Hatton Garden, E.C.1, is that the current is automatically cut off as soon as the rivet is heated. It prevents the rivet being overheated and burnt should the operator forget to switch off. The machine consists of a step-down transformer which reduces the supply voltage to about three volts and increases the current. The lower water-cooled electrode jaws are movable, and are cupped to take the head of a rivet. The upper jaws are fixed, but can be adjusted to suit rivets up to 6 in. in length. The heater is usually made to heat three rivets independently, three sets of electrode jaws being provided. To obtain the right heat for various sizes of rivets a selector switch for regulating the current is fixed to the machine. All parts carrying the primary current are fully protected and the voltage of the secondary circuit is too low to be felt at all. The machine is practically fool-proof and there is no danger of receiving a shock. It can be operated by any inexperienced person and is ready for use by simply turning on a switch. Hot rivets can be obtain from 10 to 15 seconds, and one or more rivets can be heated at a time, as required. The operator depresses the foot lever and inserts the cold rivet in the upper electrode jaw. As soon as the lever is released the jaw rises and the rivet is clamped tight between the two terminals. At the same time the current commences to flow. In a few seconds,

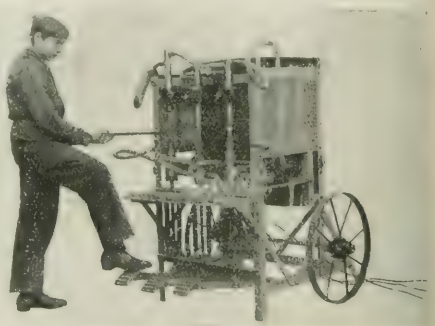


Fig. 3.—A New Electric Rivet Heater.

according to the size of the rivet, the passage of the heavy current will raise the shank to a white heat the head, by reason of its larger size, being rather cooler. An automatic switch cuts off the current when the rivet is sufficiently hot, if the workman forgets to do this.

The heater is made in three sizes taking 8 kVA, 15 kVA, and 30 kVA, respectively. The transformer is designed for single-, two-, or three-phase circuits.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot* **appear** *until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Estimates for Wiring Installations.

I have read with interest the article on estimating for internal wiring circuits; the author touches on some interesting points, but I am of the opinion that errors are not made to a great extent by wrongly estimating quantities.

Having had many years' experience in lighting contract estimating, I have surveyed this problem from all possible angles. It requires little skill to choose, say, two or three representative circuits, measure up these and use them as a basis for the whole of the job. Such procedure I find only gives an error of two per cent., which does not show a two per cent. error on the estimate, because it only affects three items, namely, cable and its protection and labour.

Bills of quantities are difficult matters for the architect, and some consulting engineers who cannot justly appreciate the many little difficulties the contractor is likely to come across.

I think there are three basic reasons for the discrepancy in prices of tenders to-day; they are:—

Faulty specifications.

Failure of proper supervision by the purchaser.

Lack of standards for materials.

Dealing with faulty specifications, here the architect is probably the chief offender; often he obtained his electric light specification, I should say, when he obtained his articles, and has used it ever since.

Specifying: "Wires to be rubber insulated and enclosed in metal casings" is ambiguous, while "Fuses to be mounted on slate bases" shows how ancient the specification is; yet the contractor continually gets this sort of thing.

The former part can be met with cheap continental cables in close-joint conduit, and there are contractors who would install it, while a contractor of repute would possibly install non-association cable made by a member of the C.M.A. in screwed welded conduit.

Again, when sizes of cables or minimum voltage drop are not specified, there are contractors who would put in cables far too small. I would not say that they do it willingly, but using the "maximum amperes permissible" column in the I.E.E. tables, they ignore length of run.

The old rule of one thousand amperes to the square inch is applicable to ninety per cent. of lighting contracts, and the I.E.E. tables only to the large cables, and the man dealing with large cables has sufficient training to use such tables intelligently.

Shades are usually specified as: "Each lamp to be com-

plete with shades." What kind of a shade—a white cone opal, or a metal reflector at six times the cost?

A specification should be accompanied by a plan, and should at least contain the following, besides the usual clauses:—

Gear.—Type of switch, fuse and distributing board.

Mains and circuit wiring.—Size of cables, or to be of 1,000 amperes per square inch capacity. Whether non-association or association. How they should be protected: casing, close joint, brazed or screwed welded conduit. Whether run on the surface of the walls and ceilings, or sunk.

Pendants.—To consist of patress, ceiling rose, flex, lampholder, lamp, and the fixing of the shade or fitting. An inclusive sum should be allowed for shades or fittings.

Switches.—To be sunk in, or fixed on the surface of, the wall. If sunk, an inclusive sum should be allowed for switch plates.

Lamps.—Lamps should distinctly be specified as gasfilled or vacuum, ring or non-ring.

As there are no definite standards, it is essential to mention makers' names or insist on samples being submitted with the tender. Tenders otherwise cannot be compared and are therefore of no value.

A purchaser must, until he has gained confidence in his contractor, inspect the installation frequently during erection. Those engineers who have to inspect and report on installations will realise the importance of this; the amount of scamped work is alarming.

The wireman does not work in the same sense as a plumber, who must make a good job; otherwise the water or gas leaks, and the purchaser sees this immediately. The wireman, on the other hand, can scamp his work, it only being necessary to avoid the critical eye and a low insulation test.

The third factor, lack of standards, is a precedent of varying prices; almost everything shows a wide range in standards of quality and therefore of price.

To name a few: Cable 3 to 1, tumbler switches 2 to 1, lampholders 5 to 3, conduit 4 to 1, distribution boards 3 to 1.

This is a problem that cannot easily be overcome; the insisting, on the part of the purchaser or his agent, on the submitting of samples with the tender would give the purchaser greater ability to choose.

There are many contractors who would welcome these reforms; the need to-day is more urgent than before the war, when the trade was free of the "cheap jacks" prevalent to-day because price rules.

Lodestone.

Manchester, *September 2nd*, 1922.

The Lightning Conductors of the County Hall.

Please allow me to correct an error made by Mr. Killingworth Hedges in your issue of the 25th inst. He refers to the Mersey Dock Board's Liver building; this should read Mersey Docks and Harbour Board office. The Liver building situated close by, has two 1½-in. by ½-in. copper-tape lightning conductors fitted to each "bird," four in all, 306 ft. above ground, and they descend to earth without a joint. This is a ferro-concrete building, and the dock office is a steel-frame building. I was the contractor for both systems of lightning conductors.

H. G. Riddell.

Liverpool, *August 31st*, 1922.

The Village Power Station.

Owing to my absence on holidays it is only to-day that I have seen the letter from "Arcadia" on this subject in your issue of August 25th. I know nothing of the schemes mentioned by "Arcadia," but as general manager of Edmundsons' Electricity Corporation, Ltd., I am closely connected with over forty small electricity supply undertakings, and I have had to approach the Electricity Commissioners on various subjects, including the permission to establish new undertakings, and I have seen nothing of the "do-nothing and dog-in-the-manger policy of the Commissioners" which "Arcadia" tells us has caused his schemes to be hung up.

My experience has been so entirely different to that of "Arcadia" that I feel compelled to trouble you with this letter; not only have I received the greatest courtesy and attention from the Commissioners and their staff, but on many occasions numerous individuals at the Commission have put themselves to a lot of trouble to be helpful to our branch of the industry. To quote one instance, I was supplied with information as to a likely source from which a supply in bulk might be available, which in fact was obtained on suitable terms, thus reducing capital expenditure at a time when capital was very difficult to obtain.

From the nature of their duties the Electricity Commissioners cannot be expected to satisfy all the conflicting interests with which they come in contact, and some of their decisions I have found it difficult to understand, but I am convinced that the future for the smaller electricity supply undertakings has greatly improved since they have come under a department which understands something of the needs of their branch of the industry.

From my personal experience I feel certain that the Commissioners are anxious to assist the smaller towns and villages to obtain a supply of electricity, provided the scheme is a reasonable one, and that it does not conflict with the larger schemes necessary for the future development of the district. What more can we desire than a fair decision on these lines?

For the past few years the development of new undertakings in the smaller towns and villages has been nearly impossible, partly through the high cost of material and labour, and partly through the effect of the Temporary Increase of Charges Act, which reduced the smaller electricity supply undertakings to such a deplorable financial position that the credit of this branch of the industry was practically destroyed. Capital could not be obtained for new work when the majority of the older companies were prevented from paying dividends equal to the deposit interest offered by the banks.

To-day the fall in prices has removed one of these difficulties, and we have to thank the Electricity Commissioners for the removal of the other difficulty through certain clauses of the Electricity (Supply) Act, 1922, which supersede the impossible conditions of the Temporary Act.

This broader policy, for which, I repeat, we have to thank the Commissioners, should rapidly restore the credit of the smaller undertakings, and attract capital to our industry.

In those new undertakings in which the brighter outlook has induced my company to participate I have met with nothing but encouragement from the Electricity Commissioners.

A. N. Rye.

Westminster, *September 1st*, 1922.

Lamp Discounts.

I, in common with all other electrical contractors and retailers, have received from the secretary of the E.L.M.A. a circular giving the new scale of discounts that it has decided to grant retailers in place of the present grading.

I notice that in every case the retailer is going to lose at least £2 15s. on every £100 worth of lamps he sells, compared to his present terms, and in a good many cases the retailer will lose a great deal more.

The E.L.M.A. informs us that this will take place on the occasion of the next reduction in the price of lamps, so that if lamps are reduced 15 per cent., the retailer, though doing exactly the same business in lamps during the coming year as he did last year, will lose at least £8 per £100, in some cases more.

For example, if his sale of lamps for the year ending March 31st, 1922, was £400 and he sold the same number in the next year, the sale would total £340, and the difference he would receive in profit, according to the E.L.M.A. circular, would be £29 11s. 7d., so that the retailer stands to lose half the reduction in the price of lamps, without any advantages worth mentioning.

In reply to the question: "Would there not be a greater sale for lamps if they were cheaper?" No! my customers would not buy a single lamp more, as they buy them to use and not to put them on a shelf to look at because they are cheaper.

To the best of my recollection, when the Royal Commission was inquiring into the profits made out of lamps, it found that the cost of making a lamp was about 8d. or 9d.; since then, wages have been greatly reduced, raw materials are cheaper, and improvements in machinery have all tended to greatly reduce the cost per lamp.

Not content with the increased profits, the E.L.M.A. is now endeavouring to obtain a part of the small profits that retailers receive on the sale of lamps.

Where was the Electrical Contractors' Association when these terms were decided? I have heard that it agreed to them, but can hardly credit it. I (a small contractor), would have fought strenuously against it, if I had had any say in the matter, and I would agree to be loyal to any movement that would give the retailers back their old terms.

One idea that I offer to contractors in general and that I would adhere to, if decided on, is that all contractors should refuse to buy any sort of accessories (from a wood block to a motor) from or made by any of the firms in the E.L.M.A. ring (there are plenty of good accessories made by British firms outside the lamp ring), and also buy all their lamps from factors, making the lamp ring pay the highest terms to them; that would be one of the ways of showing the E.L.M.A. that it is not the absolute master it thinks it is.

A Small, but Hard Hit Contractor.

August 23rd, 1922.

Making Hay the Electric Way.

With reference to the article you published in your issue dated August 25th on the above subject, based on notes on my work in this direction, supplied to you by the Electrical Development Association, in reply to the letter from Mr. Justus Eck, I would say that in all I cured three large stacks, the first figures in your article refer to the second rick, which was smaller than the first, and consisted of green grass, soaked with rain. The second figures referred to a larger stack which I cured first (with less experience naturally), consisting of green grass. The current consumption was even less for the

third rick, which consisted of green grass, cut late one day and stacked early the next day. On the basis of the maximum figures, even the farmer is well in pocket.

I find that my method has been misunderstood to a certain extent. The problem I have been working at during recent years is the making or curing of hay, *not drying* grass. A number of experiments have dried grass successfully, but the result is not what the farmer or his stock appreciate as *hay*. Proper hay is the product of certain complex bacteriological and chemical changes, concerning which there seems to be very little information available. By long experience and good judgment a good farmer can obtain these results, by properly working the hay in the fields, carting it at the right moment, and making his stack of the correct size.

By the electrical method, if certain simple rules are followed, an unskilled labourer can obtain as good hay as an experienced farmer—and further, the question of weather is entirely eliminated. It was the question of weather that started me on the problem, but now I find that in addition one can cut the grass when it is ready, be more certain of the quality of the hay, and also reduce the labour required.

R. Borlase Matthews.

Greater Felcourt, East Grinstead.
September 1st, 1922.

Calculating Currents in a Mesh-Connected Three-phase Circuit.

There has recently come to my attention an article by Prof. Alfred Still, appearing on page 78 of your issue of July 21st, 1922, and entitled "Calculating Currents in a Mesh-Connected Three-Phase Circuit." Since there appears to be a fallacy in Mr. Still's reasoning, it may not be amiss that I should call your attention to the matter.

Knowing from experience that a knowledge of the magnitudes and phase relations of the line currents does not determine the currents within the mesh, I have been forced to look for the "hole" in Mr. Still's argument; and this seems to lie in the assumption with which he begins his "proof." There he states that "Since the vectorial addition of the three currents in the mesh must be zero, . . ." Now, I am of the opinion that a second thought will reveal the fallacy of this assumption; for if we imagine the mesh to be composed of three adjustable single-phase loads, it is a simple matter to vary any one of these components without in any way affecting the currents drawn by the others. Therefore, the vectorial sum of these currents may have any value, and would be equal to zero only in special cases. And since this assumption cannot be made, the proof consequently fails.

While the vectorial sum of the currents in the three lines must be equal to zero, and the vectorial sum of the voltages around the mesh must have a similar value, it does not follow that the same holds good of the currents in the mesh.

I am forwarding a copy of this letter to the writer of the article.

Perry A. Borden.

Toronto, *August 19th*, 1922.

Electric Battery Locomotives.

With reference to your review on "Electricity in the Service of Man," page 287 of your issue of August 25th, we respectfully point out that discharges of 150 amperes from a battery of 108 ampere-hours would not be out of the way momentarily for the work which these locomotives have to perform.

Nevertheless, a greater capacity is usually employed. On the Midland Railway locomotive where our battery is installed, there are 108 cells of 300 ampere-hours capacity. This battery has now been in daily use for about nine years; only positive plates have been renewed, and that was after five years.

The "D.P." Battery Co., Ltd.
T. C. Elliott.

Westminster, *September 4th*, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—T. Carter, electrical engineer, 2, South Street, Dorchester, and High Street, Swanage.—Last day for proofs for dividend, September 18th. Trustee: Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

F. H. Dennis, electrical engineer, 20, High Street, Chelmsford.—First meeting September 15th at 29, Russell Square, W.C. Public examination October 4th at the Shire Hall, Chelmsford.

Company Liquidation.—Stockwell & Ohms, Ltd.—Particulars of claims to be sent by September 29th to Mr. H. Holmes, 2, Fenchurch Avenue, E.C., or Mr. W. Osborne, Balfour House, Finsbury Pavement, E.C., joint liquidators.

Dissolution of Partnership.—M. P. Tundley & Co., electrical engineers, 35, Adelaide Street, Fleetwood, Lancs.—Mr. F. Jackson and Mr. M. P. Tundley have dissolved partnership. Debts will be attended to by Mr. Tundley, who will continue the business.

Trade Announcements.—Messrs. J. Beer & Sons, electricians, have transferred their business to new works and offices at 76, Windsor Road, Penarth.

Messrs. Lionel Robinson & Co., 3, Staple Inn, Holborn, W.C.1. (Holborn 6323), have been appointed by the Walsall Electrical Co., London, stockholders for its two-range voltmeters, 0/10, 0/100, for measuring the filament and plate voltage of wireless valve sets.

Messrs. Aylward Bros., electricians, Bromley, Kent, have taken over the business of Mr. A. A. Hart, 55, High Street, and 6 & 7, Bank Buildings, Hastings.

Messrs. William Sanders & Co., 90, Charing Cross Road, W.C.2., announce the introduction of a new range of house service switchgear, with interlocking handle, and other special features.

Mr. H. T. Bourne, electrical contractor, has opened business premises in Whalley Range, Blackburn.

Mr. George Knight, lately inspector to the National Boiler Insurance Co., Ltd., and of Messrs. Royce, Ltd., Trafford Park, Manchester, has now joined the Stenholm Engineering Co., Lloyd's Bank Buildings, Manchester, and is in charge of the electrical department.

Messrs. Bates & Windibank, electrical engineers, Sentinel House, Southampton Row, W.C.1, have been appointed distributors for Messrs. F. & A. Parkinson, Ltd., Guiseley, makers of the "Com" type single-phase motor (manufactured under Creedy patents) and induction type single, two and three-phase motors; also for Messrs. Flather & Co., Ltd., Leeds, manufacturers of direct-current motors and dynamos.

Messrs. G. S. Peckham & Co., 4 and 5, New Compton Street, W.C.2, pointing out errors in the style and address of the firm as given in our last issue, which we regret, inform us also that they are associated with Commander R. Preston as sole agents for the British Isles and Dominions for the Swedish firms mentioned.

Private Arrangement.—Moodys, Ltd., electrical engineers and contractors, 84, Craven Park Road, Harlesden.—A meeting of the creditors of this company was held on August 28th. The company was registered on April 21st last to take over the business carried on by the brothers Moody. Each brother took 250 £1 shares, which were issued to them as fully-paid as the purchase consideration for the business, and it was stated that a Mr. Guest had taken up a further £250 in £1 shares for cash. According to the facts disclosed at the meeting the business had been losing money, and there was little or no stock in the shop, such stock as there was having been sold by the sheriff under an execution in respect of a writ which had been issued. There was about £80 in the hands of the sheriff. The liabilities to creditors were said to be about £680, and the only asset of any consequence was the book debts, which were stated to be of the value of about £170, but which might realise something less than this figure. Messrs. Moody put forward an offer of a composition of 7s. 6d. in the £, payment to be spread over a period. This was not considered satisfactory, and the meeting was adjourned with a view to giving Messrs. Moody an opportunity of finding something in the nature of a guarantee. The following are creditors:—

	£		£
Credenda Conduits	10	Times Electrical Co.	25
British Thomson-Houston Co.	25	General Electric Co.	75
Catchpole Maurice	41	Falk, Stadlemann & Co.	200

Catalogues and Lists.—Messrs. T. C. Jones & Co., Ltd., 93 and 95, Wood Lane, Shepherd's Bush, W.12.—A comprehensive tool catalogue giving illustrations and prices of vices, spanners, pliers, drills, lathe tools, &c.

Mr. Edgar W. Dorey, Norwich House, Southampton Street, High Holborn, W.C.1.—An illustrated descriptive pamphlet dealing with "A.B.C." semi-Diesel crude oil engines.

The K.F.M. Engineering Agencies, Ltd., 304, High Holborn, W.C.1.—A booklet describing various types of "Internalite" signs for advertising purposes.

Messrs. Justus Eck & S. Brook, 4-12, Palmer Street, Westminster, S.W.1.—An illustrated booklet describing "Kandem" a.c. meters; and a leaflet dealing with bells and signal transformers.

Messrs. Rayner & Heald, Ltd., Duke Street, Derby.—Leaflets G 101 and G 105, giving specifications, prices, &c., of two- and three-phase induction motors.

Messrs. A. Verey & Co., Ltd., 27, Buckingham Gate, Victoria Street, S.W.1.—Abridged net price list for September of electric lighting accessories and installation material.

The Alden Engine Co., Ltd., Crown Works, Oxford.—Publication No. 110, a folder illustrating a number of engines and small generating and pumping sets, and containing copies of letters from customers.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—Four priced leaflets dealing respectively with: vacuum and gas-filled lamps; "Sunco" electric fires; "Sunco" bell transformers; and desk fans.

Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.—A well-produced brochure dealing with "Kalanite" insulators for power transmission lines.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—An illustrated folder giving particulars and reduced prices of electrical fires of various types.

The Benjamin Electric Co., Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—A revised discount list of industrial lighting fittings, automobile accessories, &c.

Messrs. A. P. Lundberg & Sons, 477-489, Liverpool Road, N.7.—List of reduced prices of switches, connectors, and other electrical accessories.

The Stanton Ironworks Co., Ltd., near Nottingham.—Stock list for September of cast-iron pipes; also a list of principal users.

Messrs. A. W. Beuttell, Ltd., 53, Victoria Street, S.W.1.—An illustrated and priced booklet dealing with "Linolite," "Tubolite," and "Beuttell" patent systems of strip lighting.

The General Electric Co., Ltd, Magnet House, Kingsway, W.C.2.—"Reasons Why," No. 4, an illustrated card, dealing with the merits of quick-make and quick-break tumbler switches.

Also No. 5, illustrating and describing B.E.S.A. wall plugs.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—Stock list (in French) of motors and dynamos (September).

The Arora Co., Loughborough, Leicestershire.—An illustrated and priced pamphlet dealing with new designs of electric fires.

Mr. S. Utting, 82, Victoria Street, S.W.1.—Booklet on the "Thermix" air heater for recovering heat from flue gases, containing also technical data, &c.

Messrs. Crowther & Osborn, Ltd., 7, Blackfriars Street, Salford, Manchester.—A revised price list of "Sceando" m.f. lamps.

Lead Report.—James Forster & Co.'s report dated September 2nd says: Closing prices yesterday were £24 5s. for August and £23 12s. 6d. for November, against £23 7s. 6d. and £22 15s. respectively at the end of last week.

Transactions have again been fairly large, but not on the scale of the previous two weeks. The total this week is round about 4,000 tons, against 5,500 last week. The tone has been firm throughout the week. The arrivals for August are about 17,000 tons, a quantity far in excess of actual needs. In consumption, the only active trade is in accumulators, which is quite good. Cable makers are not using as much as they were.

Local Exhibitions.—Messrs. F. J. Jones & Sons, Ltd., electrical engineers, Chester, were awarded the gold medal for the most imposing stand at the Cheshire Agricultural Show last week. Their exhibit was of large dimensions, and the electric sign lights arrested the attention of crowds of visitors. Messrs. F. J. Jones exhibited about 20 lighting sets, of various sizes. Electrically-driven water pumps for the house and farm included an example which would give water service from a well equal to any town supply. A portable standard power set for driving farm and domestic machines was exhibited. The "Kaleeco" system of wiring was shown. Other exhibits were:—The "Briarton" washing machine, an electric geyser for fixing to an ordinary water tap for heating water, and an "Adjusto" light, which can be used for reading in the drawing room, for the dressing or bathroom, and for reading in bed. Many examples of art shades were shown, and a portion of the stand was set apart to form a lounge electrically lit and heated. There were wireless attractions at Messrs. F. J. Jones & Sons, and Messrs. Williams, Gamon & Co.'s stands. The instruments were made by the W. J. W. Radio Co., of Milton Street, and five valve receiving sets, complete with loud speakers, were on view and working at each of the two stands. A bronze medal was conferred upon Messrs Williams, Gamon & Co. (Kaleyards), Ltd., Chester, for their display of electrical plant and fittings.

At the Shrewsbury Trades Exhibition Messrs. W. Thomason & Co., of High Street, had a fine display of electrical goods and wireless instruments. Wireless demonstrations were given daily at their stand under the personal supervision of a special representative of Marconi's Wireless Telegraph Co., Ltd.

Trieste Sample Fair.—The Duke of Genoa opened the Sample Fair on September 3rd, the Minister for Posts delivered the opening address. The Duke afterwards made a tour of the stands, showing particular interest in the Colonial stand and the wireless exhibit of the Marconi Co.—*Reuter* (Trieste).

Book Notices.—"The Mechanism of Lubrication," by William Stone. (40 pp.). London: *Industrial Australian and Mining Standard*. Price 2s. 6d.—This is stated to be a popular explanation of the principles of lubrication as developed mathematically by Reynolds and Michell, and employed by the latter in the design of the well-known Michell thrust and journal bearings. Professor R. W. Chapman, of Adelaide University, has written an introduction, and the treatise is well illustrated by means of photographs and diagrams.

The *Journal* of the Junior Institution of Engineers, Vol. XXXII, Part 11, September. London: Percival Marshall and Co. Price 2s.—The principal feature of this number is a paper on "Anti-friction Bearings," by G. W. C. Webb, O.B.E. An index to Vol. XXXII is included, together with notes of proceedings.

Messrs. Benn Brothers will publish during September the third volume of Mr. H. H. Broughton's "Electrical Handling of Materials," entitled "Electric Cranes."—This volume, to which the two already published are introductory, deals in the most comprehensive manner with every kind of crane and crane mechanism. There are some 300 illustrations and 65 tables.

"The Construction of Wireless Receiving Apparatus," by P. D. Tyers. Pp. vii+76, figs. 28; price 1s. 6d. net. "Wireless Valves Simply Explained," by J. Scott-Taggart. Pp. v +134; figs. 56; price 2s. 6d. net. London: Radio Press, Ltd., and Sir Isaac Pitman & Sons, Ltd.

"Hand Book of the Electric Power Club of Cleveland, U.S.A." Pp. 284. Cleveland, U.S.A.: The Club. Price 50 cents.

The *Transactions* of the South African Institute of Electrical Engineers, Vol. XIII, part 5, July.—Included in this number are: "Notes on Synchronous Converters," by P. Fraser; replies to discussions on "Reinforced Concrete Poles for Overhead Line and Traction Work," by B. Sankey, and "Notes on Radiography," by H. G. Symons; and many notes of proceedings.

Trade with Germany.—Mr. J. W. F. Thelwall, Commercial Secretary to H.M. Embassy in Berlin, will be in attendance at the Department of Overseas Trade from September 11th until September 16th, where he will be pleased to interview manufacturers and merchants interested in trade with Germany. Applications for appointments with Mr. Thelwall should be made at once, and addressed to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. The reference 3905/TG/GP should be quoted in all cases.

Weldrics, Ltd., v. Quasi-Arc Co., Ltd.—We learn from Messrs. Weldrics that some misunderstanding has arisen with regard to their action against the Quasi-Arc Co., Ltd., a report of which appeared in our issue of June 30th, some readers having supposed that the question whether there was infringement of the latter's patents by the electrodes made by the former was not settled. This, however, was not the case; according to the official report published by the Patent Office, Mr. J. Hunter Gray, K.C., for the Quasi-Arc Co. (the defendants), said that the only electrode that the plaintiffs had ever made had been admitted not to be an infringement, and that the admission of non-infringement had never been withdrawn. In the course of his judgment, Mr. Justice Eve said: "The circular stated that it had been held that electrodes in which blue asbestos was partly used as a covering constituted an infringement of the company's patents. It had not, in fact, so been held." His Lordship proceed to explain that Messrs. Weldrics applied pulverised blue asbestos as an ingredient in a paste with which the electrodes were covered, and he showed from the correspondence which was put in evidence that the Quasi-Arc Co. did not assert that the electrode covered with the paste was an infringement, but limited their claim to the use of blue asbestos in the form of yarn.

Annual Outings.—The employés of the Glasgow and South-Western Railway Co.'s electrical department held their first annual excursion on September 2nd, accompanied by the Chief Electrician (Mr. George Thomson) and the Chief Inspector of Plant and Machinery (Mr. H. Urquhart). The party, from all parts of the G. & S.W. system, met at Glasgow, and proceeded by train to Craigendoran, thence by steamer to Anochar, luncheon being provided on the steamer. Walking across to Tarbet, Loch Lomond, the party embarked on the *Prince George*, and sailed down Loch Lomond to Balloch, where tea was served. The party was favoured by excellent weather, and arrived back in Glasgow about 7.30 p.m.

Norwegian Agencies.—The Commercial Secretary to H.M. Legation at Christiania has forwarded to the Department of Overseas Trade a list of Norwegian agents seeking connections with British manufacturers and exporters of a large variety of commodities, including textiles, chemicals, hardware, coal, iron, and steel, provisions, &c. Interested British firms or individuals who are desirous of appointing agents in Norway should make application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (quoting Reference Number D.O.T./F.R./5840).—*Board of Trade Journal.*

Wages in the Electricity Supply Industry.—In view of rumours current with respect to further wage decreases in the London area electricity undertakings, the Marylebone branch of the National Amalgamated Union of Labourers and Electrical Workers, at a meeting held on September 1st, passed the following resolutions, and gave instructions for them to be circulated so that common action might be taken:—

That as the wage cuts put into operation have already amounted to about 30s. per week on the average and have brought down the wages of some grades below the £3 limit, there shall be no further cuts in wages. The so-called fall in the cost of the vital necessaries of life is viewed by this branch with suspicion and distrust, as men in many grades will be driven below the poverty line if the falls go down much below £3, and will have to seek parish relief to eke out their scanty wages to ensure their children being fed and rents duly paid.

That this branch regards the still continued high charges for electricity as tantamount to a breach of faith with the public in view of the fact that prices were rapidly advanced when wage increases took place, but have not been generally lowered in similar proportions now that the employés in the London area alone have lost many hundreds of thousands of pounds through wage cuts. The branch is of opinion that the vast profits disclosed in the published balance sheets of electricity supply undertakings show the urgent necessity for a re-adjustment of prices to the consumer, to bring these charges into line with the sacrifices the men have made to ensure reduced working costs.

That a protest be lodged against the Executive Officers of the supply stations and undertakings being allowed to retain their war wages and allowances and increases due to war conditions while the men's wages are being lowered.

Other resolutions stipulate that no revision of the Schedule (if such be submitted by the employers) shall be entertained by the J.I.C. delegates before submitting it to the rank and file, and that stabilisation of wages for the London area as a separate section shall be pressed for on the lines of the Railway Shopmen's Award 728, dated July 8th, 1922, with modifications suitable to the electricity supply industry.

The Prague Samples Fair.—This Fair was opened on September 3rd. There are about 2,260 exhibitors, including two thousand Czecho-Slovakian firms.

Vulcanised Fibre.—The Committee appointed under Part II of the Safeguarding of Industries Act, 1921, with regard to vulcanised fibre, has arranged to hold its next sitting for the taking of evidence at 12 noon, on Tuesday, September 12th, at 5, Old Palace Yard, Westminster, S.W.1.

German Glow Lamp Prices.—The Glow-lamp works included in the Central Union of the German electro-technical industry have decided to double the basic prices introduced on July 31st.

Calendar.—The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.4, has sent us a calendar for September, 1922, to August, 1923, bearing illustrations of a variety of aluminium sections.

Osram Lamps—Price Reductions.—Pre-War Prices.—As we go to press we learn that the prices of Osram lamps have been brought down below the pre-war level. The reductions vary from 12½ per cent. to 30 per cent. for the various sizes:—

Osram Vacuum Lamps.

		Old price.	Reduced price.
Low voltage.			
100, 105, 110, 115, 120, 125, and 130 volts ...	10, 20, and 30 watts	from 2s. 6d.	to 2s. 2d.
do. do. ...	40 and 60 watts	„ 2s. 9d.	to 2s. 2d.
High voltage.			
200, 205, 210, 220, 225, 230, 240, 250 and 260 volts	20 watts ...	„ 3s. 3d.	to 2s. 9d.
do. do. ...	30, 40 and 60 watts	„ 3s. 0d.	to 2s. 6d.

Osram Gaspilled Lamps.

Low voltage.			
100, 105, 110, 115, 120, 125 and 130 volts ...	30 watts ...	„	4s. 0d. to 3s. 0d.
do. do. ...	40 watts ...	„	4s. 0d. to 3s. 0d.
do. do. ...	60 watts ...	„	4s. 6d. to 3s. 6d.
do. do. ...	100 watts ...	„	7s. 6d. to 6s. 0d.
High voltage.			
200, 205, 210, 220, 225, 230, 240, 250 and 260 volts	10 watts ...	„	5s. 0d. to 3s. 6d.
do. do.	60 watts ...	„	5s. 6d. to 4s. 0d.
do. do. ...	100 watts ...	„	7s. 6d. to 6s. 0d.

This remarkable result, we understand, has been achieved by means of improvements in machinery and methods of construction and by greatly increased manufacturing facilities at the specialised Osram G.E.C. factory at Hammersmith, coupled with an enhanced demand for electric lamps due to the growing popularity of electricity as an illuminant.

For Sale.—Wood[illegible] Council electricity department has for disposal [illegible] and steam generating plant, &c.

LIGHTING AND POWER NOTES.

Australia.—The Morwell Scheme.—The following particulars relating to the Morwell scheme have been forwarded to the Department of Overseas Trade by H.M. Senior Trade Commissioner in Australia in continuation of the report issued by the Department in April last:—All the principal contracts for the plant and machinery for the main power station at Yallourn have been placed, and the reports indicate that the progress with the manufacture of the machinery is good. A considerable portion of the transformers, switchgear, &c., has already been delivered, while the manufacture of the five large turbo-alternators and of the condensing plant, which is being supplied by Thompson & Co., Castlemaine, Victoria, is well advanced. The greater part of the preparatory work of the site has been completed; the contractors for the steel work for the power station are at work on the ground, and steel work is now arriving. Gangs have been organised for the erection of the transmission line (over a distance of 112 miles) for which much of the material has now arrived. The erection of the auxiliary station at Newport is proceeding satisfactorily and justifies the anticipation that the station will be in operation by May, 1923, as originally intended. On the coal-winning operations, the removal of overburden has already commenced, and it is expected that the winning of coal will be commenced by the end of this year. A considerable portion of the briquetting machinery is now arriving. Much work has been done at the site in preparing foundations for the plant and machinery which is expected to be operating by the end of 1923. The Government has authorised the erection of a model township at Yallourn, the site of the works, and this is being put in hand with all speed. The township scheme, which is estimated to cost £224,000 provides, in its first stages, for accommodation being made available for the Commission's employés by the erection of 200 tenements, but the final scheme makes provision for a population of 3,000.

Bath (N.S.W.).—The Municipal Council is applying for sanction to borrow £40,000 in connection with the scheme for supplying electricity to the town.

Amesbury.—Street Lighting.—The Parish Council has decided to adopt a scheme put forward by the Electric Lighting Co. for illuminating the streets by electricity. The company hopes that the arrangements will be completed by October.

Belfast.—Visit to Gennevilliers.—At the monthly meeting of the Corporation it was decided to send delegates to the visit which is to be made to the Gennevilliers Power Station next month. The Belfast representatives will include the chairman and the deputy chairman of the Electricity Committee, the Town Clerk, the City Surveyor, and the City Electrical Engineer.

Barrow.—Supply to Rampside.—The Highways Committee has approved of a proposal that the cables on the open front for the supply of electricity to Rampside be laid underground instead of being erected on poles, as was at first suggested.

Burnham (Berks.).—Electric Lighting Canvass.—The Parish Council has appointed a committee to obtain information relative to a supply of electricity for the parish. The Slough and Datchet Electric Light Co. asserts that a canvass made of the parish was not satisfactory, but the Council contends that the company did not make a proper canvass.

Burnley.—Year's Working.—The report of the electrical engineer (Mr. J. E. Starkie) for the year ended March 31st, 1922, records a total revenue of £88,495, comparing with £75,255 in the previous year. Working expenses totalled £70,170, as against £60,178, leaving a gross balance of £18,325 (£15,077). The net result after payment of sinking fund, interest charges, &c., was a profit of £916; in 1921-22 there was a net loss of £540. A total of £92,539 was spent on capital account during the year. This included £78,692 for machinery, and £11,684 for mains and services. The number of kWh sold decreased from 7,594,107 to 7,423,557 but the maximum load increased from 3,375 to 3,418 kW. Owing to the poor quality of the fuel obtained during the coal stoppage, the fuel consumption, for a smaller output, was about 2,000 tons more than in 1921. A schedule of prices included in the report shows a small all-round increase.

Continental.—Denmark.—The Danish Committee which last year investigated the possibilities of Danish hydro-electric works reached the conclusion that the erection of seven works in Jutland, which would be able to meet 60 per cent. of the consumption in Jutland, could be carried out with advantage. It was calculated that the expenditure on the seven works would amount to 30,000,000 kronen, and the price to be charged would be from 10 to 15 ore per kWh. Seeing that a high-pressure cable from Norway to Jutland would involve an outlay of about 50,000,000 kronen, it is stated that it would be disadvantageous to procure a supply from such a distance. Since the publication of the report of the committee the question of the rational utilisation of the peat bogs in Denmark has assumed prominence. Mr. C. Iversen, of the Danish Technological Institute,

points in this connection to the favourable results obtained in Germany. The experience gained with the latter, it is said, suggests that similar generating stations should be established at the peat bogs in Denmark.

Poland.—The Union of Polish Electrical Undertakings is reported to have prepared a scheme of works, which are considered to be of an urgent nature. Among others the scheme, which it is hoped to carry out with the aid of foreign capitalists, provides for the construction of a central station at Boryslaw, together with electric railways in this oil region.

France.—Steps are being taken to set up a rural distribution network to supply nine communes in the département of Calvados. The electricity will probably be obtained from the city of Caen. Messrs. Langeons & Geneslay, electricians, have applied for mayoral permission to cross two intervening communes for the purpose.

The Société d'Intérêt Collectif Agricole de Sandemont et Environs has applied for a concession to supply electricity to ten communes in the Pas-de-Calais département and two communes in the Département du Nord.

Italy.—The Società Elettrica del Piacentino has been formed at Salerno to utilise the River Piacentino for the production and distribution of electricity. The capital of the company is 250,000 lire.

Darwen.—Reduction of Meter Rent.—The Electricity Committee has decided that meter rentals shall be reduced 50 per cent., as from July 1st, and that the matter be reconsidered after the September balance sheet has been received.

East Grinstead.—Proposed Electricity Scheme.—By the casting vote of the chairman, the Urban Council recently adopted a report upon the proposed electricity scheme. It was shown that the income for the first year would be about £1,678, and working expenses £1,180, giving a gross profit of £498. The capital expenditure would amount to £20,000. Loan interest and repayment would be £1,600.

Elland.—Year's Working.—The Electricity Committee reports that the profit earned during the year 1921-22 was over £3,000; in the previous year a deficit of £2,000 was incurred. The Committee recommends a reduction of 12½ per cent. in the present charge of 8d. per kWh.

India.—Ootacamund.—The Municipal Council recently considered an offer of the Nilgiri Power Syndicate to supply the district with electricity, but decided to allow the Metropolitan-Vickers Co. to install a distribution scheme and provide a temporary supply from the Cordite factory at Aravangadu.

Knaresborough.—Workhouse Lighting.—The Board of Guardians has appointed a committee to consider the question of having electric lighting installed at the workhouse. The Harrogate Town Council has offered a supply with a minimum payment of £425 per annum for four years, or £300 per annum for five years.

Llanelly.—Accident.—Four men employed by the Llanelly Electric Lighting & Traction Co. on August 29th were dismantling an electric light standard in the Town Hall Square. The standard was lashed to a lowering wagon, and two men were at the top of it when it collapsed and they were thrown to the ground, one fracturing his elbow and the other sustaining injuries to the hip, which necessitated medical attention.

Lyme Regis.—Proposed Electricity Supply.—At a recent meeting of the Town Council a draft Order which the Electricity Commissioners proposed to issue was discussed. It was stated that the maximum price chargeable had been lowered, but the Mayor explained that the lower rate at which money was now obtainable would more than compensate for this. It was hoped that the objection to the erection of overhead lines would be overcome as underground cables would entail considerable expense.

Masham.—Proposed Price Increase.—The Urban Council has applied to the Electricity Commissioners for an order permitting it to increase the maximum charges for electricity from 8d. per unit to 9d. for lighting, and to 4½d. per unit for power, with minimum payments of 11s. 3d. for the winter quarters, and 7s. 6d. for the summer quarters.

New Zealand.—Devonport.—Application is being made for sanction to borrow £40,000 in connection with the electricity scheme for the district.

Okehampton.—Proposed Purchase of Undertaking.—The Town Council has instructed the Town Clerk to communicate with Messrs. Nicholls & Unwin for the purpose of arranging with them to advise the Council as to the advisability of purchasing the Okehampton electric light undertaking, and to make the necessary valuations, &c.

Seaton.—Proposed Electricity Supply.—Steps are being taken to ascertain the views of residents as to the advisability of instituting a scheme of electricity supply. There are a number of private installations in the town, but although the Council has discussed the matter at various times no definite move has been made.

Spenborough.—Loan.—The Urban District Council has decided to apply for a loan of £7,675 to carry out a scheme of electricity supply to Scholes, and to make the necessary sub-station arrangements.

St. Annes-on-Sea.—Proposed Extensions.—The Urban District Council has deputed the electrical engineer (Mr. J. H. Clothier) and a member of the Council, to confer with the Electricity Commissioners respecting extensions of plant at the electricity works.

Portmadoc.—Electricity Supply.—The North Wales Power Co. has obtained the consent of the Council to erect transmission poles and wires within the local area from Cwm Dyli *via* Tremadoc, to Criccieth.

Stalybridge.—Loan.—The Generating Station Committee of the Stalybridge, Hyde, Mossley, and Dukinfield Joint Tramways and Electricity Board has recommended, and the Board has approved, application for sanction to borrow £44,700 to carry out plant extensions which have become urgently necessary.

Wrexham.—Mutual Supply Scheme.—The Town Council has arranged with the Gresford Colliery to receive or give a supply of electricity as necessary. It is hoped to have the mains laid for this purpose by December next.

The British Thomson-Houston Co., Ltd., has been awarded the contract for the supply and erection of a rotary converter and switchgear at a total cost of £2,564.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Year's Working.—The 1921-22 report of the municipal tramway department (manager: Mr. Wm. Forbes) shows a total income of £184,618, comparing with £191,470 in the previous year. Working expenses amounted to £137,979, as against £157,585, leaving a gross profit of £46,639 (£33,885). Interest, sinking fund, depreciation, &c., absorbed £31,550, as against £32,304, giving a net profit of £15,089, as compared with £1,581 in 1920-21. Capital expenditure during the year amounted to £7,890, mainly on the construction of new cars and permanent way. There was a decrease in traffic; the passengers carried numbered 41,087,388, as against 42,953,807; the car mileage fell from 2,307,259 to 2,252,889. The motor omnibuses earned a net profit of £771.

Barrow.—Inquiry.—It is proposed to hold an inquiry into the working and control of the tramway undertaking.

Bristol.—Acquisition of Tramways.—During the present month a committee of the Corporation is to consider the question of acquiring the tramways at the next date of option.

Burnley.—Year's Working.—The 1921-22 accounts of the municipal tramways department (general manager: Mr. H. Mozley) record a total income from all sources of £163,058, as compared with £180,792 in the previous year. Working expenses totalled £144,632, as against £168,140, leaving a gross profit of £18,426 (£12,652). The payment of capital and other charges absorbed £20,740, causing a net deficit of £2,314—a large reduction upon the previous year's debit of £9,752. The traffic statistics showed a decrease; passengers carried from 23,407,356 to 19,164,508, and car-miles run from 1,774,198 to 1,522,278. The report of the general manager states that the coal miners' dispute had serious effects upon the undertaking, causing a net loss of £13,000. The arrears of repairs caused by the war were considerably reduced. The necessity to relay greater lengths of track had also had an adverse effect upon the traffic.

Continental.—Germany.—The growth in working expenses of the electric tramways at Gerthe and Hoerde, Westphalia, threatens to bring these lines to a complete standstill. Wages and raw materials have reached such a level that it is thought to be no longer possible further to raise the fares to meet the higher working expenses, the wages of the tramway employés alone having now advanced to 37½ marks per hour at Gerthe. The owners of the Hoerde district lines have already applied for permission to discontinue the services.

India.—Proposed Tube Railways.—The office of the High Commissioner for India has forwarded to the Department of Overseas Trade copies of reports on the proposed tube railways between the East Indian Railway and the Eastern Bengal Railway, together with a book of plans and a horizontal section. These documents can be inspected by representatives of United Kingdom firms interested on application to Room 49 of the Department of Overseas Trade, 35, Old Queen Street, Westminster, London, S.W.1, until September 20th next, after which date they will be available for loan in order of application to firms in the Provinces who are unable to have them inspected in London. (Ref. 9,457 E.D./E.P.)

London.—Post Office Railway.—The Minister of Transport has extended the time of the Post Office (London) Railway Act, 1913, for the completion of the railway and works, until August, 1924.

Central London Railway.—The Minister of Transport has extended the time of the Central London Railway Act, 1914, for the completion of the enlargement of the tunnels until July, 1924.

Manchester.—Result of Fare Reduction.—The reduction of fares has caused a considerable loss to the Corporation during the past two or three months. The Corporation has asked the general manager to submit a report with recommendations.

Southport.—Extension of Time.—The Minister of Transport has extended the time until August, 1923, of the Southport Corporation Act, 1913, for the completion of the electrical equipment for the working of trolley vehicles.

Sunderland.—Proposed Wages Reduction.—In view of the proposed reduction of 12s. per week in tramwaymen's wages, the Tramways Committee, being of opinion that the question is one for local settlement, has recommended the Town Council to secede from the Joint Industrial Council for the tramway industry.

United States.—New York Subway Accident.—Last week a man was killed and 25 people were injured by an accident on the Hudson (New York) Tube. A crowded train was standing on a line on account of some signal trouble when a following train crashed into its rear.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—Normal Service.—The Western Union Telegraph Co. announces that it has made considerable improvements in the facilities since August 7th, when all communication through Valentia was interrupted by the action of the Irish Irregulars. These improvements have resulted in a normal service being given to full-rate messages, and the company is now able to accept deferred or cheap-rate messages under the usual conditions.

In connection with last week's statement by the Irish Provisional Government, with reference to the cutting of a transatlantic cable at Valentia, the Western Union Telegraph Co. states that no cable has been cut, although a certain amount of damage has been done at the cable station, which will take some days to repair.—*Daily Telegraph.*

Australia.—New Loan.—The House of Representatives on August 31st passed a Bill authorising the raising of a loan of £17,000,000, of which £3,000,000 will be allocated for postal, telegraph and telephone works.—*Reuter's Trade Service* (Melbourne).

Wireless Board.—The Commonwealth Cabinet has appointed the Prime Minister as the seventh member of the board which is to install and control direct wireless communication between Australia and the United Kingdom. The board will choose a chairman, who, it is expected, will be the Prime Minister. The Commonwealth Government and the Amalgamated Wireless Co., which is to install the service, each had three directors on the joint board, but were unable to agree on the seventh, and the arbitrator under the agreement selected Sir Thomas Hughes, chairman of the Amalgamated Wireless Co., thus giving the company a majority. There was an outcry in Parliament, and Sir Thomas Hughes resigned.—*The Times.*

New Wireless Stations.—The Commonwealth Prime Minister has promised to inquire into the matter of tenders for the construction of the stations required to establish the new Commonwealth wireless scheme. A member of the House, in bringing the matter to the notice of the Prime Minister, suggested that tenders for the erection of the necessary stations should be made open to public competition.—*Reuter's Trade Service.*

Brazil.—New U.S.-Brazil Cable.—The Western Telegraph Co. was to open a new direct cable route to the United States on September 7th. It appears that this question, which during the past two years has raised difficult international controversies, has been definitely settled, and local commercial interests are greatly pleased that increased facilities for cable communication are to be made available.

British Columbia.—New Wireless Station.—It has been decided to install a wireless station at Stewart in place of the present telegraph station.—*Reuter's Trade Service* (Stewart).

Denmark.—Telephone Tariff Reductions.—The telephone tariff in Copenhagen is being reduced by about 10 per cent., from 150 to 136 kroner per annum for 1,000 calls, and from 300 to 270 kroner for the unlimited service. In the provincial towns of Zealand the charge is reduced from 100 kroner to 90, and in rural areas from 60 to 80 kroner. Distance charges are also reduced proportionately.—*Financial Times.*

France.—New Wireless Station.—The Société Francaise Radio-Electrique has been entrusted with the work of equipping the wireless station at La Fayette, near Bordeaux. The same type of machines will be used as those employed at the Sainte-Assise station, which was recently opened for service.

Germany.—Wireless Telephony.—A central wireless telephone office has been opened in Berlin in connection with the wireless station at Königswüsterhausen for an express service of financial news to subscribers.—*The Times.*

Hitherto the general public has not been allowed to have wireless installations, says the *Daily Mail*, but it has been arranged to supply subscribers in 140 cities with a service of business news by wireless telephone. At the central office in Berlin news will be spoken into a microphone apparatus connected with the chief wireless station at the Imperial post office at Königs Wusterhausen, where the news will be broadcast throughout Germany by an automatic wireless telephone sender. The subscribers to the service will be provided with apparatus by the post office, the annual payment for which will be not less than 4,000 marks, or 15 shillings. Later in the autumn it is intended to send out instructive and entertaining lectures and concerts by wireless telephone every evening.

Portugal.—Wireless Concession.—A Bill has been placed before the Portuguese Parliament to authorise the formation of a Portuguese company for the establishment of a system of wireless telephony and telegraphy between Lisbon and the Colonies. A maximum period of four years is fixed for the completion of the work. The granting of the concession to the Marconi Co. was referred to in our August 25th issue

Sweden.—Foreign Telephone Contracts.—M. Winkrantz, a director of the H. T. Cedergren Co., who has returned from a visit to Poland, Austria, Italy, and Spain, states that the agreement with the Polish Government regarding the new Polish Telephone Co. may be regarded as definitive, and that the co-operation with the Poles is good. In Spain an agreement has been entered into regarding the taking over of the telephone station of Valencia and its surroundings. The negotiations with the Italians relating to the taking over of the telephones at Verona have not yet resulted in an agreement. M. Winkrantz, however, is very satisfied with the company's position in all these countries.—*Reuter's Trade Service* (Stockholm).

United States.—Cable Companies' Alliance.—It is announced that an alliance has been formed between the Postal Telegraph Co. (part of the Commercial Cable system) and All-America Cables, Incorporated. Fifty thousand miles of submarine cables are involved.—*Reuter's Trade Service* (New York).

Wireless Telegraphy.—Reception on Trains.—According to *The Times* engineers have made experiments in the reception of wireless messages on board a railway train on the Paris-Orleans line. They employed the electric light wire as receiving wire, and between Limoges and Châteauroux they were able to pick up clearly messages from Greenwich. Later messages from the French station at Saint-Assise were received. The engineers arrived at the conclusion that with a special wire on the roof of the carriage it would be easy to hear the wireless telephone messages from the Eiffel Tower.

Restoration of Deferred Service.—It was announced on the 5th inst. that the deferred (i.c.o.) Marconi wireless service to the U.S.A., South America, &c., which was suspended when the Clifden wireless station was damaged by the Irish irregular troops a few weeks ago, had been restored.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—Victorian Electricity Commissioners. January 15th, 1923. Four water-tube boilers, each 4,500 sq. ft., with pumps, piping, and structural steelwork for boiler-house.

January 23rd. Back-pressure steam turbine, including a 1,500-kW alternator.

Sydney.—October 23rd. Municipal Council. Two thousand 240-V, d.c. and 25,000 240-V single-phase electricity meters.

October 23rd. Minister of Public Works. Two water-turbines and generators in connection with the Barren Jack hydro-electric development. (See this issue.)

Adelaide, South Australia.—December 5th. Adelaide Electric Supply Co., Ltd. 380 electric motors.—*Reuter's Trade Service* (Adelaide).

Victorian Railways.—With reference to our note on p. 309, September 1st, for three electric storage battery industrial trucks, *Reuter's Trade Service* (Melbourne) states it is understood that the order will be placed locally.

Belfast. — September 11th. Electricity Department. Stores (including wires, cable, lamps, electrical accessories, &c.) for six months. (August 25th.)

September 22nd. Tramways Committee. Reconstruction of 10 miles of single track. (See this issue.)

September 26th. Tramways Committee. Tramway stores, including electrical accessories, cable, lamps, &c., for five months. (See this issue.)

Belgium.—September 20th. The municipal authorities of Ixelles, Brussels. Armoured cable for low-pressure distribution mains.

Birmingham.—September 29th. Electricity Committee. Nechells generating station. Power-driven lathes, machine tools, shafting and pulleys. Mr. E. J. Jennings, secretary, City Electric Supply Department, 14, Dale Street.

Brentford.—September 25th. Board of Guardians. Six months' supply electric lamps and accessories. Mr. F. E. Harmsworth, clerk, 24, Twickenham Road, Isleworth.

Bristol.—September 13th. Board of Guardians. Electrical fittings for six months. Mr. J. J. Simpson, clerk, St. Peter's Hospital.

Bulgaria.—Sofia.—October 16th. Directorate of Post, Telegraph and Telephone. Telephone cable and materials.*

Conisborough.—September 18th. Urban District Council. Wiring, &c., Council offices. H. Thirlwell, surveyor.

Egypt.—Cairo.—September 11th. Ministry of Public Works. Installation of switchboard and system of armoured feeders for works of the Palais de Ras el Tine, Alexandria.

September 30th. Electric pump, accumulator plates, and a 3-phase transformer, for the Asite des Aliénés, Khanka. Engineer-Electrician-in-Chief, Electrical Service. Ministry of Public Works, Cairo.—*Reuter's Trade Service* (Cairo).

Federated Malay States.—The Government of the Federated Malay States is inviting tenders for the electric lighting plant for the Tanjour-Malim Training College, Kuala Lumpur.—*Reuter's Trade Service* (Singapore).

French Indo-China.—September 14th. Supply of copper and bronze wire, galvanised iron and steel wire for the telegraph and telephone service of Indo China. Office National du Commerce Extérieur, 22-24, Avenue Victor-Emmanuel III, Paris.

Hastings.—October 4th. Board of Guardians. Electric lift at Frederick Road Infirmary. Mr. G. Bumstead, clerk to Board of Guardians, Union Offices.

Leeds.—September 12th. Tramways Department. Reconstruction of tramway track, Woodhouse Lane and Cookridge Street. Mr. J. B. Hamilton, general and commercial manager, 1, Swinegate.

London.—County of London Electric Supply Co.—October 18th. Supply and erection of steam turbo-alternators for the Barking power station. (August 25th.)

Edmonton.—September 14th. Board of Guardians. Six months' supply of electric lamps. Mr. E. Ridley, clerk, 77, Bridport Road, Edmonton, N.18.

Bermondsey.—September 14th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Reeve, clerk, 283, Tooley Street, S.E.

Westminster.—September 13th. Board of Guardians. Supply of electric lamps, fittings, &c. Mr. W. J. Lickley, clerk to the Guardians, Princes Row, Buckingham Palace Road, S.W.

Islington.—September 12th. Board of Guardians. Electrical supplies for six months. Mr. Albert King, Guardians' offices, St. John's Road, Upper Holloway, N.19.

Fulham.—September 20th. Electricity Department. 11,000-V switchgear, 2-phase and 3-phase. (See this issue.)

Manchester.—September 12th. Tramways Committee. Steel girder tramway rails; general stores; permanent-way special track work. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Morocco.—Rabat.—September 16th. Supply of bronze wire, copper wire, and twisted copper wire for the telegraph and telephone service. Office National du Commerce Extérieur, 22-24, Avenue Victor-Emmanuel III, Paris.

Mountain Ash.—September 9th. Electrical installation: Electrical equipment of the Mountain Ash and Penrhiwceiber General Hospital, including steam generating sets, switchboards, booster, battery, all internal and external wiring, &c. Mr. John Wayne Morgan, consulting engineer, 5, Pembroke Terrace, Cardiff.

New Zealand.—Auckland.—February 1st, 1923. Harbour Board. One 1-ton fixed electric crane.*

Wellington.—October 24th. Public Works Department. 400 miles 19/13 S.W.G. bare h.d. copper wire for Mangahao electric power scheme.*

Plymouth.—September 12th. Electricity Department. Steam turbine-driven rotary boiler-feed pump. (August 25th.)

South Africa.—October 18th. High Commissioner. Electrification of the South African railways, Maritzburg-Glencoe power house. Equipment: Coal-handling plant, ash-handling plant, and circulating-water screening plant. Specifications from the Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2.

Bloemfontein. — September 20th. Municipal Council. 1,200 yd. of 4-core, .2 sq. in., 660-V paper-insulated armoured cable.

Pretoria.—September 28th. Municipal Council. Electric capstans, coal elevator, ash elevator, and coal-stacking elevator.*

Johannesburg. — September 27th. Municipal Council. House service meters and time switches.*

Torquay. — September 22nd. Electricity Department. Two water-tube boilers, with superheaters, economisers, chain-grate stokers, induced-draught plant, and other accessories. (See this issue.)

Warrington.—September 26th. Board of Guardians. Electrical supplies for three months for Whitecross Institution and Cottage Homes, Padgate. Mr. A. Bottomley, clerk to Guardians, Bewsey Chambers, Warrington.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Bargoed.—Gellygaer Urban District Council. Accepted:
Steel poles and fittings.—Johnson & Phillips, Ltd
Bare copper wire.—Johnson & Phillips.
L.p. cable and boxes.—Siemens Bros. Co., Ltd
E.h.p. and l.p. switchgear.—General Electric Co., Ltd.
Transformers.—Fuller's Electrical Manufacturing Co.

New Zealand.—Auckland.—Electricity and Tramways Committee. Four tenders were received for the supply of electrical equipment for 10 bogie tramcars:—

National Electrical and Engineering Co.	£11,131
English Electric Co., Ltd.	13,543
Metropolitan-Vickers Electrical Co., Ltd.	14,445

The first-named tender was accepted. *Tenders.*

Pembroke.—Messrs. J. J. Armfield & Co., Ltd., have secured the contract for, and are now proceeding with the manufacture of, a Francis type water turbine and oil-pressure governor for the Narberth, Pembroke and Haverfordwest electrical works.

Salford.—Tramways Committee. Accepted:—
Tower wagon complete (£823).—Leyland Motors, Ltd.
Points and crossings (£984).—Hadfields, Ltd.

Electricity Committee. Accepted:—
L.p. lead-covered cable (£361).—Enfield Ediswan Cable Co., Ltd.
1,350 yd. l.p. lead-covered cable (£1,073).—W. T. Glover & Co., Ltd.
One 6,600-V, h.p. switch cubicle (£215).—Metropolitan-Vickers Electrical Co., Ltd.

Coal for six months. Accepted:—
7,500 tons best washed slack (£7,875).—A. Knowles & Sons, Ltd.
7,500 tons best washed slack (£7,875).—Clifton & Kersley Coal Co., Ltd.
3,500 tons best washed slack (£3,412).—Bridgwater Wharves, Ltd.

Stourbridge.—Accepted:—
Installing electric light in Stourbridge Baptist Church.—Simpson and Smith.

Wrexham.—Town Council. Accepted:—
Rotary converter (£1,981) and switchgear (£583).—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

British Association for the Advancement of Science. September 6th to September 13th. At Hull. Annual meeting.

The Nation's Food Exhibition.—September 6th to 26th. At Olympia, London.

Municipal Tramways Association.—September 13th, 14th, and 15th. At Newcastle-on-Tyne. Annual Convention.

National Association of Supervising Electricians.—Tuesday, September 12th. At St. Bride's Institute, Bride Lane, E.C. At 7.30 p.m. Presidential address by Mr. W. E. Highfield.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to give replies to queries received this week we must [illegible] manufacturers or suppliers of :—

Vitrosil fittings.

NOTES.

Wireless League.—The Postmaster-General has given his consent to the formation of a British Wireless League, and Mr. Y. W. P. Evans, secretary of the Manchester Wireless Club, is the hon. secretary and organiser. Among the objects of the League are :—

1.—Intercommunication between members, with a view to improving existing transmitting circuits, especially with regard to wireless telephony.

2.—Relaying of messages through stations owned by members, at times to be regulated by headquarters, the object of which will be the efficient organisation of all amateur transmitting stations, whereby a service of excellent utility will be maintained. All messages shall be confined to the business of the League.

3.—Strict observance of all the laws and regulations applicable to wireless telegraphy and telephony, in order that facilities may be obtained from time to time from the P.M.G.

4.—Co-operation with wireless leagues of other countries as far as the Post Office authorities will allow.

The League will consist of members and associate members, and will be governed by a central council assisted by a provincial council. Among the rules is one which says that members are expected "to police the air" as regards amateur transmission, and report any flagrant breach of rules to headquarters.

Mr. Harold Green has accepted the office of president, and Mr. W. H. Lamb is the treasurer. Information will be supplied by the hon. secretary, 2, Parkside Road, Princess Road, Manchester.—*Daily Dispatch.*

Electric Light in Royal Palaces.—The name of the Duchess of Albany, whose death was recently announced, has always been associated in certain circles with the electric light, which was first used on the occasion of her wedding, April 27th, 1882, at Windsor Castle. Queen Victoria was more progressive than is usually supposed; and it was at Her late Majesty's suggestion that the Durbar Room, at Osborne, was illuminated entirely by deflected light, about the year 1890, not a lamp or fitting nor any source of light being noticeable —surely the earliest recorded example of this "modern" system.

Legal.—Prosecution for Theft.—A fine of £2 was imposed by the Tredegar magistrates on a labourer for stealing a quantity of electric cable, valued at one guinea, the property of the Markham Colliery Co. When defendant was questioned by a police constable, who had noticed the cable, he said he hd bought it from a dealer for the purpose of making inventions, but when the chief electrician at the colliery was sent for he immediately identified the goods.

Educational.—University of London, University College. —*Faculty of Engineering.*—The 1922-23 session commences on October 2nd. The new buildings, including the Hawksby Hydraulic Laboratory, the machine tools shop, and a new laboratory for experimental work, will be ready for use in October.

A Goldsmith entrance scholarship, tenable in the Faculty of Engineering, value £90, will be competed for in September. Applications for entry forms must be made not later than September 12th. (For full particulars see our advertisement columns to-day.)

Messrs. S. Rentell & Co. inform us that their new work "Elementary Determinants for Electrical Engineers," by Mr. H. P. Few, and the new (second) edition of "Electric Bells, Alarms, and Signalling Systems" by Mr. H. G. White, have been included in the works of reference recommended by the examiners of the City & Guilds of London Institute.

Northampton Polytechnic Institute.—For the full-time courses in engineering and technical optics a special entrance examination is to be held at the end of September; the 1922-23 session for evening courses opens on September 25th. Particulars, together with conditions of entrance, can be obtained at the Institute, or from the Principal, Dr. R. Mullineux Walmsley.

The New York Subway Fire.—Recently we commented on the circumstances attending the fire on the New York underground electric railway, when some 150 persons in the tunnel were overcome by asphyxiating gases alleged to have been derived from the liquids used in the chemical extinguishers on the cars. *Chemical and Metallurgical Engineering*, in its issue of July 19th, said: "It is fairly well established that a number of the victims were actually affected to a certain extent by the gases evolved from the use of carbon tetrachloride fire extinguishers. Fortunately, no one was seriously disabled. The occurrence served to emphasise the danger of the unintelligent use of this very efficacious material. Work by the Bureau of Mines has demonstrated that the decomposition products of carbon tetrachloride consist of phosgene, hydrochloric acid gas, and some times chlorine. In addition, high concentrations of tetrachloride vapour are formed when the liquid is sprayed on a heated material. Death may be caused by breathing the gases for only a short time. It is obvious that the danger of such an occurrence is considerably greater in a confined space where there is not opportunity for the diffusion of the noxious gases."

After quoting from a report of the Bureau of Mines, the journal adds: "Steps have been taken to prevent a re-occurrence of such an accident by the removal of this type of extinguisher from subway cars in New York."

The report referred to, which had been issued long before the accident, states that seven to nine per cent. of carbon tetrachloride vapour mixed with air will extinguish fires. The heavy vapour tends to settle to the bottom of a room and forms a blanket on the floor. This blanketing effect on any material wet with carbon tetrachloride excludes air and so aids in extinguishing fires. Undecomposed carbon tetrachloride vapour, arising from the use of the liquid in fire extinguishers when encountered in a small, confined space will probably produce unconsciousness by its anæsthetic effect. An employé of the Bureau of Mines was overcome while using a carbon-tetrachloride fire extinguisher on an automobile burning in the open air. Two employés of the Navy Department died as the result of breathing fumes from carbon-tetrachloride that had been used when the clothes of one of them caught fire when the men were working in a very small compartment. Care must, therefore, be observed in the use of fire extinguishers of the carbon-tetrachloride type in underground fire fighting. Such extinguishers are in common use for putting out fires in and around electrical equipment, for carbon-tetrachloride is a non-conductor of electricity, and, indeed, such extinguishers should be a part of the equipment of all mine locomotives. The operator need not inhale the fumes, as electric locomotives usually are in well-ventilated entries or haulageways.

In an editorial our contemporary blamed the manufacturers for selling fire extinguishers of this kind for use under such circumstances. However, in the issue of the same journal for August 16th, the results were announced of an investigation conducted by the New York Transit Commission, from which it appears that "all the illness and suffering of passengers were caused by smoke from burning insulation aggravated by the panic and haste with which they climbed 75 feet to the street, and that no serious amount of poisonous gases was generated by the Pyrene fire extinguishers. What fumes did come from the carbon tetrachloride used in the extinguishers were so diluted as to be negligible."

In preparing this report the commission had the services of experts from the Bureau of Mines and of consulting electrical engineers.

After stating that experiments will be made to find a better extinguisher, the report says: "In the meantime our study of the result of the use of Pyrene in this instance conclusively shows that its use was in no way dangerous or even discommoding. The continued efficient operation of the subways is essential to the life of the city, and this efficient operation requires the use of some immediately available fire extinguisher in case of electric short circuits, which are always possible of occurrence. Tetrachloride is the best known and most universally accepted extinguisher for this purpose. Nothing has been discovered by the investigation to justify ordering its discontinuance."

The British Cast Iron Research Association.—The director of research in the monthly circular for September details the matters submitted to the Association for investigation. Members have sought advice on many problems and interim reports on the progress of important researches have been prepared for early issue to the members.

The *Bulletin* giving full details of the work done during the first half year of the Association's activities was issued to the members last month. The replies to the various problems submitted for advice and investigations together with preliminary reports on the fundamental researches in hand or projected indicate the earnest endeavour the Association is making to meet the technical and scientific needs of the cast iron industry.

London's Great White Way.—Still another novelty in electric signs has joined the flickergraph zone around Piccadilly Circus, which more and more is rivalling the "great white way" of Broadway in its variety of flashing advertisements. The "Scintillating Press" has made its appearance on a building in Shaftesbury Avenue. On it all sorts of messages chase or non-stop each other across. "Don't get run over by the fire engines," it said the other night, when the fire brigade was operating near the Circus. "All over now—good-night," were its parting words at about 11.15. Truly a Brighter London idea, although Mr. L. C. Mencken, the distinguished American critic, deplores this adoption by London of what he regards as one of New York's bad habits. —*Evening News.*

Broken Trolley Wire.—Two Rawmarsh men were proceeding along Corporation Street, Rotherham, on August 29th, when a trolley wire broke and fell past them giving one of the men a slight shock. The wire fell on another man but without causing him injury. A policeman moved the wire to the track by means of a walking stick, thus causing the power to be cut off.

Wireless on a Delivery Van.—An enterprising American firm is probably the first to use wireless telephony in connection with its delivery service. The firm sells bread, and its system was described in a recent issue of the *Commercial Motor*. A low aerial is fitted longitudinally to the roof of a motor van, and the "earth" is provided by a connection to the frame. Inside the van is a complete telephone receiving apparatus fitted with a three-stage amplifier and a "Magnavox" loud speaker. The firm employs the agency of the nearest "broadcasting" station to give directions to its driver. The station is requested by telephone to send out instructions on a certain wave length, the receiving set on the van is tuned to this wave length, and having received his directions, the driver can, if necessary, communicate with his headquarters by ordinary telephone. Another function fulfilled by the van is the reception of broadcast concerts, which are enjoyed by large gaterings.

This is the first application, apart from military uses, of wireless telephony to commercial vehicles we have heard of since Capt. Riall Sankey mentioned it as being feasible at the recent London Transport Congress.

Automatic Signalling.—The Mersey Railway Company has arranged for the automatic electric signalling apparatus on its system to be extended from Central Station, Liverpool, to Central Station, Birkenhead, and also as far as the Adelphi Street signal box on the line to Park Station from Hamilton Square. At present the electrical system is only applied to the under-river section of the line, *i.e.*, from Hamilton Square to the city end of James Street station, and since it was brought into operation in November of last year has proved eminently successful. It is expected that the new apparatus, which is to be installed by the Westinghouse Brake and Saxby Signal Co., Ltd., London, will be in operation before the end of the year.

Ice-making Plant at Aberdeen.—A large electrically-operated refrigerating and ice-making plant was recently put into commission by the Aberdeen Steam Trawling and Fishing Co., Ltd., in new buildings at its Poynernook premises. The machinery comprises two compressors, each driven by a 250-h.p. motor; a brine circulating pump; automatic rams for moving the ice blocks when formed; an electric travelling crane for conveying the blocks; circulating water pumps for condensing purposes; and two ice-crushing machines, driven by electric motors. The power is supplied by the Aberdeen Corporation under a special contract which ensures a 100 per cent. load factor. The daily output of ice is 150 tons.

Kinema Exhibition.—Kinemagoers who fancy that the kinematograph is the product of this generation alone are likely to be surprised if they visit Mr. Will Day's exhibition of film appliances which opened at the Science Museum, South Kensington, S.W., on August 24th.

Mr. Day, who possesses what is virtually the whole history of motion-picture portrayal, has among his remarkable collection the wax figures used in the Chinese shadow shows thousands of years before Christ. A parchment made from bullock's hide, thin as paper, was apparently stretched before a brightly burning lamp. The wax figures were manipulated after the fashion of puppets, their shadows being cast upon the parchment screen. Sir John Herschell's spinning disk, the Thaumatrope, invented in 1826, is another exhibit. On one side of the disk is a drawing of an empty kennel and on the other a dog. When the disk revolves the dog appears to jump out of the kennel. This scientific toy was commercialised by Dr. Paris, who sold it at the rate of 14 for 7s. 6d. There followed what is much the same as the Wheel of Life, the fascinating old toy.

To an Englishman, Friese-Greene, is due the credit for the real kinematograph as we know it to-day—an invention which he patented in 1889. Edison reaped the world's applause; Friese-Greene died a year ago comparatively unknown and impoverished. His orphaned sons are being cared for by Mr. Will Day. Friese-Greene invented the first film with perforated sides, the first coloured film, the first stereoscopic film, and employed the first film camera. In 1896 R. W. Paul went far towards perfecting a mechanical projector. One of the most interesting exhibits is a Latin volume, published in Rome in 1646, in which Anathasius Kircher describes his invention of a magic lantern in 1640. There are also Edison's original kinetoscope projector which, on May 1st, 1893, at the World's Fair Exhibition at Chicago, gave the first public performance of motion pictures ever shown, and the original lantern slides of George IV's Coronation procession.—*Daily Mail*.

Appointments Vacant.—Charge engineer, for the Portsmouth Corporation electricity department; resident electrical engineer and waterworks manager, for the Witney Urban District Council; switchboard attendants, for the Hackney Borough Council electricity works. (See our advertisement pages to-day.)

The Manufacture of Radio Apparatus.—The system adopted by the American Radio & Research Corporation, Medford Hillside, Mass., U.S.A., in the manufacture of wireless apparatus, were described in a recent issue of the *American Machinist* (August 17th). The essential feature of the system is the production of a number of "units," which may either be assembled separately or combined into more complete apparatus. The frame of the "unit" is made of aluminium strip, which is first punched with three holes, and then placed on a bending machine, where each piece is formed to shape while being held upon a pin through the central hole. Rheostat coils are wound upon flat fibre strips, which are held at one end by a block which fits into a rotating chuck. The wire is wound at the correct pitch by a simple feeding gear, and during winding the core is pulled out of the block, and finally the wire is cut and a new strip inserted. Loops and bends are put into connecting wires very rapidly by small hand devices. Variometer spiders of the "basket-ball" type are punched out by an indexing machine from square sheets of fibre. The flat stampings then go to a winding machine, where they are formed into correct shape over hemispheres, and rapidly wound with insulated wire by spindles driven by small electric motors. The wire is wound under and over alternate prongs by girls, who become very expert in the operation. The riveting of the two hemispherical halves is also done by hand. All metal connections are then soldered by means of electric soldering irons. In the production of small transformers the cores are inserted in and around the coil—the coils are not wound on the core. The core stampings have a central tongue, which is bent up and thrust through the coil, alternate stampings being thrust through alternate ends, and a revolving table being used to facilitate the turning of the coil. Great ingenuity has been exercised in the assembly of small parts. For instance, the fastening of connections to an insulated panel designed for the front of three "units" is effected in the following manner: The screw connections are slipped into bushings in a base-plate, the heads of the screws being prevented from turning by a simple slotted holding device. The panel is then slipped over the screws and moved under a friction chuck, into which the nuts are placed. The chuck screws the nuts on and slips when they are right "home." Many other time-saving devices are used and the complete "units" are thoroughly tested after assembly.

Future Developments at Glasgow.—Mr. R. B. Mitchell, chief engineer of the Glasgow Electricity Department, lecturing to the Rotary Club on August 30th, traced the growth of the department since its inception, and remarked that it might be safely predicted that the recently-inaugurated station at Dalmarnock would not satisfy the requirements of the community for all time. In due course a site for another station would have to be acquired—probably in the western district of the city.

Dealing with the development of the domestic uses of electricity, Mr. Mitchell said he was optimistic enough to believe that there was a great future in that direction. The rapid growth of the use of electricity in the industrial spheres had been phenomenal, but it was more than probable that the domestic load would ultimately, and before long, be greater than the industrial load. The prospects of the domestic field were almost illimitable. Meanwhile that field had hardly been touched, but the day was not far off when the terms "Ideal Home" and "The Home Electrical" would be synonymous.

Discussing electrical heating by accumulation, Mr. Mitchell said that the solution of the problem was the provision of appliances which would accumulate energy when the generating plant was not fully loaded and release it when required by the consumer. He was glad to say that so far as the heating load was concerned there were indications that such appliances would soon be on the market. If heat-accumulating methods developed as expected the effect on supply undertakings would be of boundless importance.

Iron and Steel Institute.—The autumnal meeting of the Institute opened on September 5th in the ancient Museum of the Yorkshire Philosophical Society. The president, Mr. Francis, was in the chair, and the conference was largely attended by delegates from all over the country. The Corporation of York accorded the members a civic welcome, the place of the Lord Mayor, who was unavoidably absent, being taken by Alderman E. Walker. Mr. R. L. Wedgwood also welcomed the delegates on behalf of the chairman and directors of the North-Eastern Railway Co.

Amongst the papers read during the day probably the most interesting was that contributed by Mr. A. K. Reese, of Cardiff, who outlined the bases upon which modern blast furnace practice had been built up, and endeavoured to demonstrate that the object of modern blast furnace practice was the attainment of the greatest possible quantity consistent with quality. This view met with some opposition during the discussion which followed.

Late in the day the members of the Institute attended a film demonstration descriptive of the new McConway process for the production of steel disks by centrifugal hydraulic methods direct from molten steel.—*Daily Telegarph*.

United States Chemical Exhibition.—The National Exposition of Chemical Industries will be opened at New York on September 11th. More than 400 exhibitors have already taken space, and it is expected that 50,000 American chemists and persons affiliated with the commercial side of the industry will visit the exposition. Fuel economy devices will form one of the largest features of the show, and cheaper generation of steam will be demonstrated in several new types of power-house equipment, and also improvements in systems now in use. There will be an elaborate display of fire fighting equipment.—*Reuter's Trade Service* (New York).

Explosives in Coal Mines.—"The Explosives in Coal Mines Order of August 31st, 1922," is being printed and will be placed on sale. Clause 3 of the principal Order prohibits a shot-firer from approaching or allowing any other person to approach a missed-fire shot-hole until a prescribed interval of time has elapsed; the amending Order inserts words to make it clear that *no person* may knowingly approach such a shot-hole until after the prescribed interval.

Diesel Electric Dredgers.—It is stated that tenders are being invited for four twin-screw hopper dredgers for the United States War Department. Diesel-electric propulsion is to be employed. In each boat three six-cylinder, four-cycle McIntosh & Seymour 1,000-b.h.p. engines are to be installed, driving a 700-kW, 500-volt generator. For the operation of the electric auxiliaries there will be two Diesel engine-driven generators. The vessels will be 254 ft. long, with a beam of 46 ft.—*Motor Ship.*

OUR PERSONAL COLUMN

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

The salary of Mr. J. H. Clothier, electrical engineer of the St. Annes Urban District Council electricity undertaking, has been fixed at £800 per annum..

In consequence of the appointment of Mr. Mattinson as general manager of Manchester Corporation tramways, Mr. H. R. Kiernan, now chief assistant in the civil engineering department, has been made permanent way engineer, at £500 a year; and Mr. W. N. Barrett, engineering assistant, succeeds to the post of assistant permanent way engineer, at £330 a year.

Mr. R. H. Andrews, who served his articles at the Canterbury Municipal Electricity Works under Mr. C. A. Blascheck, has secured an appointment as assistant electrical engineer under the Shanghai Municipality.

Mr. E. P. Bennett, joint general manager of Simplex Conduits, Ltd., is leaving on September 26th for an extensive business tour in India, Ceylon, Burma, East Indies, Australia, New Zealand, &c., in the interests of his firm and Credenda Conduits, Ltd. He will establish new agencies in all oversea centres of importance.

The marriage took place, on August 23rd, at New Malden, of Mr. S. T. Short, A.M.I.E.E., youngest son of the late Mr. Nathaniel Short, of Waltham Cross, and Miss Dorothy May Boyd, second daughter of Mr. A. H. Boyd, of Surrey Villa, New Malden.

Mr. James Preston, rolling stock superintendent at the Cardiff Corporation electric power station, has been presented with the Special Service Cross of the British Red Cross Society in recognition of exceptional service. Some time ago a workman at the power station was caught in the cog-wheels of an elevator, and in order to save his life Mr. Preston amputated his arm with a pen knife as he was suspended in mid-air.

Mr. A. P. Ambler has resigned the position of publicity manager to the Edison Swan Electric Co., Ltd., and has joined the Dorland Advertising Agency as from September 1st. Mr. H. V. Richards has been appointed Mr. Ambler's successor with the Edison Swan Co.

A marriage has been arranged, and will shortly take place, between Mr. K. Newell Mayne, engineer and manager of the Redditch U.D.C. electricity undertaking, and Isabella Dorothea, fifth daughter of Sir John Holder, Bart., Pitmaston, Moor Green, Birmingham.

Mr. J. A. Sloane, who has been in charge of the accessories section of The Metropolitan-Vickers Electrical Co., Ltd., supply department, has resigned that position, and commenced business as a manufacturer's agent, at 49, Deansgate, Manchester. He will act as sales manager for the Ironclad Switchgear Co., Ltd., of Eccles, the Mycromet Manufacturing Co., of Oldham, and Messrs F. Pratt & Co. ("Z" fuses), of London.

Mr. E. Wilcox, lately chief assistant in the accessories section of The Metropolitan-Vickers Electrical Co., Ltd., supply department, has resigned to take up the development and manufacture of patented electrical accessories of his own design. For the time being communications should be addressed to 49, Deansgate, Manchester.

Mr. H. Tweedy, who was chief assistant in the fittings and showroom section of The Metropolitan-Vickers Electrical Co., Ltd., has resigned in order to take up the position of buyer for the lighting and heating department of Messrs. Lewes's, Liverpool. He will be pleased to receive catalogues and prices from manufacturers and agents.

Mr. T. H. Windibank, sales engineer to Messrs. City Electrical Co., and Mr. E. Hugh Bates, recently with Messrs. E. Brook, Ltd., in a similar capacity, have gone into partnership under the name of Bates & Windibank, electrical engineers, with offices at Sentinel House, Southampton Row, W.C.1. They will deal principally in a.c. and d.c. plant, and have been appointed distributors for Messrs. F. & A. Parkinson, Ltd., Guiseley, Leeds, and Messrs. Flather & Co., Ltd., Leeds.

Obituary.—Mr. J. Wordell Shemeld.—We regret to read in the *Irish Builder and Engineer* that Mr. J. Wordell Shemeld, electrical engineering contractor, of 49-53, Berry Street, Belfast, was killed while motor cycling near Portrush, his companion, who was in the sidecar, being seriously injured. The sidecar struck some stones and overturned.

Mr. F. E. Hesse.—The death occurred at his home at Richmond-on-Thames, on Tuesday last week, in his seventieth year, of Mr. F. E. Hesse, for many years general manager and secretary of the Eastern Extension, Australasia & China Telegraph Co.

NEW COMPANIES REGISTERED.

Murray & Ramsden, Ltd. (184,067).—Private company. Registered August 30th. Capital, £20,000 in £1 shares. To carry on the business of manufacturers of ebonite, vulcanite and synthetic rubber, manufacturers of and dealers in ebonite, vulcanite, rubber and rubber substitutes, accumulator cells, acid pumps, pipes, cocks, vessels, insulators and electrical appliances, reclaimers of rubber, manufacturers of, dealers and proofers of textile cloths or fabrics, chemical manufacturers, electrical and general engineers, &c. The first directors are:—G. I. Murray, South Bank, Broad Oak Park, Worsley (of G. I. Murray & Co.); G. I. Murray, junr., South Bank, Broad Oak Park, Worsley; C. S. Ramsden, Osborne House, Alderley Edge, Cheshire (managing director of Wm. Ramsden & Sons, Ltd., and director of Northern Auto-Electric Services, Ltd.). Remuneration (except managing directors) as fixed by the company. Registered office: Vulcanite Engineering Works, Carrington Field, Stockport.

Lumens, Ltd. (183,965).—Private company. Registered August 24th. Capital, £1,000 in £1 shares (500 cumulative preference and 500 ordinary). To carry on the business of manufacturers of and dealers in electrical, magnetic, telegraphic, telephonic, and other appliances and apparatus, &c. The permanent directors are:—J. B. Levee, 23, Hartley Street, Levenshulme, Manchester; H. Lomax, 11, Cathedral House, Long Millgate, Manchester (electrical engineer). Qualification: 20 shares. Registered office: 11, Cathedral House, Long Millgate, Manchester.

Napier Wireless, Ltd. (184,068).—Private company. Registered August 30th. Capital, £100 in £1 shares. To carry on the business of manufacturers of and dealers in machines, instruments, and apparatus for use in connection with telegraphy and telephony, and other modes of transmitting and receiving signals, &c. The subscribers (each with one share) are:—J. Coleman, 11, Netherford Road, Clapham, S.W.4, clerk; A. H. Palmer 49, Penshurst Road, Thornton Heath, Surrey, clerk. The subscribers are to appoint the first directors. Solicitors: Bristows, Cooke and Carpmael, 1, Copt hall Buildings, E.C.2.

Robert Crust, Ltd. (184,087).—Private company. Registered August 31st. Capital, £1,000 in £1 shares. To acquire the business of an electrical engineer carried on by R. Crust, of 40, Brook Street, Bradford. The permanent directors are:—R. Crust, 63, Norman Lane, Eccleshill, Bradford; S. W. Hill, 25, Walker Terrace, Bradford; W. A. Toppin, 111, Heaton Road, Bradford. Qualification: 50 shares. Registered office: 40, Brook Street, Bradford.

P. E. T. Luminous Ads, Ltd. (184,122).—Private company. Registered September 1st. Capital, £1,000 in 1s. shares. To carry on the business of manufacturers of and dealers in kinematographic and other films and pictures, photographic, optical, electrical and other apparatus, &c., for kinema shows, or for advertising purposes, &c. The first directors are:—F. W. Price, Dale Cottage, Merthyr Tydfil, merchant; F. Taylor, 8, Dyke Street, Merthyr Tydfil, kinematograph theatre manager. Qualification: 500 shares. Secretary: J. E. Taylor. Registered office: 5, Milbourne Chambers, Merthyr Tydfil.

C.A.V. Small Tools, Ltd. (184,095).—Private company.—Registered August 31st. Capital, £25,000 in 23,000 preference shares of £1 each and 40,000 ordinary shares of 1s. each. The objects are: to adopt an agreement between C. A. Vandervell & Co., Ltd., and F. R. Wade, and to carry on the business of manufacturers of and dealers in tools, hardware, ironmongery, &c. The subscribers (each with one preference share) are:—M. P. G. Elliott, The Laurels, Sunbury Common, Middlesex, merchant; D. D. McNeile, The Laurels, Sunbury Common, Middlesex. The governing directors are: F. R. Wade (chairman) and M. P. G. Elliott. Qualification: £100. Remuneration: £100 each per annum (chairman £200) and 10 per cent. of the profits, divided between them. Solicitors: Watson, Sons & Room, 11, Bouverie Street, E.C. No notice of situation of registered office was filed at time of incorporation.

Highfield Electrical Co., Ltd. (184,119).—Private company. Registered September 1st. Capital, £2,500 in £1 shares. To carry on business as indicated by the title. The first directors are:—F. W. Highfield, 29, Newland Road, Coventry (chairman); C. B. Lee, 4, St. Ann's Road Stoke, Coventry; H. Beesley, Burton Green, Tile Hill, near Coventry. Qualification: £250. Secretary: H. Megainey. Solicitors: R. A. Rotherham & Co., Coventry.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dawlish Electric Light and Power Co., Ltd.—Satisfaction to the extent of £300 on May 11th, 1922, of mortgage debenture dated September 24th, 1920, securing £2,000.

Dudley, Stourbridge and District Electric Traction Co., Ltd. (144,763).—Return dated June 8th, 1922. Capital, £200,000 in £5 shares (20,000 ordinary and 20,000 preference). All shares taken up. £200,000 considered as paid. Mortgages and charges, £72,500.

Western Electric Co., Ltd. (106,921).—Return dated July 26th, 1922. Capital, £900,000 in £5 shares. 99,995 shares taken up £155,975 paid. £344,000 considered as paid. Mortgages and charges, nil.

Johnson & Phillips, Ltd. (84,968).—Return dated June 8th, 1922. Capital, £700,000 in £1 shares. 437,500 shares taken up. £269,135 paid. £108,365 considered as paid. Mortgages and charges, £450,000.

New Gutta-Percha Co., Ltd. (74,517).—Return dated June 16th, 1922. Capital, £125,000 in 50,000 preference shares of £1 and 150,000 ordinary shares of 10s. each. 14,100 preference and 138,250 ordinary taken up. £1 per share called up on 11,350 preference and 10s. on 38,250 ordinary. £30,475 paid. £52,570 considered as paid on 2,750 preference and 100,000 ordinary. Mortgages and charges, £30,000.

English Electric Co., Ltd. (152,250).—Return dated May 30th, 1922. Capital, £5,000,000 in 1,500,000 preference and 3,500,000 ordinary shares of £1 each. 648,564 preference and 1,521,509 ordinary shares taken up. £315,673 paid. £1,904,400 considered as paid. Mortgages and charges, £2,190,100.

X-Rays, Ltd.—Deposit on August 23rd, 1922, of deeds of 10, Devonshire Grove, Old Kent Road, S.E., to secure all moneys due or to become due from the company to Lloyd's Bank not exceeding £10,000.

CITY NOTES.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

Profit for the year ended December 31st, 1921, £6,078, as compared with £10,708 for the previous year. After providing for debenture interest and £5,500 for depreciation, there remains to be carried forward a balance of £3. Debentures amounting to £7,500 were paid off during the year, thus extinguishing the whole of the company's debenture debt. Having regard to the large sum which must be provided each year from revenue to meet depreciation on the company's plant and machinery, the board has had under careful consideration the future policy to be pursued in the best interests of both preference and ordinary shareholders. In the past the amounts placed to depreciation account have been utilised in redeeming the company's 7 per cent. debentures, provision for repayment of the outstanding balance of which was made in December last. It is now proposed to return to the preference shareholders their capital in the form of 6 per cent. non-cumulative income debenture stock, with capital and interest rights practically identical with those attaching to the preference shares, but subject to redemption, and to utilise the amounts to be provided for depreciation in discharge of this stock, which the company will be entitled to redeem by purchase or tender. With the cancellation of this stock the ordinary shareholders will gradually become entitled to the whole of the reversion of the company's assets.

Meetings called by order of the Court to approve the scheme will be held at Winchester House, Old Broad Street, on September 14th.

Tyneside Tramways & Tramroads Co.

The half-yearly meeting of the Tyneside Tramways & Tramroads Co. was held in Newcastle-on-Tyne on August 29th. Mr. G. E. Henderson, the chairman, in moving the adoption of the report, said that £2,639 had been spent from the reserve fund for the re-surfacing of the track on the North Road, in re-building rolling stock, and other work. The reserve fund now stood at £64,761, as against £38,397 last year. Without attempting to forecast the future, he mentioned that their financial position for the past few weeks was a little better than last year, and he believed that that improvement would continue. The report was adopted.

Nenagh Gas and Electricity Co., Ltd.

Capt. Pee, chairman, presided at a meeting of shareholders which considered a report from a committee appointed to investigate the company's affairs, which were declared to be in a serious condition. The committee attributed the difficulties to the flotation of the company at a time when money was at the height of inflation, lack of supervision by responsible officials, under-capitalisation, and uneconomic working; and recommended reductions in salary and wages lists, in price of gas and electricity, and with regard to £4,000 due under the head of trade creditors, the raising of further capital, or, alternatively, a further advance from the bank, or the issuing of short-dated debentures to principal creditors, dividend on preference shares to be withheld meantime. The report was adopted, and it was arranged that the shareholders should be circularised, so as to ascertain their views on future action.

South London Electric Supply Co., Ltd.—Dividend of 5 per cent. per annum, less tax, on ordinary shares for the half-year.

Brazilian Traction, Light and Power Co., Ltd.—Quarterly dividend on cumulative preference shares of 1½ per cent.

Crossley Brothers, Ltd.—The directors report they are not yet able to recommend the payment of the dividend on the preference shares due September 1st.

American Telephone and Telegraph Co.—Interim of 2¼ per cent. on capital stock.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148A :—

Adelaide Electric Supply Co.—68,678 six and a-half per cent. "C" cumulative Preference shares of £1 each, partly and fully paid, within Nos. 1 to 68,678.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Marconi's Wireless Telegraph.—20,000 ordinary shares of £1 each, fully paid, Nos. 2,933,259 to 2,953,258.

Northern Mexico Power and Development.—67,428 common shares of $100 each and 28,570 seven per cent. cumulative preference shares of $100 each.

The undermentioned have been ordered to be officially quoted :—

Marconi's Wireless Telegraph.—20,000 ordinary shares of £1 each, fully paid (Nos. 2,933,259 to 2,953,258).

Northampton Electric Light & Power Co., Ltd.—Interim dividend of 4 per cent., less tax, on "B" ordinary shares.

The Direct Spanish Telegraph Co., Ltd.—Dividend at the rate of 10 per cent. per annum on the preference shares; an interim dividend at the rate of 8 per cent. per annum, free of income tax, on the ordinary shares, both for the half-year ended June 30th last.

Western Telegraph Co., Ltd.—Dividend of 5s. per share, making a total of 10 per cent. for the year, ended June 30th, 1922, free of income tax.

Lancashire Dynamo & Motor Co., Ltd.—Interim dividend of 3 per cent. actual, tax free, on ordinary shares.

Clarke, Chapman & Co., Ltd.—Interim dividend of 1s. per share, less tax, on ordinary shares.

Oxford Electric Co., Ltd.—A dividend at the rate of 5 per cent. per annum, less tax, on ordinary shares is announced.

Canadian General Electric Co., Ltd.—Dividend of 1½ per cent. for the three months ended September 30th on the common stock.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange conditions underwent a decided change for the better upon the passing of the September 1st settlement without any open trouble becoming manifest. This was the date fixed as being twelve months after the official termination of the war, and, in spite of the eight years which have passed since the outbreak of the struggle, there was still a certain remnant of stock unpaid for, and of bargains yet uncompleted, which gave rise to apprehensions, more especially as the uncertainties of foreign politics added anxiety to the position. Nevertheless, the settlement has been successfully surmounted, and Stock Exchange markets are once more upon an even keel as regards pre-war obligations. Money has begun to flow into securities, and, notwithstanding the breath of business which begins to give a welcome sign of rippling the currents of industry, the amount of capital required for business developments is not sufficient to make any difference to the demand for good-class stocks and shares. The electrical industry is in favour, and the declaration of an interim dividend of 5 per cent. on South London Electric Supply ordinary shares has served to raise the price by 7s. 6d.

The Home Railway market is giving a better account of itself. Districts in particular have recovered from some of the weakness which overtook them on account of liquidation of weak stock; and from 39 the price ran to 41½. At the same time, Metropolitan consolidated, which had been down to 54, rallied to 55. The Underground group is quiet, without any particular feature, but attention has been directed again to the debenture stocks of the East London Railway which are indicated in various directions as holding opportunities for appreciation. It deserves to be noticed, however, that the dulness of preference stocks and (less noticeable) of debentures continues to be apparent, and prices in the pre-ordinary department of the Home Railway market show tendencies to dwindle. This is explained in part by reference to a possibility of the next change in the Bank Rate being in the upward direction.

Underground Electric income bonds are now quoted ex their dividend of £2 per cent. net.

Mexican Utilities are no better, but the news from the country is decidedly more encouraging than it has been for some time past. The Mexican Government has proposed a scheme of arrangement under which it should be possible for the payment of obligations to be, at any rate, commenced. In consequence, prices of Mexican Government bonds are 2 to 5 points higher, and unless the scheme is turned down, as seems unlikely to happen, there should be a general recovery in Mexican securities as a whole. Brazilian Tractions have risen to 52, a gain of 2½, on the expectation that the quarterly dividend of 1 per cent. can be maintained, as to which a lurking doubt had begun to manifest itself owing to the drop in the Brazilian exchange. British Columbia Electric stocks are steady.

Babcock & Wilcox have recovered to £3. Other shares in the engineering group are inclined to hang fire, movements, however, being confined to very small alterations. English

Electric preference are firm at £1. Other shares in the manufacturing group are simply steady.

Increases in South London shares to 3⅝ has already been mentioned. New County of London ordinary, after dipping to 3⅝ 1/2d premium, recovered to 3⅝ 6d. premium, the preference holding their premium of 2s. 1½d. with noticeable strength. Chelsea ordinary are ¼ up at 6½. Metropolitans are equally better at 5⅞, and City of London ordinary hardened to 22s. 6d.

Marconis are the only active shares in the telegraph and telephones group. The price rose to 2⅜, on active bidding for the shares this, Tuesday, afternoon. Radios, after a drop to 21s. 6d., recovered a shilling, and the preference at 14s. 3d. are slightly harder than they were. The Eastern cable issues are quiet, and no changes have occurred amongst the others in this market.

Rubber shares continue dormant, the low price of the material affording no cause for encouragement to the long-suffering clientèle who hold rubber shares.

British Electric Traction ordinary has gone back to 57. London Electric Railway 4½ per cent. debenture holds its price at 95⅞: the City & South London twin stock is also quoted 95½-96. Of the other new issues, Bengal Telephone sevens are 100⅛, a premium of 3⅛, and the Madras Electric 7 per cent. second debentures are rather better at ⅝ premium. It is stated in responsible quarters that certain electrical companies with debenture stocks that fall due for repayment within the next decade or so, are debating the question of antedating the redemption of the stocks. Holders of sound securities of this nature may be glad of a hint not to sell unless they require money now.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Sept. 4. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7⅛		£7 14 10
Charing Cross Ordinary...	8	9	7⅝	—	5 17 0
do. do. do. 4½ Pref. ...	4½	4½	4		5 12 6
Chelsea	6	6	6½	+ ¼	4 16 0
City of London	14	14	22½	+ 1/-	6 11 9
do. do. 6 per cent. Pref....	6	6	23/-	—	5 4 4
County of London	8	8	1⅞		5 11 4
do. do. 6 per cent. Pref....	6	6	23/-		5 4 4
Kensington Ordinary	9	10	7⅝		6 15 7
London Electric	2½	4	2¼	—	5 11 6
do. do. 6 per cent. Pref....	6	6	5	—	5 17 1
Metropolitan	7	7	6⅞	+ ⅛	6 1 9
do. 4½ per cent. Pref....	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	8⅝	—	6 17 2
South London	7	7	8⅛	+ ⅜	7 4 4
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104⅛	—	5 14 8
do. Def.	1½	34/6	23⅛	—	7 9 0
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 9 8
Eastern Extension	10	10	18⅜	—	5 6 8
Eastern Tel. Ord.	10	10	186⅜	—	5 7 3
Globe Tel. and T. Ord.	10	10	19⅜	—	5 8 5
do. do. Pref.	6	6	11⅜	—	5 2 2
Great Northern Tel.	24	22	29½	—	7 10 6
Indo-European	10	10	86	—	6 19 0
Marconi	25	15	2⅜	+ ⅛	6 6 4
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 8
Home Rails.					
Central London Ord. Assented ...	4	4	67	—	5 19 5
Metropolitan	1½	2½	55	+1	4 2 0
do District	Nil	1	41½	+ ⅛	2 8 2
Underground Electric Ordinary ...	Nil	Nil	2⅜	—	Nil
do. do. "A" ...	Nil	Nil	7/-	—	Nil
do. do. Income ...	2	4	82½xd	—	*4 17 0
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref. ...	5½	12½	8½	—	7 17 2
do. do. 2nd Pref.... ...	Nil	5½	8⅝	—	7 0 9
do. do. 5 per cent. Deb....	5	5	82	—	6 2 0
Brazil Tractions...	Nil	Nil	52	- 2½	7 13 10
British Columbia Elec. Rly. Pcs. ...	5	5	76½	—	6 9 9
do. do. Preferred ...	8	9/6	69½	—	*6 18 6
do. do. Deferred ...	3	19/6	76½	—	*8 2 4
do. do. Deb.... ...	4½	4½	76	—	5 11 0
Mexico Trams. 5 per cent. Bonds ...	Nil	Nil	70½xd	—	7 1 10
do. do. 6 per cent. Bonds ...	Nil	Nil	41½	—4	Nil
Mexican Light Common	Nil	Nil	20⅜	—	Nil
do. Pref.	Nil	Nil	48⅛	—	Nil
do. 1st Bonds	Nil	5	63½	—1	7 15 0
Manufacturing Companies					
Babcock & Wilcox	15	16	3	+ ⅛	5 6 8
British Aluminium Ord.	10	10	18/8	—	—
British Insulated Ord.	15	15	42/-	—	7 2 10
Callenders	15	15	2⅛	—	7 1 2
,, 5% Pref	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	8/9	—	Nil
do. do. 5 per cent. Deb. ...	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	8	5	17/6	—	5 14 8
do. do. Pref.	6	6	1	+ ⅛	6 0 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/9	—	5 6 8
Henley	15	15	2¼	—	6 18 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	⅝	—	—
Met.-Vickers Pref.	8	8	2⅝	—	6 8
Siemens Ord.	10	10	27/6	—	7 5
Telegraph Con	20	20	26	—	4 12 2

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	7½d.	...
a Ammoniac, Sal	per ton	£63	...
a Ammonia, Muriate (large crystal)	,,	£48	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£30	...
a Copper Sulphate	,,	£26 10s.	...
a Potash, Chlorate	per lb.	5d. to 5½d.	...
a ,, Perchlorate	,,	7½d.	...
a Shellac	per cwt.	£16	15s. dec.
a Sulphur, Sublimed Flowers ...	,,	£14 10s.	...
a ,, Lump	,,	£11	...
a Soda, Chlorate	per lb.	3½d.	...
a ,, Crystals	per ton	£6	...
a Sodium Bichromate, casks ...	per lb.	5d.	...
METALS, &c.			
b Aluminium, Ingots...	per ton	£100	...
b ,, Wire	per lb.	1/9 to 2/6	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal -			
Grade I	per ton net	£150	...
Grade II	,, ,,	£108	...
Grade III	,, ,,	£62	...
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c ,, Tubes (solid drawn) ...	,,	11¾d. to 1/-	...
c ,, Wire, basis	,,	9½d.	½d. dec.
c Copper Tubes (solid drawn) ...	,,	1/1½	...
c ,, Bars (best selected) ...	per ton	£94	...
c ,, Sheet	,,	£94	...
c ,, Rod	,,	£94	...
d ,, (Electrolytic) Bars ...	,,	£71	...
d ,, ,, Sheets ...	,,	£145 10s.	...
d ,, ,, Wire Rods ...	,,	£81	...
d ,, ,, H.C. Wire ...	per lb.	10½d.	...
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	2/6	...
b Gutta-percha, fine	,,	12/6	...
b India-rubber, Para fine ...	,,	10½d.	...
j Iron Pig (Cleveland Warrants) ...	per ton	90/-	...
i ,, Wire, galv. No. 8, P.O. qual.	,,	£24	...
g Lead, English Pig	,,	£25 10s.	10s. dec.
g Mercury	per bot.	£12 10s. to £12 15s.	15s. to £1 inc.
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e ,, ,, medium ...	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/1	...
p ,, drawn bars and rods	,,	1/3	...
p ,, rolled strip & sheet	,,	1/2½	...
p ,, wire	,,	1/3½	...
o Platinum	per oz.	£19 10s.	...
d Silicium Bronze Wire	per lb.	1/1	...
r Steel, Magnet, in bars	,,	1/-	...
n Tin, Block (English)	per ton	£159 5/- to £159 10/-	5s. to 10s. dec.
n ,, Wire, Nos. 1 to 16 ...	per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r. W. F. Dennis & Co.

Deep X-ray Therapy.—Although King's College Hospital was built and supplied less than ten years ago with the latest equipment for hospital work, the progress of research in connection with X-rays and radium has been rapid under the direction of Dr. Robert Knox, and a further development is about to be made by the use of one of the seven empty wards of the hospital for deep therapy work. Apparatus equal to that in use in Erlangen is being supplied by Messrs. Watson & Sons to Dr. Knox's specification, and will be tested by the National Physical Laboratory. Arrangements have been made for the cost, amounting to £1,500, to be advanced by a generous supporter of the hospital, though it is hoped that contributions will be forthcoming from those who appreciate the importance of any endeavour to mitigate the suffering from cancer and allied disease.—*Daily Telegraph.*

An Improved Telephone.—It has occurred to a German electrical engineer, Dr. Georg Seibt, of Berlin-Schöneberg, that the efficiency of the telephone could be increased considerably by improving the electro-magnet on the attraction of which the vibrations of the diaphragm are dependent. Dr. Seibt's improved telephone comprises laminated, in the place of solid magnet cores, which, while not interfering with magnetic effects, counteract eddy-currents. The cores have been given a closer form, thus reducing the resistance to the magnetic lines of force and increasing the intensity of magnetisation. It has thus been possible to raise the acoustic efficiency of the telephone to double or two and a-half times the figure otherwise attainable.—*Manchester Guardian Commercial.*

THE SAYERS DYNAMO.

A New Design.

By W. BROOKS SAYERS.

Some time ago it was announced* that a new design of electric generator and motor had been evolved which, it was claimed, would appreciably reduce the cost of building such machines and at the same time make it possible to manufacture a machine which, for a given weight and size, would produce a considerably greater output than that of the standard type. Such claims naturally excited considerable interest, but for certain good reasons very few details could be made public at the time.

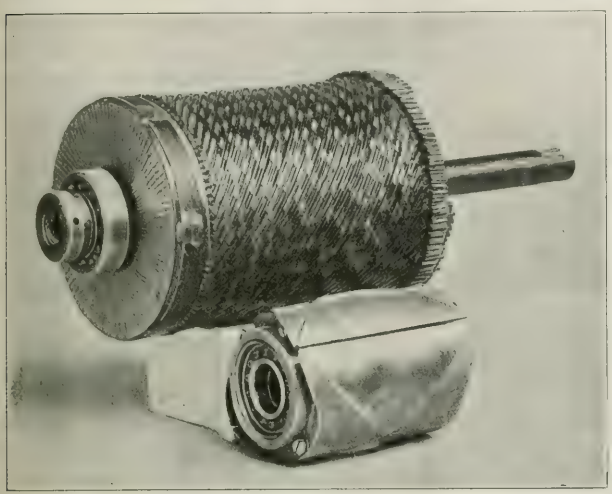


Fig. 1.—Sayers Helical Induction Cylinder and Free Core.

During the intervening 10 months, however, matters have progressed somewhat, as is shown by a recent report on the invention, in the course of which Mr. James Swinburne, F.R.S., a consulting engineer who needs no introduction, says:—"I consider that you are on a new, and almost unexplored, path in dynamo design; and that the adoption of your type of armature will increase the ratio of output to price in most cases; and that it will also increase the efficiency and the ratio of output to weight. . . . The general basis on which you are working is quite new to me, and I am an old dynamo designer. . . . I think you have a very good thing. . . ."

The dynamo-electric machine in all forms depends for its essential action on the cutting of magnetic lines of force by revolving conductors. For this purpose re-entrant windings of one form or another are employed. Such windings hitherto have consisted of wires, or conductors, laid in slots approximately parallel with the axis of the shaft and formed into a re-entrant winding by means of end connecting-wires, or bars, which occupy valuable space and cause a material part of the electrical resistance and heating of the armature.

The Sayers helical re-entrant inductor cylinder forms, it is claimed, an incomparably better basis for dynamo-electric machinery of all types and sizes than the forms of re-entrant winding in or upon laminated iron cores hitherto known. The helical bars associated with the necessary iron strip or wire to carry the transverse magnetic induction build into an independent cylindrical structure without added length for end connections, are ideal from the electrical standpoint of efficiency, and have excellent mechanical properties of robustness and stability. Moreover, the conditions for sparkless commutation with or without commutating poles are vastly improved.

The development of electric power and lighting schemes has been enormous during the past 15 or 20 years, but no radical advance has been made during this period in efficiency, weight, and output of generating machines and motors for a given price. The Sayers invention is a radical advance, passing the barrier which expert designers know as "space factor" and eliminating the necessity for expensive material and wasteful methods at present in vogue (laminated highest-quality iron of which 50 per cent. is wasted in scrap, and varnished tapes and other combustible insulating material).

The present method of embedding conductors in slots in laminated-iron structures and providing ventilating ducts for carrying off the heat generated involves losses on an increasing scale. A compact structure with eddy currents and hysteresis minimised would give the highest efficiency, but the heat unavoidably generated even with very thin laminations must be got rid of. To effect this, ventilating ducts are essential; the ducts and their associated fan or impellers involve windage losses themselves and also increased dimensions of the whole structure, which involve greater lengths and resistances and consequently *more heat to be got rid of*. Temperature rise is the controlling factor, and designers therefore find limits to output per unit weight, efficiency and price.

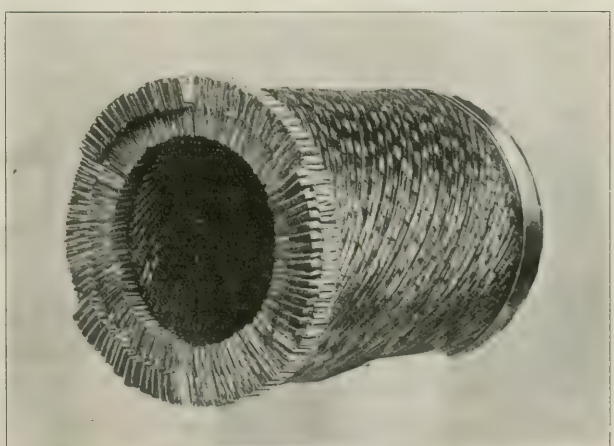


Fig 2.—Helical Induction Cylinder.

The new Sayers cylinder is (to begin with) of abso-

* Elec. Rev., November 4th, 1921, p. 590.

lutely minimum weight and resistance for a given duty; it is thought to be amply and abundantly ventilated without appreciable spreading for air ducts, and it enables a *solid stationary core* to be used, which is vastly cheaper to manufacture and lighter and better in every way than a laminated core; moreover, it entirely avoids the generation of heat in its mass by eddy currents and hysteresis.

The desirability of a free core has been recognised

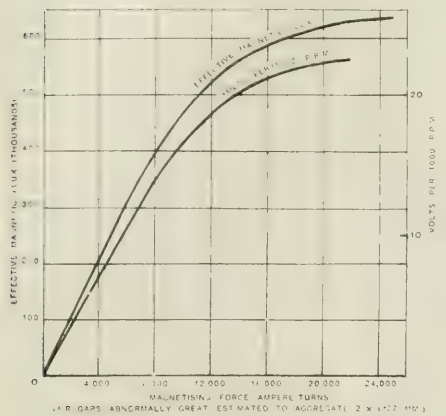


Fig. 3.

by several previous inventors, but no practical method of employing a freely-mounted solid core was evolved. The free-core arrangement involves three air gaps in place of one, with a slot-wound laminated core armature. This, at first sight, might appear to off-set to some extent the advantages by increased excitation expenditure, but this apparent disadvantage is transformed into a further advantage on investigation, because:

1. The effective area of the air gaps is from 50 to 100 per cent. greater than that given by the aggregate of the teeth, plus fringe allowance, in a toothed armature.

2. The edges of the helical iron strip may be so close

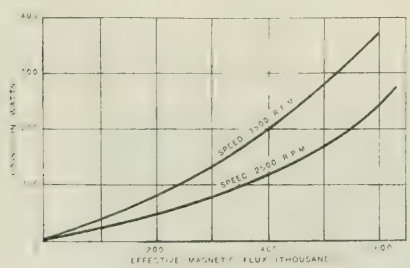


Fig. 4.

together and form so true a cylindrical surface (depending on the degree of excellence of manufacture) that the air gaps may be reduced to safe mechanical clearances—say 1 mm. in the internal and intermediate surfaces, and 2 mm. between the outer surface and pole faces.

3. Owing to the helical strips lying so close together, there is no perceptible heating of a solid pole shoe, which may continue practically to a sharp edge *without causing noise*.

4. Again, owing to the same cause, there need be no "tooth ripple" and no disturbance to telephone or telegraph systems due to inductance.

5. When adopted on a.c. generators, a smooth sine wave will be produced.

6. Owing to the iron being disposed between the conductors instead of forming an iron circuit round them in groups, and also to the iron being discontinuous, the self-induction of the armature sections is greatly diminished, even with the shortest possible air gap, and good commutation is correspondingly facilitated.

The claims put forward, therefore, are well founded. The invention is amply covered by patent rights already granted and by others for details pending. The preliminary work has already been done, and working examples are to be seen by appointment at Faraday House, Southampton Row, London, where several have been built, the one referred to below having been completed in July last.

The helical strip cylinder and its free core are illustrated in fig. 1; the cylinder presents its commutating end surface, and is shown with its shaft and ball bearing in position. (Since the photograph was taken, the surface of the cylinder has been smoothed off, and presents a more regular appearance than is shown in the figure.) At the commutator end the shaft mounting

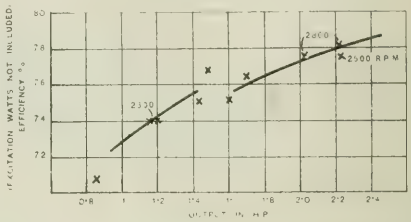


Fig. 5.

carries mica-capped dogs, which engage in three large recesses formed in the back of the commutator connectors. At the distant end the connectors form a shoulder, and half the bars are cut longer than the others in three groups, fig. 2; by means of mica-capped drivers a thoroughly mechanical fixture is secured for receiving or transmitting torque and resisting tension due to the centrifugal force on the bars.

The "free core" is divided longitudinally, thus providing for air ingress, the surface being also recessed lozenge-shape as required for most effective operation; there is free ventilation inside, a minimum of cross magnetisation, and advantageous commutation conditions. It is mounted on ball bearings and remains

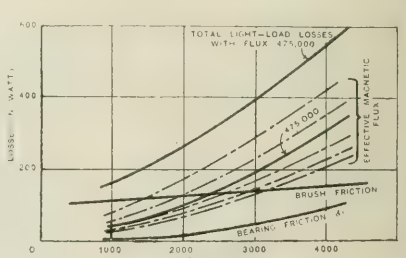


Fig. 6.

stationary inside the cylinder when the latter revolves and the field is excited.

The dimensions of the cylinder are as follows:—

Length, overall with end mounting ...	7½ in.
,, of helix	5½ in.
Diameter, external	5 3/32 in.
,, internal	3½ in.
Mean angle of helical bars with axis ...	45 deg.
Weight, with commutator	13 lb. 11 oz.

The number of composite helical bars is 216, *i.e.*, 108 each in the inner and outer layers. The bar spans are substantially 180 deg., giving a two-pole re-entrant winding, and each bar is composed of a copper and an iron strip laid together in contact, alternate bars only being wound with asbestos strip 1/64 in. thick and

$\frac{1}{4}$ in. wide, the laps being spaced $\frac{1}{4}$ in. apart to allow space for the passage of air between each conductor. The dimensions of the bars are:

Copper, 0.375 x 0.022 in.

Iron, 0.375 x 0.02 in.

Asbestos strip (varnished), 0.0156 in. thick.

The electrical resistance of the armature between the brushes is 0.05 ohm.

The composite helical bars are channelled in such a manner that their projected tangential thickness with insulation is at all diameters equal to the pitch of the conductors.

The cylinder is mounted at the commutator end upon a simple expanding device, and is positively driven through mica insulation by three dogs which fit into recesses formed in the inner end-connectors, the outer surface of which forms the commutator surface. At the opposite end a gunmetal carrier engages the castellated end of the cylinder and fits upon the splined shaft. Jack screws bearing on a fixed abutment in the shaft take the tension of the conductors.

The accompanying curves show the performance of the machine. These results are given with the *distinct reservation* that, while they indicate to the designer that the structure functions in practice normally, they are far below what is demonstrably realisable with the helical inductor cylinder. With regard to fig 5, the low temperature rise, 37° F. after one hour's run at 2,500 r.p.m., while producing an output of $1\frac{3}{4}$ b.h.p., shows that the ventilating arrangements are much more effective than the ventilating ducts generally employed in slot-wound laminated-core armatures. The brush gear functioned absolutely sparklessly at all loads without needing any adjustments, but a greater load than that indicated was not available at the time the test was made.

The tests recorded above were made on a d.c. machine, but the induction cylinder is equally applicable to a.c. machines.

IONIC CURRENTS.

In a note presented to the French Academy of Sciences on July 10th, M. Maurice Leblanc dealt with the properties of three-electrode valves filled with gas at low pressure. The note was reproduced in *La Revue Générale de l'Electricité* of August 19th, from which source we derive the following particulars:—

In the gas-filled three-electrode valve, the space between the anode and the cathode does not acquire a "space charge"; a potential difference of a dozen volts will cause hundreds of amperes to flow, but the properties of such valves differ from those in which the current is carried by electrons, and they must be used in a different way.

Fig. 1 shows a three-electrode valve filled with mercury vapour; it consists of a glass bulb carefully exhausted of air, and containing an iron or carbon anode *a*, a metal grid *b*, and

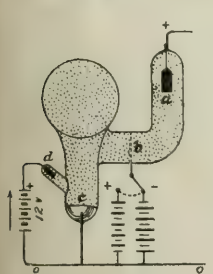


Fig. 1.—Ionic Valve.

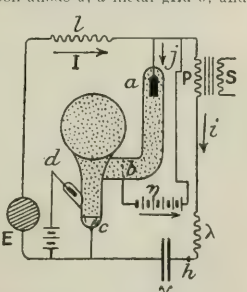


Fig. 2.—Ionic Transformer, d.c. to a.c.

a mercury cathode *c*. An auxiliary anode *d* enables an arc to be maintained between it and the cathode, in order to keep the valve continually "primed."

Current can only traverse the bulb from the anode *a* to the cathode *c*. If the grid is made negative with regard to the cathode whilst a current is flowing, the grid is covered with a layer of positive ions, which neutralise its charge, and the current is not interrupted as it would be in the case of an electronic valve. But if by acting on the external circuit the current is interrupted, for a period which may be very brief, the grid being negative reabsorbs the positive ions deposited on it and afterwards prevents the emission of electrons by the cathode as in the electronic valve. The current cannot be re-established while the grid remains negative; for that purpose, its charge must be made zero or positive.

These properties can be utilised as follows:—

1. *Transformation of direct current into alternating current of high frequency.*—A circuit (fig. 2) comprises a source of constant e.m.f. E; an inductance coil *l* resisting any appreciable variation of the strength of the current I in the circuit for the duration of one cycle of the alternating current that is to be generated; the primary winding P of a transformer, of which the secondary winding S is connected to the consuming circuit; and a resonator consisting of an inductance λ and a capacity γ. Between the points indicated is connected one of the primed ionic bulbs described above of which the grid is connected to the anode *a* by a circuit containing an e.m.f. η.

Assume the cathode *c* to be at zero potential, and let *h* be the potential at the other terminal of the condenser, *i* the current in the coil λ, and *j* the current flowing through the bulb (the current flowing to the grid will be negligible). Now, if, when the device is in operation, the current *j* dies out, the grid is then negative, the current through the bulb cannot be restarted, and the current I will charge the condenser. But directly *h* equals η, the grid ceases to be negative and the bulb short-circuits the resonator, the discharge current in which oscillates, whilst dying away, with a frequency α differing but little from $1/2\pi\sqrt{\lambda\gamma}$. If the energy $\frac{1}{2}\gamma\eta^2$ is greater than EI/α, the current *i* becomes equal to I; the current *j* becomes zero, the grid is then negative and remains so until the potential *h* is again equal to η, and so on.

Thus continuous waves are produced, the current *i* and the potential *h* varying as shown by the curves in fig. 3. The positive waves are truncated, but they are the less deformed

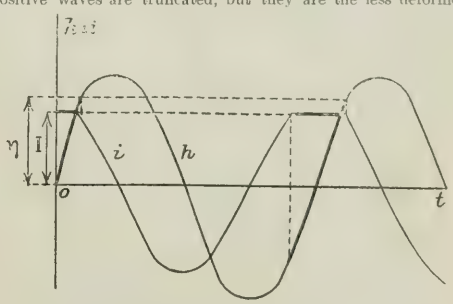


Fig 3.—Wave-form of High-frequency Current.

in proportion as the quantity of energy $\frac{1}{2}\lambda I^2$ is greater compared with $\frac{1}{2}\gamma\eta^2$; if the latter is small with respect to the former, the pressure at the terminals of the consuming circuit is constant.

If, for example, E=500 V, I=20 A, α=20,000, we must make $\gamma\eta^2$=1 joule, and in order that the waves may not be much deformed, make λI^2=4 joules. Then we shall have λ=0.01 henry, γ=0.00633 microfarad, and η=12,566 volts.

Lest this pressure should set up an arc between the anode *a* and the grid, the grid circuit must have a high resistance; but if it were too high, the grid would not be able to absorb almost instantaneously the positive ions with which it was covered at the moment when the current *j* fell to zero, as well as the ions still liberated in its neighbourhood by molecular agitation or by the ultraviolet rays emitted by the cathode. All difficulty can be avoided by cooling the grid with a current of oil or water, which will permit the resistance in its circuit to be reduced without allowing it, by heating, to become a cathode. Fig 4 shows how this can be done.

This method of transformation must have a very high efficiency; the bulb behaves as though it were a valve always fully open or completely closed. On the other hand, the heterodyne bulb behaves like a valve always throttled, whose aperture is periodically varied, and its efficiency is at most 45 per cent. The author has not as yet carried out this method of producing currents of high frequency, but has explained the principle because it can be combined with the method next to be described (which has already been realised) to form a new system of electric traction.

2. *Transformation of alternating currents of high frequency into currents of normal frequency, variable at pleasure.*—The apparatus employed is shown in fig. 5. It comprises: a transformer A, whose primary winding P is fed with the current to be transformed. The two secondary circuits, s_1 and s_2, are identical but differently connected, the start of the first and the finish of the second being joined to a neutral point O; four bulbs 1, 2, 3, 4, like that already described. The anode of bulb 1 and the cathode of bulb 4 are connected to the finish of the winding s_1, the anode of bulb 2 and the cathode of bulb 3 are joined to the start of the winding s_2. Finally, the cathodes of bulbs 1 and 2 and the anodes of bulbs 3 and 4 connect with a conductor XX, and the consuming circuit R is joined between this conductor and the neutral point.

To charge the grids a small transformer B is used, of which the primary circuit p_1 is fed by a battery Ac, the polarity being periodically reversed by a commutator c; the frequency of the current obtained is equal to the speed of rotation of this commutator. The transformer B has three secondary windings, s_1, s_3, and s_4; the first is joined between the grids

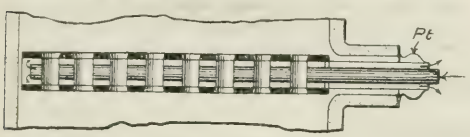


Fig. 4.—Section of Water-cooled Grid.

Pt, flexible collar of platinum, welded to the glass and to the outer tube.

of bulbs 1 and 2, joined in parallel, and the conductor XX, making them simultaneously positive or negative with regard to their cathodes. Winding s_3 is connected between the grid and the cathode of bulb 3, and winding s_4, between those of bulb 4. [Here the text and the figure are not in agreement.—Eds.] The connections are so disposed that the grids of bulbs 1 and 2 are positive when those of bulbs 3 and 4 are negative, and *vice versa*.

Let us suppose the grids of bulbs 1 and 2 to be positive at the instant when the circuit R is closed; a current can then flow through it only in the sense of the arrow, fig. 5. The circuit will be completed through either bulb 1 and winding s_1, or bulb 2 and winding s_2.

If the circuit R has no self-induction, the current will vary in the circuits s_1, s_2, and R as shown on the left of fig. 6; if it is inductive, the current will grow gradually, as shown on the right of the figure.

Let us now make the grids of bulbs 1 and 2 negative, and those of bulbs 3 and 4 positive. If the circuit R is inductive, the current which traverses it cannot immediately change sign

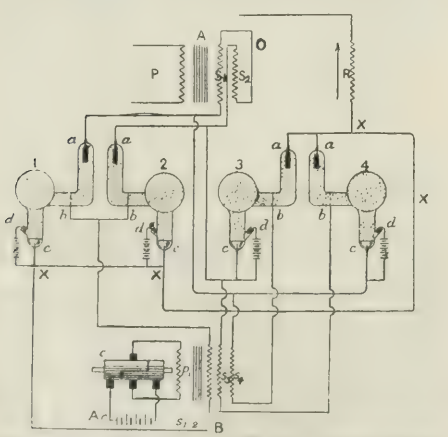


Fig. 5.—Ionic Transformer, High to Low Frequency.

in passing through zero, and until it does so, it cannot traverse bulbs 3 and 4, not being able to go from their cathodes to their anodes.

At the moment of commutation it was traversing, for example, bulb 2. It cannot re-establish itself in bulb 1, the grid of which has been made negative while no current passed. It continues therefore to pass through bulb 2 and winding s_2. But the alternating e.m.f. developed in this circuit cannot sustain it. It dies away and, after being annulled, re-establishes itself through bulbs 3 and 4, traversing the circuit R in the opposite sense to the arrow.

The oscillogram, fig. 7, taken during the transformation of a current of 500 cycles frequency to 50 cycles, with a circuit R possessing resistance and inductance, shows that this is indeed the case.

Now, if the current continues to pass in bulb 2, whilst the grids of bulbs 3 and 4 have become positive, a short circuit current is set up through bulbs 2 and 4 and the circuits s_1 and s_2, every time the e.m.f.'s developed in the latter tend to

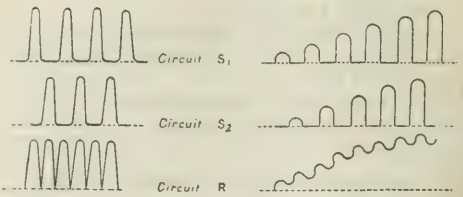


Fig. 6. Wave-forms of Low-frequency Current.

Without inductance. With inductance.

make the current enter by the anode of bulb 2 and leave by the cathode of bulb 4, say for half the time. To avoid this, it is necessary that the segment of the commutator c which is connected to the negative pole of the battery Ac shall subtend a greater angle than the one connected to the positive pole, so that the current passing through bulb 2 may die out between the moment when the grid of this bulb ceases to be positive and that when the grids of bulbs 3 and 4 begin to be positive; by means of this precaution a very high efficiency is obtained.

Other experiments have shown that one could likewise, by rendering the grid of a bulb successively positive and negative, deal with alternating currents of a frequency of 30,000 cycles per second.

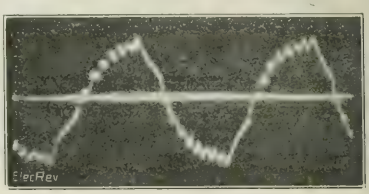


Fig. 7.—Oscillogram of Low-frequency Current.

Finally, by arranging several similar apparatus fed by other secondary windings S_1', S_2', S_1'', S_2'' . . . , excited by the same primary circuit P and with the commutators mounted on one shaft, but successively displaced with regard to one another, one could produce currents out of phase with one another.

In a later issue we shall show how the author proposes to apply the system to the electrification of railways.

The Diesel Engine in Electric Furnace Work.—The Diesel engine has been used in various industries, but as the source of power for electric furnaces the oil engine has not received the attention it deserves, says *Power*. The general opinion has been that an oil engine of a capacity suited to the normal working demand of an electric furnace has insufficient reserve capacity to cope with the furnace starting load. That this is not correct is proved by the results of the Diesel-engine power plant of the Oklahoma Iron Works Co., Tulsa, Okla. The power plant contains four Nordberg two-stroke Diesel engines, one of which, of 750 h.p. rate, is direct-connected to a two-stage 4,000-cu. ft. compressor supplying air to drive the hammers in the forge shop and other air-driven machines in different departments.

Three 550-h.p. units are direct connected to 400-kVA alternators and are provided with belted exciters. The total connected electrical load is 1,535 kW; 1,100 of this is composed of induction motors, 35 kW is used for lighting and 400 kW in the electric furnaces. Fifty per cent. of the motors are squirrel-cage and the remainder are slip-ring type machines. The usual motor load ranges from 75 to 350 kW, with a daily average of 250 kW. The furnace load ranges from 150 to 600 kW and is very unsteady during the first part of a heat. The following are the production costs per kilowatt-hour when operating under the conditions stated:—

Fuel oil, cents	0.397
Lubricating oil, cents	0.048
Labour, cents	0.329
Repairs, cents	0.004
Total production cost per kWh. cents	0.778

The total cost per kilowatt-hour including fixed charges is less than two cents. Fuel oil of 25 deg. Baumé is burned, and the engines have operated satisfactorily either singly or in parallel. The lubrication consumption averages 0.2 gallon per hour per unit, there being little change in the rate from light to heavy load.

THE TELETYPE.

A New Printing Telegraph.

During the past few years remarkable developments have taken place in telegraph and telephone mechanisms, but it is only since the completion of the development of the multiplex system that machine telegraphy has really begun to come into its own. The multiplex printing telegraph, however, is only suitable for heavy traffic between busy centres; it is quite unsuitable for the immense number of minor telegraph lines that form the bulk of the telegraph network of all countries and entirely unsuited for use outside of the telegraph network, for instance, as a means of intercommunication in big manufacturing plant, hotels, banks, newspaper offices, and big institutions of all kinds. Up to the present, business men have had to rely on the inaccurate telephone and the slow post.

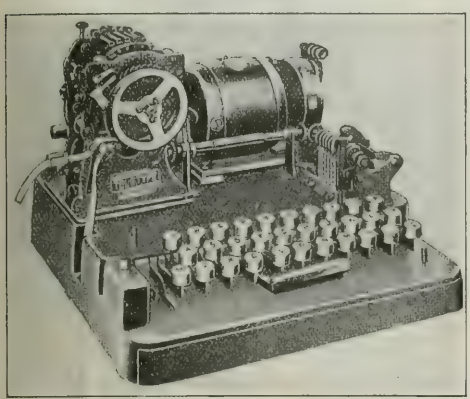


Fig. 1.—Transmitting-Receiving Teletype.

The new development of machine telegraphy, originating in Chicago and known as the "Teletype," to which brief reference was made in our columns a few weeks ago, is therefore of considerable theoretical as well as practical interest. It does for minor telegraph lines and for the internal economy of business and industry what the multiplex printing telegraph is doing for the long and heavily-loaded telegraph lines between large centres of population.

The teletype, made by the Morkrum Co., of Chicago, has now been in use for about a year in the United States, and has already established itself in Europe as a successful and indispensable telegraph machine. The British Post Office has bought four teletypes, and the secretary of the Post Office states that they "continue to give every satisfaction."

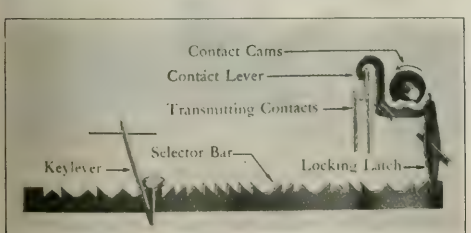


Fig. 2.—Keyboard Selector Bar and Contact Lever.

The Midland Railway Co., the pioneer in the use of the teletype in Europe, has two machines working on a line between Derby and Birmingham, with very satisfactory results. The Marconi Co. has gradually increased its stock of teletypes until it has now 16 in use in London connecting local offices and large customers to Radio House. The Dutch Government bought 12 and will soon have 30 in service. The Indian Government has ordered four, the Straits Settlement authorities two, the Siamese Government four (for the Bangkok-Singora line, 600 miles of iron wire) and the Gold Coast authorities three. The Russian Government proposes to try the teletype, and there are numerous other interesting developments, including its use for wireless communication The American naval authorities put a teletype on an aeroplane and communicated by wireless with the base station.

That the teletype can be used for wireless communication is a fact, though how far any printing telegraph can achieve commercial success in face of "static" or "atmospheric" disturbances is a question not yet settled. There is promise in wireless printing telegraphy, but about the secrecy of communication by the teletype by wireless there is no question at all. Secrecy can be made practically absolute by quite simple means.

The teletype employs the five-unit alphabet prefixed with a starting and stopping unit signal. The prefix signal contact is normally closed so that the teletype is usually arranged to operate on the closed-circuit plan. The mechanism starts operation by the breaking of the closed circuit, and the machine is stopped by the closing of the circuit again. It is, therefore, strictly speaking, a seven-unit system compared with the eight-unit Morse system, and has a slight advantage over Morse apparatus, but the advantage is not nearly so great as in the case of the five-unit multiplex system. On the other hand, the speed of operation being only from 40 to 50 words per minute, the operating margin on nearly all telegraph lines is so great that the question of the limiting speed of the telegraph line seldom arises.

Referring to fig. 1, the teletype will be seen to consist essentially of a typewriter keyboard in front, a small transmitting mechanism on the right, a motor, a centrifugal flywheel governor to keep the motor speed reasonably uniform, and a printer at the back on the left, in front of which can be seen the three-spoke typewheel and the paper tape on which the message is printed. The printer is essentially a Baudot device combined with a mechanical distributor, which bears a close resemblance to the Hughes "chariot."

Fig. 2 shows one of the five selector bars, or code-bars, which lie side by side under the keyboard. Depression of any key lever moves one or more of these selector bars to the right or left, as the result of the pressure of the key lever on the wedge-shaped notches. Each selector bar controls one of five locking latches; the latter hold back or release one or more of five contact levers. Normally the contact levers hold the transmitting contact open. A group of five contact cams arranged spirally on a single-revolution cam spindle, as they revolve, permit the transmitting contacts to close and open again successively like playing successive notes on a piano; but any contact lever which is held back by a locking latch will prevent a contact closing.

Fig. 3 shows the complete transmitter unit and the parts will be recognised from the above description. There is, in addition, a locking loop which drops down at the right moment and prevents the next key from being depressed until the previous key signal has been transmitted. The teletype is arranged so that the normal speed is 40 words a minute (240 letters), but the machine will work at any speed from 10 to 50 words a minute; 45 words a minute, however, is about the limit for practical working.

The motor runs continuously, and when a key is depressed a clutch engages with a spindle driven by the motor and the transmitter cam-shaft makes a single revolution, thereby transmitting a letter signal; the clutch is then thrown out, and the cam shaft stops ready for the next letter.

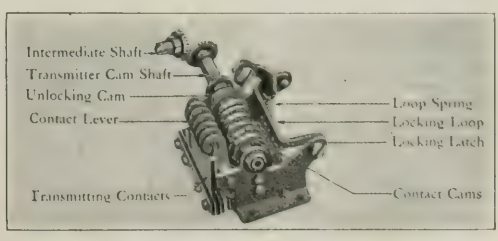


Fig. 3.—Transmitter Contact Unit.

The remaining feature, the printing mechanism, is difficult to describe in a simple way. Referring to fig. 4, the main shaft of the printer, driven by the motor by a gear-wheel, carries a shuttle keyed to the shaft so as to have a lengthways motion on the shaft, but it is carried round positively by the shaft. The small illustration to the right, fig. 4, shows the details of the shuttle. The shuttle spring tends to push the shuttle to the left. The shuttle carries a

roller and also a raised ring. Referring to the larger illustration, fig. 4, the printer has no electrical contacts; it is purely mechanical in its operation, and there is only one magnet consisting of a pair of coils that correspond exactly to the sounder of a Morse circuit. The signals from the telegraph line pass through these coils and attract or release the armature of the magnet. The armature therefore rises and falls under the control of the signal impulses and an armature extension, when the armature rises, also rises to the left of the raised ring on the shuttle and prevents the shuttle moving to the left. If the armature is attracted downwards, the shuttle is free to move to the left.

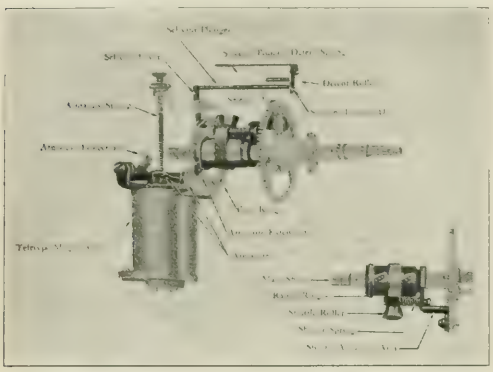


Fig. 4.—Received Signals Controlling Setting of Seekers

Normally the shuttle roller presses against a steel cam ring having five notches in it arranged at intervals round the ring. In each notch there is a selector pin. If a line signal pulls down the magnet armature, then the shuttle armature will be free to move to the left under the pressure of the shuttle spring and the roller will enter a notch and press its selector pin sharply to the left. This pin will then oscillate a selector lever, which will in turn press a selector plunger to the right, where it will be caught by its detent roller. In the illustration it is shown in the left or unpushed position. There are five of these selector pins, levers, and plungers, and as the main shaft of the printer revolves the shuttle, co-operating with the armature of the magnet, will move one or more of the five plungers to the right. The five-unit signal is thus recorded in the relative positions of the five selector plungers.

Fig. 5 is a plan view of the five selector levers, plungers, and selector-plunger disks. It also shows a group of five seekers which are moved backward or forward (to or from the reader) in accordance with the particular selector plungers that were moved to the right in fig. 4 as already described. (To the reader in fig. 5.) This movement of the seekers is performed by the Baudot combiner wheel shown in fig. 6, projecting from the back of which will be seen two cam plates marked "setting face" and "resetting face." They will be recognised in fig. 5, and it is these cam plates on the combiner wheel that successively catch the selector plunger disks that have been selected and moved to the right in fig. 4, and push them against the corresponding spindles of the seekers. The cam plates also restore the plungers to their normal position of rest ready for the next letter.

In this way a particular signal group of the five-unit alphabet has been transferred to the five seekers. These can occupy any one of 32 permutations of positions by moving one or more of the seekers back or forward. Actually in fig. 5 the seekers are set in the position for printing the letter Y (o-o-o).

Fig. 7 shows the method by which any particular grouping of the five seekers results in the printing of a letter on the paper tape. Glancing first at the combiner wheel (fig. 6) it will be seen that this consists of two notched plates with a separator plate. The notches are arranged so that a notch on the edge of one plate always comes opposite a blank or continuous portion of the other plate. Turning again to fig. 7, it will be seen that each of the five seekers has a toe, which runs on one of the combiner wheel plates. Accordingly, as the seekers are shifted back or forward the toes will ride or run on the back or front combiner plate. The notches in the latter are so cut that for any particular arrangement of the seekers there is a particular place on the combiner wheel where each of the five toes will be able to drop down into a notch.

Normally, the seekers are not being able to tip forward on account of one or more of the toes not being over a notch, hold back the seeker trip lever. If the seekers all tip forward into notches in the edges of the combiner wheel plates, then the seeker trip lever will no longer be supported by the seekers and it will move forward under the tension of the trip lever spring, and the horizontal extension will strike the upper part of the trip pawl which retains the print arm mechanism in its place. The trip pawl being struck, the print arm will be liberated and it will rise under the tension of its spring and cause the print roll to press the paper tape against the revolving typewheel, thus printing a character on the tape, as shown in fig. 8. The ratchet wheel guides and controls this printing action, which also serves to feed the paper tape forward to the position for printing the next letter. The remaining operation is to restore the print arm to the reset position shown in fig. 8. This is effected by a reset roller on the ratchet wheel striking the reset lever, which throws the print arm back to the reset position ready for the next letter. The resetting takes place at the blank point on the ratchet wheel and typewheel.

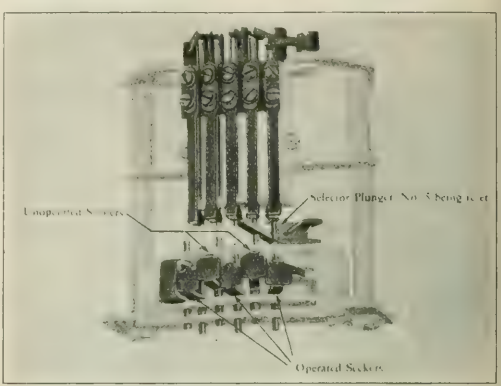


Fig. 5.—Resetting Selector Plungers.

This is the complete chain of operations involved in the recording and printing of a signal and being purely mechanical there is little tendency for it to get out of order; there are no electrical contacts to get dirty.

The teletype is a "start-stop" printer and, therefore, no synchronism is involved, but a starting and stopping clutch takes its place. This is an exceedingly ingenious mechanism for coupling the typewheel shaft of the printer to the motor driving spindle for the period of one revolution of the typewheel. There is also provision for shifting the typewheel slightly back or forward to print letters or figures.

The teletype signals are recorded in type on the tape at both the sending and receiving stations. This "home record" arrangement is not in all cases necessary, and the



Fig. 6.—Combiner Wheel.

British Post Office is working the teletypes on a duplex balanced-line without a home record. Of course, each keyboard teletype can send or receive, but receiving teletypes without the keyboard are also employed in certain cases, and keyboard transmitters without the printer are used in some other cases.

The teletype has been operated successfully on a line between New York and Chicago, 1,000 miles. For such long lines, of course, it is necessary to operate at station A and station B by means of polarised line relays and alternating or "double-current" in the telegraph line. In such cases the teletype is put in a local circuit operating on or being operated by the polarised relay. For moderate distances the teletype will work satisfactorily direct in the telegraph line, about 60 milli-amperes of current being required. The motor is of 1/40th horse-power.

Experience of more than a year under severe traffic conditions has proved that the teletype is remarkably robust

and requires but little maintenance attention. By using copying ink on the typewheel ink-roll, as many as six good copies of messages may be made in a wet-press roller copier.

When secrecy of communication is required, as in the case of wireless working, a fair degree of secrecy exists in consequence of the employment of the five-unit alphabet. When greater secrecy is wanted, it can be readily obtained by changing the speed and the code. The speed of the motor can be set for any rate from, say, 20 to 45 words a minute. Interception of the teletype messages would be extremely difficult without the use of a teletype to interpret them, and if an interceptor used a teletype he would have to set it to the right speed, a difficult task and practically impossible if the sending and receiving teletype speeds are altered from time to time. Even if the interceptor gets the speed right he will still find that the code is wrong, because the arrangement of the five-code or selector bars under the teletype can be changed so as to give a vast number of possible combinations. Interchanging the five bars will give 120 permutations, of which about 60 are useful, and reversing the selector bars end for end combined with the 60 permutations already mentioned will give an immense range of secret codes. For each a different typewheel will be required. If, say in time of war, still greater secrecy is necessary, two or three teletypes, each with a different speed, different code, and different typewheel, would be provided at each station, and messages would be sent on each teletype switched in successively at station A and station B.

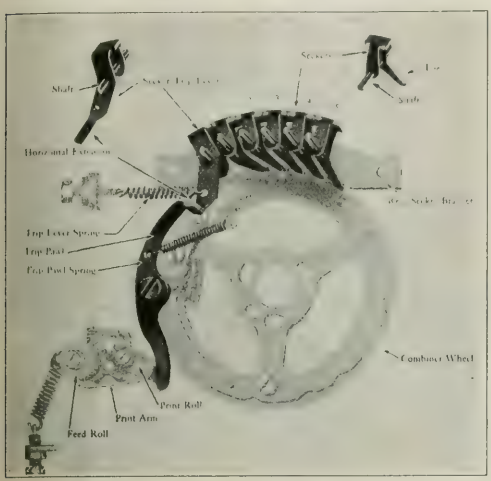


Fig. 7.—Print Arm Before Being Tripped.

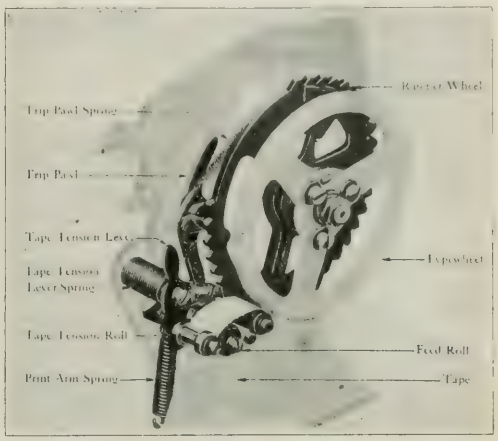


Fig. 8.—Printing Mechanism.

THE RADIO EXHIBITION.

Wireless Convention.

The International Radio Exhibition and Wireless Convention that was held this week at the Central Hall, Westminster, was inaugurated on the 2nd inst. by a luncheon at which Major-General Sir W. B. Brancker, K.C.B., A.F.C., presided. The show was opened by wireless, Sir William's speech being delivered by means of a loud-speaking wireless telephone. It was the first exhibition of its kind to be held in London. Officials were in attendance daily to advise amateurs, and prizes were offered for the best home-made receiving set and for the best invention in connection with wireless apparatus. Two prizes were also offered in a Morse key signalling competition and to illustrate the usefulness of wireless as an aid to the detection and apprehension of criminals, a detective competition was organised, the "wireless effects" produced therein being obtained by means of the dictograph interconversing telephone system of Dictograph Telephones, Ltd.

The exhibition organisers obtained a temporary receiving licence from the Post Office authorities, and demonstrations were given daily. A series of conferences on the following subjects were also arranged: "The Formation of a Wireless Society" (Mr. Geo. Sutton, A.M.I.E.E.); "Long-Distance Wireless" (Capt. Mittell, A.M.I.E.E.); "The Scientific Aspect of Wireless as Distinct from Wireless Technique" (Major Raymond Phillips and Mr. P. J. Risdon); "Automatic Morse and its Future in Wireless" (Mr. A. J. Polley); and "The Use of Wireless in the Home" (Mr. Waring S. Sholl, A.M.I.E.E.).

There were some three dozen exhibitors, whose products consisted chiefly of the various component parts that go to the making of receiving sets and what may be described as "wireless novelties."

Mr. R. Scruby exhibited a complete receiving set with a range of 250 miles, to operate which no previous experience is necessary. The set is enclosed in a Jacobean cabinet, and the diaphragm of the loud-speaker, which is also enclosed in a similar cabinet, is so constructed as to eliminate extraneous metallic sounds as much as possible. The two cabinets make handsome pieces of furniture.

Messrs. Autoveyors, Ltd., showed a two-seater motor-car equipped with a receiver, the aerial of which was incorporated in a sunshade to be held over the operator's head. In addition, the firm had on view "Marconiphones," the Chapmen regenerative static coupling, frame aerials, loud speakers, with components and accessories.

The British L.M. Ericsson Manufacturing Co., Ltd., probably had the best stand in the exhibition, on which were displayed complete receiving sets of various sizes; also telephones and component parts.

Mr. W. J. Henderson, who is more especially interested in wireless control as distinct from wireless telegraphy and telephony, had on view a selection of accessories, accumulators, condensers, transformers, &c.

The City Accumulator Co., as its name implies, exhibited batteries, also headgear, and the "Parliphone" loud-speaker horn that is moulded in one solid piece of ebonite; the base encloses a standard Brown receiver, and no metal is used in its construction.

The following firms, amongst others, were also exhibiting:—

Associated Electric Traders, Ltd., telephone headpieces, small receivers.

Messrs. J. B. Bower & Co., Ltd., crystal and small valve sets; components.

B.N.B. Wireless, Ltd., galena, ganerite, crystal detectors, switches, condensers, &c.

Messrs. Henry J. Brewster & Co., crystal receivers and accessories.

Messrs. J. Bridge & Sons, crystal receiving sets, amplifiers, sets of parts, and accumulators.

The Concordia Electric Wire Co., Ltd., wires and insulating linen, silk, paper, &c.

The Electric Appliance Co., Ltd., wireless instruments and parts.

The Fleet Radio Co., one-valve receiving sets.

Fuller's United Electric Works, Ltd., batteries and accumulators.

Messrs. J. Lipowsky, three-valve receiver and general accessories.

Messrs. James Macintyre & Co., valve and crystal receivers and loud speakers.

Messrs. Pettigrew & Merriman, Ltd., valve and crystal receiving sets, auxiliary apparatus and parts.

The Wireless Exploitation Corporation, crystal and valve sets, frame aerials, &c.

The Consolidated Trading & Manufacturing Co., Ltd., crystal receiving sets.

The Murray Printing Telegraph Systems, "Teletype," a new printing telegraph machine that is described above.

REVIEWS.

Principles of Radio Communication. By J. H. Morecroft. Pp. x+985. Illustrated. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Price 45s. net.

In view of the very extensive literature on wireless communication, the issue of a new work, especially a bulky and expensive volume, requires considerable justification. The great increase in the number of persons interested in the subject as compared with pre-war days may partly supply the justification. Advances and improvements made would also, if of sufficient importance, to some extent justify its appearance. Fortunately, however, Professor Morecroft's book requires neither basis of justification. A cursory perusal reveals its merits and places it on a plane very much above the usual text book expositions. There is a sound practical touch, together with high theoretical attainments in the method of dealing with the subject. The numerous misconceptions that pervade the average wireless text book have been almost, if not quite, sifted out. At the same time there are, it need hardly be said, some criticisms possible, though in some measure these might be generally held to be of a debatable nature.

Exception is taken to the method of treatment of fundamental ideas in the opening paragraphs of the first chapter. As in most American electrical works, the electronic viewpoint of fundamental electric phenomena is adopted and the reader is tacitly invited to accept this viewpoint as having been proved beyond question. Thus a steady current in a circuit of copper wire is definitely stated to be a slow drift of electrons along the substance of the copper. The drift is assumed to be a resultant effect arising out of the heterogeneous motions of free electrons in immense quantities, there being zero drift for zero current and drift proportional to the current and in a direction along the circuit determined by the positive or negative character of the current. Whilst this view of electronic progression in conductors is a great advance on the older hypothesis of high-speed electronic progression, there are many reasons for doubting its validity, or at least, for assuming that if the drift exists it is a secondary or concomitant effect rather than the electric current *per se*. That is, the "electron drift" may be merely an index of a condition determining conductivity in a material, whilst the heterogeneous motions of free electrons constitute the quality of conductivity. On this view the drift would be an aspect of the electronic motions assumed during the passage of a current. A fundamental objection to the previous hypothesis arises from the fact that electric currents are circuital in character; every electric current that flows does so in a complete circuit, having the same strength at every part of the circuit at the same instant even when it is partly conduction and partly displacement current. All currents are, therefore, resolvable into fundamental elements which must also possess the same circuital characteristics. What is there in the idea of an electronic drift which is compatible with a circuital element? The two conceptions do not harmonise. Apart from its highly debatable character, the electronic hypothesis is not necessary in a work on wireless communication. Evidence of this is given by the fact that beyond the very proper reference to electrons in connection with thermionic and kindred devices, they are not again referred to in the later parts of the book where the more advanced wireless theory is dealt with.

It is also a little unfortunate that in the opening paragraph there is a very weak statement to the effect that clouds become intensely electrified by *wind friction* and other causes. A sufficient proof of such a statement would be difficult to find.

One or two of the figures showing distribution of electric field, notably figures 6 and 8, in the first chapter could be improved upon. The equal concentration of charges at the two ends of a rod under the inductive influence of a charged sphere placed near one end, as in fig. 8, conveys an inaccuracy of conception.

The succeeding chapters dealing with the theoretical principles of high-frequency currents and circuits, together with those concerning practical forms of apparatus, are less open to criticism and are good and informative. One point that is usually ignored is well brought out in connection with spark transmitters, *viz.*, that spark resistance is a very erratic and variable quantity, the indications being that the resistance varies widely during one-half cycle of oscillation. To speak of the resistance of a spark or arc as being so many ohms and to base decrement and other calculations on that figure, leads nowhere. Other points of the kind, indicating good practical discrimination, are not wanting. The author has, however, shown himself to the best advantage in the portions dealing with thermionic tubes. That term is not, however, adopted in the book, the devices under that classification being referred to as vacuum tubes, audions, triodes, &c., throughout. If any criticism might be made on the way in which these devices are discussed in their more fundamental aspects it is that the idea of "space charge" is perhaps rather over elaborated and the simpler idea of electrostatic screening due to conductivity of the electronic stream or the ionised gas, as the case may be, is not conveyed. An important factor in the theory of three electrode tubes, and one which appears to be inadequately appreciated by authors in general, is but slightly touched upon in a footnote on page 381, viz.: the function of the grid in acting as an electrostatic screen on the filament with respect to the plate and the variation of screening power with the changes of grid potential.

Other points on which some comments may be made are as follows: The theory of wave reception given on pages 738 *et seq.*, though carried out at some length, leads nowhere, since the whole of the reasoning is practically invalidated by the footnote on page 739, which states that the solutions hold good only for the *steady state*, that is, after the transient stage has been passed and the maintained stage reached. Seeing that wireless reception is only concerned with the transient stages, it would appear that no sufficient solution is given. This reveals a weakness in wireless theory that is common to practically all text books. The reference on page 314 to quenching of sparks by rotary gaps gives rise to the query as to what proof is available that a lengthening gap will cause quenching. The assumption is not justified and is probably wrong. With regard to Poulsen arc transmitters, the scope of the information given is somewhat disappointing. More information is wanted as to the limitations and best conditions of use of arcs. The theory of the tikker receiver given on page 331 is incomplete and unsatisfactory, though it is the usual explanation. The important question of the protection of generators and other appliances from damage by high-frequency retro-action is not adequately treated. In the matter of wireless direction finders, the important improvement arising from the use of so-called *aperiodic* antennæ loops tightly coupled to a movable coil of a tunable circuit is not discussed. In this connection a principle is involved in radio systems which should not be ignored, since the plan enables separate tuning of individual antennæ to be dispensed with, though they are, in effect, tuned by the agency of the tuned circuit to which they are normally tightly coupled.

A few misprints occur, such as on page 609, fig. 25, where "arcs" should evidently read "cores," and on page 382 "electrodes" for "electrons."

There is, perhaps, a little too much use of photographic illustrations where diagrams or sketches would be more useful; this certainly applies to some of the illustrations of thermionic tubes.

The book covers 919 pages and a very large number of illustrations. As already stated, and in spite of the criticisms made, it certainly forms a very useful addition to wireless literature.—J. E. Taylor.

Protective Relays: their Theory, Design, and Practical Operation. By Victor H. Todd. Pp. xii+274; 244 illustrations. London: McGraw-Hill Book Co. Price 12s. 6d. net.

Mr. Todd introduces his subject by a clear and interesting account of the historical side of the protection of electrical machines and supply networks. He is quite certain that modern relay installations have amply justified the expenditure incurred, and quotes an instance in which the number of supply interruptions was reduced from 25 a year to one per year in this way.

British opinion is divided on this subject. Many engineers are, like Mr. Todd, protective gear enthusiasts, but at least an equal number have the opinion that good mechanical and electrical construction, combined with the simplest possible protective devices or none at all, is a better means of ensuring continuity of supply.

The undoubted importance of the subject should justify the somewhat detailed discussion which follows.

The step from the use of simple fuses to circuit breakers and relays was followed by the introduction of relays which could give more sensitive and accurate settings than was possible with any of the foregoing devices alone. The author is strongly of the opinion that an independent source of supply should be provided for operating trip circuits, and this is quite in accordance with British views.

When dealing with the question of retarded action of relays, he spends most of his time with bellows, oil dash-pot, and magnetic time relays, but does not appear to be acquainted with the pendulum type commonly used in Britain, which is obviously far superior in reliability and accuracy to any of the above-mentioned types.

Power directional relays are described clearly and in close detail, and the alternating-current types should be studied by all who are interested in the subject.

It is interesting to note that Mr. Todd considers that selective relays of this type can give results better than those obtained from any other type of protective gear. This may be true under American conditions, but the reviewer does not think it at all possible for any existing relays to give results at all comparable with those obtained from balanced protective devices such as the split conductor or improved Merz-Price systems.

Important notes of a practical nature and some simple calculations are given of the characteristics of a.c. disturbances, and although there is nothing of a fundamental nature in them, the notes are well worth perusal.

Instruments, transformers and groupings, are dealt with generally, and sufficient information is given about current transformer characteristics to be of considerable assistance to engineers in setting relays accurately.

In a chapter on miscellaneous relays, automatic re-closing relays, and temperature and overload relays of novel types, are dealt with.

A cycle counter for timing relays, breakers, &c., is described, which deserves to be better known.

The testing of current and time settings of relays is dealt with at some length, and the treatment contains much matter of an obvious nature, but the author evidently wishes to emphasize the necessity of taking great pains with details when making tests.

The inaccuracy and unreliability of relays employing leather bellows for introducing time lags are given much prominence with a view to showing the necessity for regular testing and adjustment. The more obvious and economical remedy would be to scrap the type entirely.

The book concludes with an elementary chapter on methods of locating faults on feeders and wiring.

Generally, the book shows up the great differences that exist between American and British practice as regards protective gear. In America, selective relays and graded time limits are relied on to discriminate between faulty and sound pieces of apparatus. The protective installation is comparatively cheap, but requires constant attention from skilled engineers. In Britain, pilot wire or differential systems are preferred. In this case the initial cost is higher, but the subsequent expenses are reduced, and very little skill is necessary except when gear is being installed.

The printing and illustrations are excellent, and the only criticism that can be offered regarding the latter, is that the vector diagrams, fig. 107, are much too small. In spite of many appalling Americanisms, the book can be easily read by anyone who has had an elementary electrical training, and it is heartily recommended by the reviewer.—C.W.M.

Switching Equipment for Power Control. By Stephen Q. Hayes, A.B., E.E. Pp. vi+454; 272 illustrations. London: McGraw-Hill Publishing Co., 1921. Price 20s. net.

The objects of this book as outlined by the author in his preface are: (1) to furnish the actual switchboard operator with information that will help him to keep the equipment in his care in the best operating condition, and to assist him in the selection and installation of new material; (2) to help the student of electrical engineering in a technical school to appreciate how switching equipment ties together the various generators, transformers, feeders, &c. It is also stated that consulting engineers and others will find enough in the theoretical features to give them an understanding of the functions and limitations of the various devices.

A very careful examination of the book by the reviewer revealed many interesting features which are not widely known in Britain, but which appear to be standard American practice. For example, considerable attention is paid to the Schweitzer & Corad products, including carbon tetrachloride fuses and breakers, and automatic reclosing electro-pneumatic breakers. There are also interesting sections dealing with out-door portable and automatic sub-stations. On the whole, however, the treatment is scrappy and superficial, and the reviewer could find no trace whatever of the theory which the author stated in his preface to have been included.

A particularly irritating feature is the repetition of almost identical sections in the same chapter. For instance, in Chapter 12 one section is headed "Rheostat" and two "Rheostats"; practically the same information is contained in them all.

With the exception of the inevitable split infinitives the style is, for the most part, quite clear.

The explanations of the action of a.c. apparatus are very marvellous. For example, on page 237 the action of a polyphase voltage regulator is explained thus:—

"The primary sets up a magnetic flux of constant value, which induces a constant voltage in each of the secondary windings. The induced voltage is added therefore vectorially to the feeder as the cosine of the angle between windings. As the position of the rotor is changed the phase angles between the feeder voltage and the secondary voltage correspondingly changes, and the feeder voltage is either increased or decreased as the phase angle is less or greater than 90 degrees."

The reviewer fails to see how an explanation of this type can be of the slightest value to anyone.

The treatment of balanced protective gear seems very inadequate from a British engineering standpoint, but possibly American views on this subject may differ very widely from ours.

Many minor grammatical or printers' errors occur. For example, page vi, "generator" for "generators"; page 237 "phase-angles . . . changes"; page 293, "curent."

The general production of the book is on the usual high standard of the McGraw-Hill Co., and the numerous excellent diagrams help to counteract the feebleness of the descriptive matter.

Alternating Currents. By C. G. Lamb, M.A. Part I, pp. 7+61 figs. Price 5s. 6d. net. Part II, pp. 127; 82 figs. Price 7s. 6d. net. London: Cambridge University Press, 1921.

These two paper-covered volumes are in the nature of a series of notes intended for the assistance of third-year students in the engineering laboratories at Cambridge. The treatment is condensed and there are no examples appended, as the author considers that these can best be composed by the lecturer; but in spite of these limitations, there will probably be a considerable circulation for these little books beyond the confines of the Cambridge engineering schools.

Part I treats in the main of what are generally described as the phenomena of a.c. circuits, while Part II deals with alternating-current machinery, the aim being to enable the student to proceed to such works as Miles Walker's "Specification and Design of Electrical Machinery." The author naturally assumes a mathematical, mechanical and physical equipment such as may be expected of a third-year electrical engineering student, and he is therefore able to push on rapidly to such subjects as the vector treatment of transformer imperfections. It must not be thought, however, that the treatment is exclusively mathematical; considerable attention is given to the physical and also the real engineering aspects of the subject; measuring instruments are treated in some detail and a comparatively long section is devoted to the heating and cooling of transformers.

Part II treats very fully of the principles of a.c. generation, commencing with the simple sinusoidal field form and then introducing harmonics and the use of the oscillograph for investigation of wave forms. Polyphase armatures are then considered in detail and the characteristic curves of typical two and three-phase machines are worked out. Motor problems are dealt with vectorially, the circle and "V" diagrams being utilised, and a brief treatment of the rotary converter is also given. Sections on the measurement of power in polyphase circuits and the losses in a.c. machines complete the series of notes.

There can be no doubt that, as aids to the understanding of hastily written lecture notes on a subject in which difficulties both mathematical and physical are met with at every turn, these notes will be invaluable.—P.H.S.K.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

22,041. "Automatic electric sub-station systems." G. A. Cheetham. August 24th.

22,561. "Electric liquid heaters." V. B. Learoyd. August 18th.

22,572. "Electric signalling devices." E. I. David, G. F. Flanders and D. S. Williams. August 18th.

22,573. "Alternating current protective apparatus." British Thomson-Houston Co., Ltd., and A. S. FitzGerald. August 18th.

22,585. "Variable high-tension wireless battery cabinet." J. Flessati and F. W. Sellars. August 19th.

22,591. "Electric gas purifiers." Kirchhoff & Co. and E. Oppen. August 19th. (Belgium, September 16th, 1921.)

22,592. "Electric projection lamps." A. Taylor and H. D. Taylor. August 19th.

22,620. "Magnetic separators." W. Box, A. E. Davies, and H. H. Thompson. August 19th.

22,626. "Method of repairing worn-out electric lamps." A. Jannes. August 19th.

22,631. "Telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. August 19th.

22,648. "Combined gas and electric cooking apparatus." E. C. R. Marks (Salvisbera Fabrik Elektrische Koch-und Heizapparate Salvis). August 19th.

22,651. "Shades for electric incandescent lamps." N. W. Prangnell. August 19th.

22,675. "Electric circuits and switches." G. R. C. White. August 21st.

22,684. "Variable condenser for wireless receiving apparatus." E. T. Chapman. August 21st.

22,696. "Aerials for wireless telegraphy, &c." H. Challis-Sowerby. August 21st.

22,704. "Attachment for sparking plugs." E. B. Gnapp. August 21st.

22,705. "Device for testing sparking plugs." E. B. Gnapp. August 21st.

22,717. "Crystal detector for wireless apparatus." H. W. Parker. August 21st.

22,718. "Crystal detector for wireless apparatus." H. W. Parker. August 21st.

22,735. "Generation of electric power from water supplies." J. H. Ewart and J. W. Ewart. August 21st.

22,736. "High-frequency telephone systems." Ges. für Drahtlose Telegraphie. August 21st. (Germany, August 22nd, 1921.)

22,735. "Couplings for electric cables." Felten & Guilleaume Carlswerk Akt. Ges. August 21st. (Germany, August 20th, 1921.)

22,751. "Magnetic separating process for treatment of residues of fuel." Meguin Akt. Ges. and J. H. Leopold. August 21st. (Germany, August 23rd, 1921.)

22,754. "Telephonic receivers." R. H. Marriott. August 21st.

22,774. "Mercury [illegible] of wireless telegraphy, &c." F. Y. Robinson. August 22nd.

22,790. "Insulating electric wires and conduits." R. Wright. August 22nd.

22,820. "Multiple-way plugs." O. F. Foss. August 22nd.

22,840. "Automatic regulators for dynamo-electric machines." I. J. Hunt and Sons (1920), Ltd. August 22nd.

22,841. "Automatic regulators for dynamo-electric machines." I. J. Hunt and Sons (1920), Ltd. August 22nd.

22,842. "Automatic regulators for dynamo-electric machines." I. J. Hunt and Sons (1920), Ltd. August 22nd.

22,849. "Insulating supports." J. W. Pontriero. August 22nd.

22,850. "[illegible] transmission mechanisms." A. H. Stevens (C. I. [illegible]). August 22nd.

22,851. "Controlling system for electro-magnetic transmission mechanism." (C. I. [illegible]). August 22nd.

22,859. "Electrolytic apparatus and method of depolarising same." W. D. [illegible]. August 22nd.

22,865. "Wireless receiving apparatus." C. H. Collins. August 22nd.

22,870. "Automatic switching apparatus for electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 22nd.

22,871. "Steam-reheating apparatus." Electrical Improvements, Ltd. August 22nd.

22,876. "Electric switches." A. Green. August 22nd.

22,885. "Connecting device for radio receiving systems." W. Dubilier. August 22nd. (United States, May 23rd.)

22,886. "Sparking plugs." A. G. Brown. August 22nd.

22,902. "Miners' electric safety lamps." J. T. Jackson. August 23rd.

22,903. "Miners' electric safety lamps." J. T. Jackson. August 23rd.

22,907. "Telephone [illegible]." C. H. J. Harvey. August 23rd.

22,939. "Sparking gap device." A. Shuttleworth. August 23rd.

22,943. "Sparking plugs." S. G. Ransley and H. E. Sexton. August 23rd.

22,964. "Sparking plugs." W. F. Ricketts. August 23rd.

22,967. "Production of electric discharges in vacuum tubes." C. Degnasse and F. Dussaud. August 23rd.

22,971. "Electric generators." F. Westwood. August 24th.

22,979. "Condensers for wireless telephonic and telegraphic apparatus." R. S. Woods. August 24th.

23,008. "Electric burglar, &c., alarms." E. R. Smith. August 24th.

23,015. "Radio telephonic and telegraphic receiving and transmitting station." A. Perego. August 24th. (Italy, August 25th, 1921.)

23,020. "Electrically-heated soldering irons." C. R. Riber and Siemens Bros. & Co., Ltd. August 24th.

23,023. "Wireless transmission by thermionic vacuum tubes." E. J. Grainger, L. G. Preston, and G. Shearing. August 24th.

23,024. "Generation of high-frequency alternating currents." L. G. Preston and N. Shuttleworth. August 24th.

23,028. "Switching for tuning wireless receiving sets." E. E. Moore. August 24th.

23,029. "Lightning protector for wireless receiving sets." E. E. Moore. August 24th.

23,030. "Fixed condensers having small valves of capacity." E. E. Moore. August 24th.

23,034. "Electric heaters." British Thomson-Houston Co., Ltd. August 24th. (United States, August 24th, 1921.)

23,035. "Motor control systems." British Thomson-Houston Co., Ltd., H. Dreghorn, and H. F. Farmer. August 24th.

23,041. "Automatic electric sub-station systems." Metropolitan-Vickers Electrical Co., Ltd. August 24th.

23,046. "Holders for incandescent electric lamps." A. M. Carey. August 24th.

23,059. "Rectifying devices." A. R. Angus. August 24th.

23,062. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 24th. (United States, October 11th, 1921.)

23,070. "Head lamps for motor vehicles." F. E. Musgrave. August 24th.

23,081. "Illuminated number-board signal and rear light for motor cars, &c." M. Woodward. August 25th.

23,104. "Rail joints for tramways, &c." H. Littlewood. August 25th.

23,108. "Variable inductances." J. H. Reyner. August 25th.

23,111. "Sparking plugs." F. J. Mills and G. H. Ward. August 25th.

23,112. "Electric resistances." Crompton & Co., Ltd., and W. F. Jones. August 25th.

23,113. "Electric resistances." Crompton & Co., Ltd., and W. F. Jones. August 25th.

23,114. "Electric rheostats." Crompton & Co., Ltd., and W. F. Jones. August 25th.

23,115. "Electrical instrument cases." Crompton & Co., Ltd., W. F. Jones and W. G. Smith. August 25th.

23,[illegible]. "[illegible] switching and clearing apparatus." A. G. Lamb and M. Sanders. August 25th.

23,138. "Telephonic receivers, &c." A. J. Henderson. August 25th.

23,141. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). August 25th.

23,142. "Systems of electric control." British Thomson-Houston Co., Ltd. (General Electric Co.). August 25th.

23,166. "Automatic circuit-breaking device." E. Johnson. August 25th.

23,175. "Brakes for tramway vehicles." G. H. Read and H. Read. August 26th.

23,196. "Electric hand lanterns." J. Eaton and Efandem Co., Ltd. August 26th.

23,216. "Electrically-operated change-speed gear." C. Ter Cock. August 26th.

23,220. "Brackets for electric fans, &c." M. J. Railing and C. W. Saunders. August 26th.

23,233. "Thermionic valves." C. H. Burgess and J. Gray. August 26th.

23,234. "Thermionic valves." British Thomson-Houston Co., Ltd., C. H. Burgess and J. Gray. August 26th.

23,235. "Pneumatically-operated controllers." British Thomson-Houston Co., Ltd. (General Electric Co.). August 26th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

3,927. "Automatic exchange telephone system." H. Baron (F. Aldendorff). February 2nd, 1921. (Cognate applications, 4,777/21 and 7,884/21.) (184,200.)

4,178. "Method of and means for registering telephone calls." E. H. Kinnard and W. Clark. February 4th, 1921. (Cognate applications, 6,528/21, 10,179/21, and 19,314/21.) (184,202.)

5,001. "Coils for electrical transformers." British Electric Transformer Co., Ltd., and J. Roothaan. February 12th, 1921. (184,207.)

9,185. "Employment and production of polyphase currents for wireless telegraphy, telephony, or other purposes." J. H. Whittaker-Swinton. March 24th, 1921. (184,216.)

9,491. "Electric drive for vehicles." E. C. R. Marks (Soc. Anon. Construction Electriques de Belgique)). March 30th, 1921. (184,219.)

9,721. "Electric heaters." Cutler-Hammer Manufacturing Co. June 22nd, 1920. (165,443.)

9,952. "Automatic electric circuit breakers." Metallurgique Electrique. September 6th, 1920. (168,849.)

12,213. "Sound amplifiers for gramophones and phonographs." T. W. Price. April 28th, 1921. (184,234.)

12,406. "Sealing of leading-in wires for electric incandescent lamps and for similar purposes." W. F. Thompson (Vereinigte Glühlampen und Elektrizitats Akt. Ges.). April 30th, 1921. (184,238.)

12,450. "Electrical means for operating or controlling mechanisms by sound." C. P. Ryan. April 30th, 1921. (184,239.)

12,454. "Electric radiators." J. R. Quain and H. Harrison. April 30th, 1921. (184,240.)

12,573. "Process for the electrolytic production of potassium bi-carbonate from potassium chloride solutions." Chemische Fabrik Briesheim-Elektron and Dr. R. Suchy. May 2nd, 1921. (184,244.)

12,654. "Telephone exchange systems." Western Electric Co., Ltd., and L. Polinkowsky. May 3rd, 1921. (184,249.)

12,922. "Apparatus for converting alternating electric currents to direct currents and *vice versa*." J. E. Calverley and W. E. Highfield. May 5th, 1921. (184,259.)

12,935. "Electrical plug switches and the like." E. Jones. May 6th, 1921. (Addition to 159,618.) (184,260.)

13,010. "Manufacture of drawn tungsten wires." Patent Treuhand Ges. für Elektrische Glühlampen. May 7th, 1920. (163,014.)

13,427. "Regulating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). May 11th, 1921. (184,278.)

13,467. "Device or apparatus for recording and checking telephone calls." W. C. Sutherland, J. G. Sutherland, C. W. Cooke, J. E. Copeland, and W. Rogers. May 12th, 1921. (184,280.)

13,514. "Quartz mercury vapour lamps." Quarzlampen Ges. June 17th, 1920. (165,081.)

13,566. "Methods of controlling the relative phases of alternating currents, especially applicable to wireless signalling." W. H. Eccles. May 13th, 1921. (184,282.)

13,654. "Operating handles for electric switches or like devices." W. J. Mellersh-Jackson. (Appareillage Gardy Soc. Anon.). May 13th, 1921. (184,283.)

14,144. "Incandescent electric lamps and the like." O. Oberlander and W. H. Le Marechal. May 20th, 1921. (184,291.)

14,695. "Electric safety lamp for miners." L. A. Didier. August 17th, 1920. (168,038.)

14,918. "Electric glow lamps." R. L. Woosnam. May 30th, 1921. (184,302.)

15,532. "Electric heating elements." H. W. Sullivan and C. B. Gresham. June 4th, 1921. (184,307.)

15,917. "Piezo electric devices." E. W. C. Russell and A. F. R. Cotton. June 9th, 1921. (Cognate application 8,066/22.) (184,314.)

17,727. "Cut-out for electric circuits." Rayerische Elektrizitats-Industrie Rott & Co. July 15th, 1920. (166,223.)

17,784. "Electric accumulators." C. J. J. L. De Vos. June 30th, 1921. (184,336.)

17,801. "Electrical commutators or distributors." G. H. Jackson. June 30th, 1921. (184,337.)

18,226. "Induction electric motors." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. July 5th, 1921. (184,340.)

19,636. "Electric couplings." A. L. Davis. July 21st, 1921. (184,354.)

19,650. "Device for maintaining a constant voltage in variable-speed dynamos." A. H. Traeger. July 21st, 1921. (184,355.)

20,281. "Terminals or connections for use in electric circuits." H. Lucas and W. H. Egginton. July 28th, 1921. (184,362.)

20,761. "Electric switches." C. L. I. Manufacturing Co., Ltd., and E. A. Watson. August 4th, 1921. (184,367.)

20,990. "Means for making watertight connection between cables and switch junction boxes or other fittings in electric wiring systems." M. J. Railing, F. G. Quance, and H. V. Owen. August 8th, 1921. (184,369.)

21,871. "Electric clutch coupling for use in dental technics." E. Huet. November 20th, 1920. (171,969.)

22,273. "Systems for wireless transmission of writing, pictures, and the like." M. H. Petersen. September 9th, 1920. (168,876.)

1922.

1922.

5,791. "Push-button electric switches." T. E. D. Bilde. March 21st, 1921. (177,509.)

14,906. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. May 26th, 1921. (180,694.)

New York's Fire Alarm System.—The new fire alarm system of New York City has been completed and is now in use. The work was started in 1904 and the plans were finally completed in 1914. The new system has cost the city $1,750,000, and the Empire City Subway Co. has spent $1,200,000 for additional ducts to carry the wires under its contract. The central station of the system is in Central Park.—*T. & T. Age.*

THE

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ELECTRICAL REVIEW.

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HIGH-FREQUENCY A.C. RAILWAY TRACTION.

ONE of the joys of electrical engineering science is that one never knows what will come next. The unexpected is always happening. Sometimes, it is true, the result approximates more closely to a mole-hill than a mountain, but fortunately in many cases the product of an apparently minor observation ultimately becomes of immense importance to the industry. As examples, we may cite the coherer, discovered as long ago as 1835, with the aid of which Marconi carried out his first successful experiments in wireless communication; or the Edison effect, which was applied by Fleming and de Forest to wireless telegraphy with such extraordinary consequences.

Now we are invited by M. Maurice Leblanc, Hon. M.I.E.E., to consider the possibilities of the three-electrode valve in an entirely new and unexpected field—no less than the electrical operation of railways! How this is to be done—dispensing with the use of sliding contacts—is explained elsewhere in this issue. We need not point out that the proposal is as yet no more than an idea; a vast amount of investigation, experiment, and research would be necessary before it could be carried into effect. But we must tender our congratulations to the inventor on the remarkable ingenuity and breadth of vision which he has displayed, first in developing the methods of conversion from direct to alternating current of high frequency, and from the latter to current of ordinary frequency, described in our last issue, and secondly, in conceiving and working out the idea of applying them to so heavy a branch of engineering as the propulsion of railway trains. There are many obvious difficulties in the way—the development of the three-electrode ionic valve on the large scale required, the construction of the novel type of overhead condenser-conductor, and the perfecting of the accessory apparatus, all involve wide departures from existing practice; but whilst the achievement of the ideal of M. Leblanc may be a matter of the distant future, we cannot but admire the audacity of his genius, and wish him the success that his painstaking efforts have deserved.

We may recall the fact that previous attempts have been made to supply propulsive energy to trains without physical contact—but, of course, on very different lines. In 1890 the "Portelectric" system was exhibited in Boston, U.S.A., in operation on a track 3,000 feet long; a small carrier running on rails passed through a succession of fixed solenoids, each of which communicated to it an impulse by electromagnetism. This idea was revived in the Bachelet levitated railway in 1914; in this case the inventor not only propelled the car by solenoidal impulses, but also supported it by electromagnetic repulsion from the track. In the late nineties a scheme more directly comparable with M. Leblanc's was put forward—namely, to lay conductors along the whole length of the track, half surrounded by laminated iron, the cars carrying coils and similar iron cores which with the track equipment completed the magnetic circuit of a transformer, a clearance air-gap being provided between the two sets of laminations. M. Leblanc adopts this plan in principle, but omits the iron cores and uses current of very high frequency—besides, of course, making many other innovations. We hope his scheme will have a better fate than its forerunners.

Incidentally, we may remark that even if the traction scheme comes to nought, the converting apparatus will certainly find other, less imposing, applications in science and industry.

Tramway Troubles.

In view of the statement of the secretary of the Municipal Tramways Association that municipal authorities operating tramways last year incurred a loss of over £840,000, it is clear that something must be done to enable these undertakings to make ends meet. The course adopted by the employers has been to propose a reduction in wages of twelve shillings a week, in three stages at intervals of one month. The employés are strongly protesting against the proposal, which involves the abolition of the existing sliding-scale agreement, and a national conference of the Transport and General Workers' Union has been called for Monday next three days before the expiration of the notice, which, so far as it relates to the termination of the agreement, was issued as long ago as June 21st.

On the other hand, certain of the Tramway Committees notably those of Sunderland and Newcastle —have announced that in their view the wages and conditions differ so widely in different districts that the matter should be decided locally, and hence they propose to withdraw from the Joint Industrial Council. This, we think, would be an unfortunate decision, and we trust that wiser counsels will prevail. It has been proved by experience that most beneficial results can be derived from the direct association of representatives of employers and employed round the council table, and that friendly discussion on a national scale is infinitely preferable to sporadic struggles. Withdrawals from the Whitley Councils tend to weaken their influence and to destroy the spirit of harmonious collaboration which ought to be cultivated in every branch of industry. At a mass meeting held at Manchester on September 3rd a proposal that Manchester and Salford tramwaymen should withdraw from the Council, implying that they would then fight the matter locally on their own behalf, was met with a storm of protest from delegates from other towns; clearly, then, the employés realise the advantages of the Whitley system.

The workers have refused to submit the question to an Industrial Court; in this they follow the example set by the employers two years ago. They have also declared that the action of the employers has been dictated by the Federation of British Industries, a suggestion which, on the face of it, is absurd.

It is to be hoped that some means will be found very quickly to settle the dispute—otherwise a national strike of tramwaymen is almost inevitable.

Nitrate for Germany.

The fact that the German Government has authorised the free importation of 200,000 tons of Chilean nitrate is not without significance. Before the war Germany annually consumed about 900,000 tons of nitrate, but by the production of synthetic nitrate she satisfied her requirements during the war, and since then she has only admitted 20,000 tons from abroad. It has been suggested that the increased cost of producing synthetic nitrate due to the depreciation of the mark is the reason for the new departure; on the other hand, the same cause renders the purchase of foreign nitrate still more costly, and apparently there must be other factors at work that influence the situation. What these might be was a subject of discussion at the meeting of the British Association, where Dr. J. A. Harker stated that whereas in 1913 Germany produced 90,000 tons of nitrogen, she now made 290,000 tons, and would shortly be in a position to produce 500,000 tons a year. Thus in time of war she would have abundance of raw material for the manufacture of explosives as well as fertilisers for agricultural purposes. At the same time, she is replenishing her stocks of non-ferrous metals and seeking to regain control of the market.

The Gennevilliers Visit.

Arrangements are now complete for the Gennevilliers visit, and the party will leave London on Friday afternoon, October 6th. Saturday morning will be devoted to an inspection of the high-power wireless installation at the Eiffel Tower. The afternoon will be spent at the Gennevilliers power station, the visitors returning to Paris in the early evening.

On Sunday there will be an excursion to Versailles and Malmaison, for those members of the party who desire to visit these well-known places. On Monday the party will leave Paris at 8 a.m. for Arras by train, and from Arras will motor by way of Vimy and Lens to Beuvry, where the new large power station of the Cie. des Mines de Vicoigne et Nœux will be visited. After luncheon at Béthune, by way of La Bassée and Hulluch, Pont-a-Vendin, near Lens, will be reached, where the new station of the Société des Mines de Lens is situated. Close to this station is one of the 45,000/15,000-volt sub-stations of the Cie. du Nord. The party will then, after inspection of these stations, reach Lille, where the night will be spent.

On Tuesday morning it is hoped to visit one of the latest electrically-equipped cotton mills of Lille, and then to return by way of the Menin road to Ypres and so on through Poperinghe to Hazebrouck, where the train for Calais will be taken, enabling the party to reach London at 7.30 on Tuesday evening. Apart from the fact that the stations to be visited lie in some of the most famous battle areas of the war, the overhead work and small sub-stations will prove of great interest, as will also the building and civil engineering work.

Full details will be sent to members at the end of the present week.

The party is now complete, and further applications can only be considered in the event of certain members finding it impossible to attend.

It should be noted that those who cannot spare time to take part in the northern portion of the tour can return to London early on Monday morning.

The British Association.

The Hull meeting of the British Association came to an end on Wednesday last, the members having had a very busy time following a crowded programme. It is unfortunate that the results of these meetings cannot be gauged, although there can be no doubt as to their usefulness in acquainting those engaged in a particular branch of science with the latest developments in other departments, as well as in co-ordinating the results of workers in different fields. It is unfortunate again that so much of the proceedings should reach the public in a distorted form, giving the impression that the sole object of the meeting is to provide sensational newspaper headlines. What is needed is a series of abstracts of the leading addresses written in simple language "to be easily understanded of the people," but unless individual authors could be prevailed upon to do this as well as to produce the usual *Journal* abstract, the work would be too heavy for the Association officials.

One of the most remarkable features of the Hull meeting was the demonstration of the ultra-micrometer by Prof. R. Whiddington. The way in which the changes in frequency of oscillating valve circuits are employed in making extremely minute measurements is remarkably ingenious and even fascinating. The possibilities of the device are mentioned in the abstract of Prof. Whiddington's remarks appearing in our record of the proceedings. Several other devices of an electrical nature for biological purposes also formed interesting subjects of study for members of the physics and mathematical section.

The selection of Sir Ernest Rutherford as the next President is a matter upon which we congratulate both Sir Ernest and the Association. It is noteworthy that the last physicist President was Sir Oliver Lodge, who occupied that position in 1913.

FRANCE REVISITED.

Impressions and Comparisons.

By THEODORE RICH.

It is nearly four years since the Armistice, and it is very interesting to some of those who came into close contact with French affairs during the war to visit again some of the districts and to exchange opinions with some of those connected with electrical and allied matters; there is, however, always a tendency to view what other people are doing through rose-coloured spectacles. Although France is so close to us, too many English people take their ideas of French people from spicy novels or Paris Music Halls, and they cannot understand that underneath a somewhat frivolous exterior there is a large fund of rock-bottom common sense. During the war many British officers used to say that if a company of French soldiers were put on a job it often seemed as if they were doing little or nothing, whereas it was soon found that they got through a surprising amount of work.

Electrical Development.

Long before the end of the war plans were being made to use electricity as a factor for national reconstruction, and whilst many schemes are still in the air, a large amount of work has been accomplished. Although in the United Kingdom, to the well-merited amusement of electrical men throughout the world, anything over 3,000 volts is called "extra-high-pressure," yet abroad in many countries from twenty to eighty times this voltage with aerial transmission is not merely being talked about, but is being actively developed, and, strange to say, sheep can browse and small boys play in the neighbourhood without fear of instant death. The lattice supports of a line under construction, to be ultimately worked at 100,000 volts, connecting Boulogne with the Bethune coalfields, can be seen on the downs near Cape Gris-nez, little more than an hour's run from Croydon as the aeroplane flies; but we are likely to have many conferences, to appoint many score of officials, and to waste gallons of ink and tons of paper before the Dover coalfield is connected up with London.

Public Utility and Private Enterprise.

Comparisons may be odious to professional politicians and to interfering pork-butchers and drapers who talk glibly about "load factors," but the fact remains that in France, where private enterprise is encouraged, electricity is much more widely dispersed, especially in the country, than at home, and since the Armistice people have not merely talked but done things.

The average Frenchman, black-coat or corduroy, has something put away in a stocking, and the stocking is usually of the kind out of which he expects interest; he knows by sad experience why so many men nowadays go into national or local politics, and he prefers to leave an expert's job to an expert man, and has perhaps an aversion to the placing of unearned sums for the "relief of rates."

In France there is a system by which if a railway, electricity, gas, water supply or similar undertaking is termed a "Public Utility," then many facilities and certain compulsory powers can be given to it, and although the wayleave problem is by no means solved, the fact that in France there are per head of the population probably twenty to thirty times as many yards of overhead lines as in the United Kingdom shows that such difficulties as exist have largely been got over.

The French Post Office has apparently realised that cheap electric power benefits the public, and therefore encourages postal business, and if one can judge by the proximity of telegraph and power lines, then the obstructive and unfair policy of our Postmaster-General, as exemplified in the Blackpool and Fleetwood tramway case, has but little counterpart in France.

As a whole, people in France recognised that business could not be revived on the Micawber system of "waiting for something to turn up," but that effort and co-operation were necessary, and it should be noted that under the system in vogue, under certain circumstances, pig-headed local obstruction can be over-ruled. There has been but little alteration in the general French electricity supply laws and regulations, although water power is now the subject of a new law, and apparently recent developments have not necessitated the creation of many new highly-paid official appointments.

Our early electric lighting Acts were based on the "lack of principle" that reward for enterprise was little less than a crime, and the outcry about oil rights shows that the British people have not learned the lesson. In France, practically the whole of the electrical enterprise is in the hands of companies (some of them, it is true, assisted in various ways by the Government); therefore local red tape and difficulties about expansion of areas of supply are much less met with there than in this country.

Gas and Electricity Companies.

According to French law, monopolies have been granted in many areas for lighting, and therefore as gas companies were first in the field, in many parts electricity is supplied by a gas and electricity company. In larger towns this system certainly does not seem to have interfered with the development of electricity supply. In many supply companies' show-rooms gas fires can be seen alongside of small motors, electric irons, and toasters. The combined companies as a whole seem to encourage electricity for lighting and motive power and gas for cooking; it may be noted, however, that many of the French gas cookers and hot plates, finished off in green, blue, and brown fireproof enamel, have a most attractive appearance. There is no monopoly in France for power supply or for lighting used in commercial undertakings as accessory to power use, and in certain parts of the north, power was available before the war from more than one source; there is now, however, much more give and take between companies than there was before.

The Driving Force.

The people in France (and for that matter in Italy) were dependent very largely during the war on the supply of coal from England, and when sitting with empty fire grates, they were utterly disgusted to read in their newspapers about the continuous strikes, demands and deliberately limited output of the once hard-working British miner. After the armistice, the "lid was put on it" by the proceedings of the Coal Commission and the vote-cadging policy of our Government in forcing the French people, whose mines had to a large extent been smashed up, to pay a high price for coal to enable coal consumers at home, with votes to sell, to have domestic coal below cost. The French railway companies were at their wits' end, and the name of England began to "stink in the nostrils" of many large consumers of coal.

The French Government therefore was determined to encourage the wholesale electrification of the railways, using water power as far as practicable, and to assist electricity supply as much as it could—once bit resulting in twice shy: the ill-wind brought about by British colliers, trimmers and politicians has done a good deal to fill the order books of French electrical manufacturing concerns.

Railway Electrification.

A provisional programme has been drawn up for the electrification of the trunk railroads in France, and a

start has already been made in the South. The Government is encouraging the interchange of power not merely between supply companies, but also between railway companies and power consumers, the very idea of which would send Parliament Street and Victoria Street "into fits." For instance, in order to be in a position to sell its seasonal surplus power, the Midi Railway Company (which operates in a zone along the Pyrenees from Bordeaux to Toulouse and the Mediterranean) has adopted 50 periods for generation and distribution to substations, the objections to 50 periods for conversion to high-pressure direct current having apparently been got over. The Government has definitely decided to support direct current high-pressure traction for standard-gauge railway electrification.

The steam-hauled suburban traffic at some of the Paris stations, notably at St. Lazare, is remarkable, the number of morning and evening passengers being comparable with that of Liverpool Street; the comparatively small amount of third-rail electrification which exists round Paris will be largely increased before long. Owing largely to the Octroi system, that is to say, the collection of a material proportion of the local rates by means of a tax on goods and materials brought in, the Paris Underground system has not extended beyond the old ring of fortifications; this distinctly limits the usefulness of the lines, as it means an enormous amount of interchange traffic at some of the big stations. The system of fixed fare for any distance on the Metro. still prevails.

Tramways, Light Railways and Road Traffic.

The enormously increased cost of running tramways and light railways, owing very largely to the demands of labour has, as at home, led to great difficulties, and in some places the rolling stock is in poor condition. In some places the public refused to pay the higher fares necessitated by the "demands," and the tramways have been shut down altogether. The eight-hours' system encouraged but not adopted by Germany is being recognised in many quarters as madness during a reconstruction period—professional politicians in France having had the ballot box to face as in other countries.

There are many hundreds of miles of metre-gauge, steam-driven light railways worthy of the name, many lines being owned or partly financed by local authorities. To meet extra costs and the eight-hours' policy the service has been cut down to a minimum, to the obvious inconvenience of the public; an attempt is being made in one or two quarters to ease the situation by the use of petrol-driven rail-cars.

It is interesting to note that while Parliament at home has blocked clauses which would give a free hand, regarding motor road traffic, to railways, which pay hundreds of thousands a year through the rates for the upkeep of roads, in France, on the contrary, the railways, especially the Orleans, the Midi, and the Paris-Lyons and Mediterranean, have done a great deal to develop charabanc road traffic in Auvergne, the Pyrenees, and the French Alps respectively. The theoretical danger of monopoly has not been realised, as small local concerns frequently quote lower fares, and the companies have realised that even where the road traffic parallels the railway, the business brought into the district by the tourists and therefore the freight of commodities will very much more than balance the disadvantages.

Although a trolley system was exhibited at the Paris exhibition over twenty years ago, it seems that such systems have not made much progress in France; and although France may be called the home of the automobile, set apart from Paris and some other large towns, the motor omnibus system has not been greatly developed.

Electricity Suppliers as Vendors of "Juice."

If one can judge by the developments which have taken place, suppliers of electricity in France seem to realise that they are vendors of a commodity, that the cost of what they sell comes down with the quantity sold, and that the customer must be attracted, not repelled.

Some of the larger companies buy part of their supplies in bulk and sell a material part to local distributing companies; they realise that if other people can supply in bulk more cheaply than they can generate, it pays to buy in bulk.

There are probably ten times as many working men in France who have electricity in their homes as in the United Kingdom; the wiring systems mainly used seem to be simple and not as a rule based on any special "stunts" necessitating "So-and-so's" fittings and wiring; and connection to overhead lines is of the simplest and most practical description. The almost universal use of lamps at from 110 to 125 volts enables cheap wiring to be used without causing a nightmare to the supply companies. It comes about therefore that electric light poles can be seen in many villages which are being re-built in the devastated area.

Interconnecting Networks.

France is gradually being covered by a network of power lines, and it is the policy of the Government to encourage co-operative interconnection of supply. To this end some interconnecting trunk lines have been put up by the Government to enable those responsible for the distribution of power to help one another as and when required; an effort is also being made to interlink water-power areas with coal-power areas so that at times of ample water supply the coal consumption can be reduced.

There is a difficulty in that the largest coal areas are in the North and the largest water power in the South; the coalfield at St. Etienne to the south-west of Lyons is, however, in a very favourable position. In France, power from the glacier-fed Alpine streams is known as "white coal," whereas power from the non-glacier Central Plateau and elsewhere is known as "green coal." Glaciers, of course, tend to form natural reservoirs, and in view of the higher falls frequently met with in glacier districts, it can easily be understood that development is cheaper in the "white coal" areas than in the "green."

The Devastated Areas.

In going through the devastated areas one is struck by the appearance of business, although in country districts things are not so far advanced as in the mining and industrial areas; in fact, so rapid has been the rebuilding that round Henin-Lietard and Loos it is difficult to see traces of war without looking for them. Although complaints are now being made that brickwork costs nearly ten times as much as before the war, yet it is obvious that the French bricklayer was not restricted to 300 bricks a day.

In fact, it has been said that in many parts the spirit of the workers is very good, and they are doing better work than they did before the war; if this is the case it is to be hoped that the French people will get the reward they deserve. In the south one of the newer electrical concerns is advertising for labour.

Little but rusting corrugated iron remains at some of the British war dumps, although in some parts the temporary shanties of the people remind one of the native part of a mining town in South Africa; the strategic railway lines and sidings have in most places been taken up.

A great feature of the northern devastated area is the use of the interlocking Marseilles orange-coloured tiles, which make a very neat-looking job; they are used not merely for houses, but for factories, sub-stations, and buildings of all kinds. In some industrial buildings they are laid on light steel supports, making a non-conducting fireproof roof. In some areas old military 60-cm. tramway material is used to haul bricks and cement about, and some of the German six-coupled light locomotives were seen at a depôt near the River Oise.

(To be continued.)

THE BRITISH ASSOCIATION.—II.

As in previous years, the reading of papers in most cases occupied fully the allotted time, and discussions were therefore postponed indefinitely, or were held privately between groups of members after the session.

Almost two thousand members took part in the Hull proceedings, and a goodly proportion of them attended the inaugural meeting on the evening of September 6th. Among those present were the Maharaja Rana, of Jhalawar, M. le Duc and Mme. la Duchesse de Broglie, Professors G. Gilson (Brussels), P. Langevin (Paris), C. Julin (Liége), Weiss (Strasburg), Drs. Mortensen, Jon Petersen and Jon Schmidt, of Copenhagen, Dr. E. B. Mathews (American Association for the Advancement of Science), and Drs. K. A. Anderson (Stockholm) and Edouard Le Danois (Paris).

It was announced that, having regard to the high cost of text-books, Sir Robert Hadfield had given the Association £50 a year for three years to enable grants to be given to universities for the purchase of books for the poorer students.

Before introducing the new president, Sir Edward Thorpe, the retiring president, voiced the Association's regret at the death of Dr. Rivers, who was to have been the president of the Psychological Section at the Hull meeting. (His successor is Dr. Charles S. Myers, F.R.S., whose paper on "Industrial Psychology and the Efficiency Engineer" was abstracted in our last week's issue.) Sir Edward also referred to the death of Sir Albert Rollit, a vice-president designate of the Economics Section.

Prof. Sir Charles S. Sherrington then delivered his address upon "Some Aspects of Animal Mechanism," after which an official welcome was extended to the Association by the Lord Mayor of Hull (Councillor G. F. Wokes, J.P.), who proposed a vote of thanks to the President. This was seconded by Sir E. Sharpey-Schafer, who also thanked the Lord Mayor for the excellent arrangements made for the convenience and comfort of members.

The report of the Treasurer (Dr. E. H. Griffiths) announced the fact that Sir Charles Parsons had given the Association the sum of £10,000 to be used for general purposes. A legacy of £450 had also been bequeathed to the Association by the late Mr. T. W. Backhouse.

The president-elect for the Liverpool meeting next year is Sir Ernest Rutherford, F.R.S., who has earned a world-wide renown for his researches into the structure of matter and kindred subjects. Mr. F. E. Smith, F.R.S., has consented to become joint general secretary in succession to Prof. H. H. Turner, who has held the office for about nine years. Dr. J. L. Myres will continue to act as the other joint general secretary.

A few words must be said about the handbook to Hull and the East Riding, ably edited by Mr. T. Shepherd, M.Sc., F.G.S., the local honorary secretary. This is a volume of 532 pages containing a number of excellent photographic views of the districts described. Apart from a few notes upon "The Rise and Progress of Hull," by the late Sir Albert Rollit, little is said of the importance of the city to industry, or of the importance of the city's own industries. The matter is principally historical, geological, and archæological, and is of great literary merit. The handbook has been admirably produced by Messrs. A. Brown & Sons, of London and Hull.

As stated in a previous issue, the papers of immediate interest to electrical engineers were practically *nil*, but the Economics Section produced several items of value to industrialists generally. One of these was the presidential address by Professor F. Y. Edgeworth, M.A., and the other a paper on unemployment insurance by Mr. J. L. Cohen, M.A.

On the morning of September 8th, Mr. G. V. Maxted, of Messrs. Maxted & Knott, consulting engineers, described in some detail the works of the Humber Portland Cement Co., Ltd., opened last year. This, similarly to the Stone works described in our issue of February 3rd last, is an electrically-driven works employing a number of large induction motors. Power is obtained from the Hull Corporation electricity works—a distance of eight miles away—and an annual consumption of 10,000,000 kWh makes the company a good customer.

There are one or two features of this works which are worthy of mention. The cement making plant was supplied by Messrs. Edgar Allen & Co., Ltd., Sheffield; the motors were constructed by the English Electric Co., Ltd. At the works is a gyratory crusher weighing 70 tons, belt-driven by a 150-h.p. motor. Two 300-h.p. motors drive grinding mills, and there are two coal-grinders each equipped with a 150-h.p. motor driving through reduction gearing. The largest motors in the works are those of 400 h.p., driving the clinker-grinding tube mills. The slurry mixer is a basin 66 ft. in diameter and 11 ft. deep fitted with a motor-driven "sun and planet" gear for keeping the mixture in constant motion to prevent settling. Mr. Maxted also traced the history of cement making, and exhibited numerous examples of the raw materials and finished cements. The Humber works was illustrated by a number of lantern slides, and a two-part film showing the plant at work was also "screened." In the afternoon a party from Section G was shown over the works.

At a meeting of the General Committee on September 8th, the election of Sir Ernest Rutherford as next year's president was confirmed, and the invitation to hold the 1924 meeting in Toronto was accepted. Professors J. T. Field and J. C. McFennan, of the University of Toronto, outlined the arrangements proposed for the meeting. A number of eminent scientists were appointed to the Council, including Dr. C. S. Myers.

On Saturday morning a party of about 50 members from Section G was conveyed by charabanc through and around the Hull docks, the arrangements being made by the Board of Directors of the North-Eastern Railway Company. The party first visited the largest of these, the King George Dock, which has a water area of 53 acres and quays totalling 8,163 ft. in length. The cargo-handling arrangements are of the most modern type, and for the most part electrically driven. An idea of the value of this load to the Corporation may be obtained from the fact that a bulk supply of 2,000 kW is taken for many hours during the day. The energy is received at a sub-station at a pressure of 6,600 V (50 cycles, 3-phase) and dealt with by a single motor converter with an output pressure of 440 V d.c.; the three-wire system is employed. The pumping machinery consists of four sets of three-throw pumps driven through reduction gearing by 200-h.p. shunt-wound motors. Each set is capable of pumping 250 gal. per minute; the hydraulic pressure is 800 lb. per sq. in. The motors are automatically started and stopped by the action of the hydraulic accumulators, which operate, by means of relays, tramway type controllers. In the graving dock are two centrifugal pumps, with a capacity of 36,000 gal. per minute, running at 370 r.p.m. Each of these is driven by a 400-h.p. shunt-wound motor. The starters for these motors are of the lever type with a magnetically-operated switch in the main circuit. There are also two drainage pumps driven by 75 h.p. motors. The goods-handling equipment is very extensive. There are 53 electric cranes with lifting capacities ranging from 3 to 25 tons; two coal conveyors each capable of dealing with 800 tons per hour; two coal hoists of 500 tons per hour capacity; and a floating crane able to handle 80 tons per hour. In this dock is open water space amounting to 200 acres, and there are six ferro-concrete warehouses (222,750 sq. ft. floor area), a grain silo holding 40,000 tons, and a wool shed for 140,000 bales. The other docks, including the Alexandra and the Victoria, were also visited. These are not so extensive as the King George Dock, but are all well equipped, although electricity does not play such an important part in their working. The tour occupied only a little over two hours, but in this short time a good

acquaintance was made with Hull's principal feature. Mr. Shaw, of the North-Eastern Railway Co., acted as guide.

On Sunday, special services were arranged at the churches of various denominations. At Holy Trinity Parish Church the preachers were the Archbishop of York and Dean Inge: at St. Charles's Roman Catholic Church the Rev. A. L. Cortie, S.J., preached on "The Relation of Science to Religion." Rev. Sir James Marchant, K.B.E., LL.D., was the preacher at the Central Baptist Church. A large proportion of members made excursions to places of interest within a wide range.

On Monday, the morning was devoted by Section A. to the study of physical instruments for biological purposes, and in the afternoon an exhibition of some of these took place. A description follows of apparatus exhibited by Major Tucker, Prof. Whiddington, and the Cambridge and Paul Scientific Instrument Co. Section I.—Physiology—participated in the morning's discussion.

The presidential address to Section F.—Economics—was delivered on Monday morning by Prof. F. Y. Edgeworth; this dealt with the question of equal pay for men and women for equal work, and a short abstract will appear in our next issue.

Physical Apparatus for Biological Purposes.

Section A.—Mathematics and Physics.

The whole of Monday, September 11th, was taken up by the subject indicated in the heading. In the morning a discussion was opened by Prof. A. V. Hill, F.R.S., and the speakers included Major W. S. Tucker, Mr. F. E. Smith, F.R.S., Mr. Somerville Hastings, Mr. R. S. Whipple, and Lieut.-Col. C. B. Heald, C.B.E., M.D.

In the afternoon an interesting exhibition of some of the apparatus mentioned was held. Major W. S. Tucker, R.E., demonstrated ear-testing appliances made at the Signals Experimental Establishment.

The following is a description of the apparatus:—

Ear-testing Apparatus.

A constant source of sound is actuated by an oscillatory current generated in an acoustic oscillator whose output is measured by a method suggested by Mr. F. E. Smith. The oscillator consists of a thermionic valve connected in the usual way for producing low-frequency oscillations. The inductance coils are free of iron, and are so designed as to give, with a 2 mf. condenser, a pure note of 500 vibrations per second. A Duddell thermo-galvanometer is placed in the oscillating circuit and measures the current. Wires attached to the condenser plates connected through a resistance of 80,000 ohms lead away a certain fraction of the current for the purpose of producing the sound in a standard Sullivan receiver, capable of being clamped to the ear under examination. The receiving installation consists of a non-inductive Wheatstone bridge, the arms of which are of 1,000 ohms resistance, and one of these is capable of adjustment by intervals of 1 ohm. When balance conditions are secured no signal can be obtained in the telephone receiver on depression of a key in series with it. To secure noiselessness when the key is depressed a special Morse key is employed, vibrating between rubber stops and tilting a mercury column in a glass tube attached to the key. This mercury column makes contact between two platinum wires passed through the walls of the tube, which is quite air tight.

The patient, being unaware of the nature or timing of the signal, can indicate by motion of his finger the moment of hearing or losing the signal, and in this manner the limiting strength of audible signal can be discovered and its value expressed in terms of the out-of-balance resistance in the adjustable arm of the bridge. For the purpose of applying a rigid test in which only one ear can perceive the signal it is the common practice to put the other ear out of action by subjecting it to a continuous disturbing sound. Such sound is supplied by the vibration of the diaphragm of a second Sullivan receiver attached to the same head set. The necessary constant oscillatory current for this purpose is supplied by a coil mounted between the prongs of an electrically-maintained tuning fork having a known amplitude. In order to complete the test a distributing switch is employed, so that this same sound can be thrown into the receiver employed in testing the ear. Thus a maintained low-frequency sound is received by the ear, and at the same time the signal is imparted by the key. The faculty of hearing a sound more favourably with a disturbing sound than without it, termed "paracusis," can thus be tested. The employment of transformers for introducing this disturbing sound into the receivers inductively is essential to this apparatus. Great care is taken in the wiring so that no oscillatory currents from the acoustic oscillator can enter the telephone receiver except when the key is depressed. The scale of acuteness is approximately linear for variations of the variable resistance of the bridge up to 100 ohms; for values above this a special curve has been prepared, and indicates that the range of sounds varies in intensity from 1 to 1,000. It is therefore suitable for very deaf people, as well as for those having acute hearing.

Another apparatus exhibited by Major Tucker procures the amplification of heart sounds. This apparatus employs an electrolytic microphone coupled up with a four-valve Marconi amplifier of the resistance-coupled type. The microphone rests against the chest wall in the appropriate position, and the sound is heard by the usual telephones on the amplifier.

Measurement of Audition.

Mr. F. E. Smith, F.R.S., demonstrated and described apparatus for the measuring of acuteness of hearing and other purposes. The principle of the method is as follows: The current in a triode-valve circuit is caused to oscillate at an audible frequency, the value of the alternating current being directly measured by an ammeter in the main oscillatory circuit. The frequency of the oscillation is varied by varying the inductance, or capacity, or both, and the intensity of the oscillatory current is varied by varying the filament current. Included in the plate oscillatory circuit is the primary coil of a mutual inductance, the secondary of which is connected with a telephone or other receiver. By varying the intensity of the main oscillatory current, or by varying the mutual inductance between the coils, or by varying both, the note from the receiver can be rendered inaudible. If the amplitude of vibration of, or the total energy emitted from the receiving mechanism is known the apparatus can be used for absolute measurements of acuity. The total energy can be measured by means of thermophones, by an electrostatic transmitter, or by piezo-electric crystals.

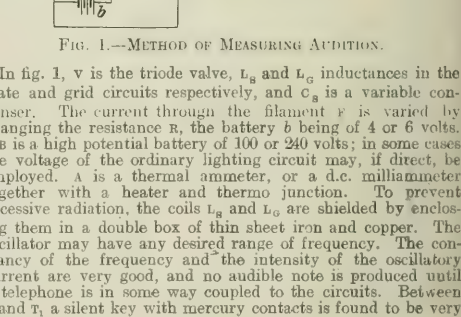


Fig. 1.—Method of Measuring Audition.

In fig. 1, V is the triode valve, L_S and L_G inductances in the plate and grid circuits respectively, and C_S is a variable condenser. The current through the filament F is varied by changing the resistance R, the battery *b* being of 4 or 6 volts. B is a high potential battery of 100 or 240 volts; in some cases the voltage of the ordinary lighting circuit may, if direct, be employed. A is a thermal ammeter, or a d.c. milliammeter together with a heater and thermo junction. To prevent excessive radiation, the coils L_S and L_G are shielded by enclosing them in a double box of thin sheet iron and copper. The oscillator may have any desired range of frequency. The constancy of the frequency and the intensity of the oscillatory current are very good, and no audible note is produced until a telephone is in some way coupled to the circuits. Between S and T_1 a silent key with mercury contacts is found to be very convenient.

The mutual inductance may be of various forms. During the war an air core transformer with a secondary coil capable of rotating about a vertical axis was used. In general, however, it is more convenient to have two parallel coils P and S. P is in series with L_S, and the number of effective turns on P can be varied from such values as 1 to 10 to 100 by means of a switch K_1. Such changes in P are practically without influence on the oscillatory circuit $C_S \cdot L_S$, as the impedance of L_S is very great compared with that of P. The secondary S is in series with the telephone receiver T_1. The receiver T_2 may, if desired, be placed in series with T_1, or it may be used in a separate circuit.

The frequency of the note is directly given on a dial connected to the condenser C_S. It may be varied over a very wide range. The note from the valve set is very pure; if necessary, wave filters can be introduced. The coupling between the coils P and S may be made such that when the number of effective turns on P is a minimum any note may be made inaudible by reducing the filament current, the oscillations being still maintained. When the note becomes just inaudible the value of the oscillatory current, together with the reading of the switch K_1, and the efficiency factor of the telephone is a measure of the acuity of hearing for the particular frequency. The sensitiveness of the ear varies considerably with change of frequency, and the relation between the two varies also with the age of the individual.

The audibility of sound is influenced also by the presence of other noises and by the state of the ear as regards fatigue. Lord Rayleigh found the latter to be especially apparent with notes of very high pitch. In the apparatus diagrammatically shown in fig. 1, a key (K_2) can be operated so as to produce disturbing noises in T_1 or in T_2. If T_1 and T_2 are in series the

disturbing noises are produced in both. The turns of wire on S, which are connected to K_2, are not in series with those connected to T_1. An arrangement of this kind should enable quantitative measurements to be made of the effect of disturbances and of fatigue.

If the mutual inductance between the coils is known, the apparatus enables one to measure the energy passing into the telephone, but not the acoustic energy transmitted to the air. Since the efficiency of telephone receivers, as transformers of electrical energy into acoustical energy, varies with the energy and the frequency, and since also receivers vary greatly among themselves, it becomes important to standardise the complete outfit, the telephone or other receiver being of particular importance.

Among the standard sources of sound which may be employed are: The method described by Bragg (*Engineering*, June 13th. 1919), a pendulum method of determining very small amplitudes of vibration of a diaphragm when the frequency is known. The piezo-electric crystal method. The Rayleigh disk method—which measures the mean velocity of the air particles at an anti-nodal point in a resonator. The thermophone method, in which very fine Wollaston wires or thin strips of metal foil are heated by an alternating current, or by both d.c. and a.c. The temperature of the wires varies periodically, and a temperature (also acoustical) wave is set up in the surrounding medium. For a particular type of strip thermophone the acoustical amplitude of the air particles can be calculated. Finally, there is the electrostatic transmitter, in which a special condenser is used and an alternating potential applied to the plates. The plates are set in vibration and the electrostatic force is calculated.

Apparatus for Various Purposes.

The Cambridge and Paul Scientific Instrument Co., Ltd., exhibited a large collection of apparatus for various purposes.

This included a MacGregor-Morris anemometer similar in design to that described by us in connection with the Cardiff (1920) meeting of the Association.*

Another exhibit was a Salomonson string galvanometer—a simple form of the Einthoven galvanometer. This had two copper fibres 0.01 in. in diameter. The magnification is about 40 at a working distance of 80 cm. The galvanometer can be used in conjunction with a larger Einthoven galvanometer (fitted with a silvered glass fibre), the optical work in the small instrument forming the eye-piece of the large one. An electro-cardiagram and a pulse-tracing can thus be taken simultaneously on the same plate.

Two outfit types of hydrogen ion apparatus were shown, one for accurate research work, and the other for ordinary electrometric titrations. In the former outfit the e.m.f. is measured by a specially-designed potentiometer, in which the slide wire, contacts, and resistances are totally enclosed, thus being protected from corrosion and other deteriorating effects. This instrument reads directly to 0.2 millivolt. It is connected to a moving-coil galvanometer, the movement of the coil being observed by a lamp and scale. The potentiometer circuit is standardised by a Weston normal cell. The electrodes are of the Clark pattern, and comprise two hydrogen electrodes a connecting vessel and calomel electrode suitably mounted with rocker and motor. For blood work a special set of electrodes is supplied.

For electrometric titration work a direct-reading potentiometer is supplied, the instrument consisting of a moving-coil galvanometer of the pivoted type, adjustable rheostat, battery and electrode-reversing switch. The e.m.f. of the electrodes is read directly on the scale of the instrument, which is calibrated in millivolts, the standard ranges being 0-600 and 0-1,200 millivolts.

X-ray Electrons.

By Prof. R. Whiddington, D.Sc.—*Section A.*

It has been known for many years that an approximate relationship exists between the energy carried by the moving electrons within an X-ray tube and the energy possessed by electrons liberated from surfaces illuminated by such a tube. The author was able to show some ten years ago that if the heterogeneity of such flights of electrons be disregarded, and only the speediest be considered, then very simple approximate relationships emerge. It may, perhaps, be sufficient to recall that the approximate relationship indicated that an element of atomic weight w emitting both K and L radiations caused electrons of speed up to $w \times 10^8$cm/sec and $\frac{1}{2}(w-50)10^8$ cm/sec to be emitted from material surfaces on which these radiations were incident.

The experimental method was not at the time capable of definitely proving the existence of groups of electrons of less speed, although very recently Simon has succeeded in improving the methods sufficiently to do so. The method depending, as it does, on the absorption of the electrons in a gas and the measurement of ionisation is frankly an inaccurate one, and a fresh series of experiments, using a different method, with the object of obtaining more accurate results, were commenced in 1920.

It transpired that M. de Broglie, at about the same time in France, had the same object in view, and the author's results are in general agreement.

The experimental method, in short, consisted in illuminating, with X-rays of definite wave length, a narrow strip of the element under consideration and observing the magnetic spectrum *in vacuo* of the X-ray electrons emitted.

The main experimental difficulty was to get sufficiently powerful X-ray illumination. De Broglie used a Coolidge tube, but the author was able to get an even greater intensity by other means which need not be described in this abstract.

The results of a large number of experiments showed that generally the magnetically-dispersed X-ray electrons yielded a line spectrum of comparatively simple appearance. Each line corresponded to a group of X-ray electrons of definite speed. It is probably the fastest of these groups which were investigated by the approximate method first mentioned.

As was to be expected, the position of the lines is definable in terms of the frequency of the incident X-rays and the atomic number of the illuminated atom. It is an atomic phenomenon, and from the position of an X-ray electron spectral line it is possible to deduce the atomic level or ring within the atom from which the electrons were originally ejected.

Thus if the energy carried in the original X-ray be W and that required to lift an electron from the K level be W_K, there is a balance of energy $(W-W_K)$ if W is greater than W_K, with which the electron emerges from the parent atom. In the case of an X-ray electron from the L level the energy will be greater giving rise to another spectral line of energy $(W-W_L)$, and so on for the other outer levels.

Each of these levels, therefore, contributes X-ray electrons of definite energy producing a line in the appropriate part of the photographic plate recording the spectrum.

Nuclear electrons, such as have recently been investigated by Ellis, are not affected in these experiments since the X-ray energy available is not sufficient to disturb them.

The incident energy W is defined by the quantum relation $W=h\nu$ where ν is the frequency of the incident X-rays, so that W is known.

Also W_K, W_L, &c., are known working back from the quantum relation $W_K=h\nu_K$ where ν_K, ν_L, &c., refer to the fundamental X-ray frequencies of the element emitting the X-ray electrons.

Thus it is possible to calculate and compare with experiment the position of the lines.

Lantern slides showing the arrangement of apparatus and results obtained were exhibited by the author.

The Application of Oscillating Valve Circuits to the Measurement of Dielectric Constants and Magnetic Susceptibilities.

By J. E. P. Wagstaff, M.A., B.Sc.—*Section A.*

The applicability of the simple formula for the frequency $(N=1/2\pi\sqrt{LC})$ has been fully investigated for low-frequency oscillations by the use of standard tuning forks, and for high-frequency oscillations by means of a standard wavemeter. It has been shown that if c is the capacity of the circuit introduced by the condenser, N^2c decreases as the frequency increases, but by the suitable choice of a quantity c, $N^2(c+c)$ can be shown to be accurately constant over a wide range of frequencies. The introduction of c indicates that the capacity in the formula for the frequency must include not only the capacity introduced by the condenser, but the capacity of all the various parts of the circuit, together with any change in the value of the capacity due to the use of high-frequency fields. This is further tested by using the calibrated circuits to measure accurately the S.I.C. of air by a beat method.

Results are obtained which are in excellent agreement with those obtained by previous investigators.

The valve circuits have also been used for the measurement of low-order susceptibilities for steady fields.

For this experiment the upper plate of a parallel plate air condenser is clamped to a vertical upright, fixed rigidly to a steel base. The lower plate is fastened to a long brass rod and is suspended between two rigid vertical uprights by means of a thin steel wire under tension. The lower plate is thus free to move in a vertical plane, and the motion is controlled by the torsion of the wire. The specimen to be examined is suspended from the end of the rod, so as to lie between the poles of a powerful electromagnet. Before commencing the experiment, by means of sliding weights fixed to the rod, the lower plate is adjusted so as to lie horizontal when free, and the upper plate is fixed above it. The apparatus is essentially a delicate torsion balance, capable of measuring very small changes (0.01 dyne) of the tension applied to the end of the rod.

It can be shown that if a uniform cylinder of material of section A, whose coefficient of susceptibility is K, is suspended in a horizontal magnetic field of varying intensity, there is a pull P downwards on the specimen given by $P=KA(H_1^2-H_0^2)/2$ where H_0 and H_1 are the values of the magnetic field at the two ends of the specimen. Thus, by switching on the current through the electromagnet, the pull applied to the end of the rod is altered by this amount. This produces a small change in the distance between the two plates, and a corresponding small change in the frequency of oscillation of the circuit of which the condenser forms a part. In this way, by measuring the change of frequency, K can be calculated. This has been done in the case of bismuth and nickel carbonyl, and reliable results have been obtained.

*Elec. Rev., September 10th, 1920, p. 345.

The Application of the Ultramicrometer to the Measurement of Certain Physical Quantities.

By Prof. E. Whittington, D.Sc. *Section A.*

The ultramicrometer was devised by the author in 1919, when it was shown to be capable of measuring very minute *changes* of length or distance. It was possible to measure down to 10^{-8} cm., a length comparable with atomic diameters.

Briefly, the apparatus consists of two oscillating circuits, each maintained by a thermionic valve. The frequency of the first circuit is affected by the change in capacity produced by the motion of one condenser plate towards another; this frequency change is made apparent by audible beats set up in conjunction with the second when suitably adjusted.

I. *The Ultramicrometer used as a Thermometer.*

By fixing one condenser plate to a metal rod exposed to temperature changes Mr. Sucksmith (*Phil. Mag.*, 1921), working at Leeds, showed that it was easy to obtain indications from the instrument when the temperature changed by so little as 10^{-6} deg. C.

II. *The Ultramicrometer used as a Pressure Gauge.*

Mr. Hare has succeeded in producing a very sensitive manometer by connecting one plate of the ultramicrometer condenser to a flexible metal diaphragm, so that small changes of pressure produced corresponding changes of frequency.

He was able to measure a change of pressure of about 7×10^{-4} mm. of mercury at atmospheric pressure, a result which, at the pressure he used, proves the instrument to be more sensitive than its predecessors.

III.—*The Ultramicrometer Principle Applied to the Construction of a Sensitive Microbalance.*

This has proved to be a problem not quite so formidable as originally thought.

Mr. Long, working in Leeds University Physics Laboratory, has already succeeded with very rough apparatus in detecting a mass so small as 4×10^{-9} to 8×10^{-9}. This is of the same order of sensitiveness as has been obtained by ordinary mechanical means by Steele and Grant, Ramsey and Gray, and Petterson and Stromberg.

The balance itself was of the Stromberg type in quartz. At each end was carried a light aluminium disk, forming one plate of a condenser. When the balance turned one condenser increased in capacity while the other decreased.

They were both connected to valve maintained oscillation circuits adjusted to beat audibly in a telephone. Thus a small tilt of the balance manifested itself as a change in musical frequency, which was determined by comparison with a standard.

The remarkable thing about the experiment so far is that the high sensitiveness obtained was with a load of about 1 gramme on a balance weighing 3 grammes hung from phosphor bronze strips of the ordinary sort used for galvanometers. It is expected that a far greater sensitiveness will be obtained with a new apparatus now in course of construction.

MUNICIPAL TRAMWAYS ASSOCIATION (INC.)—I.

ANNUAL CONFERENCE.

On Wednesday last the annual Conference of the Municipal Tramways Association was opened at Newcastle-on-Tyne. Over 250 delegates attended from all parts of the kingdom. The Lord Mayor (Ald. R. H. Millican, J.P.) and the Sheriff (Councillor James Lunn) gave a civic welcome to the Association in the Lecture Hall of the Literary and Philosophical Society, after which Ald. Richard Mayne, J.P., chairman of the Newcastle-on-Tyne Transport and Electricity Committee, read his presidential address. Thanks having been accorded to the President, Mr. Ernest Hatton, general manager and engineer of the Newcastle tramways, read a paper entitled, "An Argument for the Penny Fare, Demonstrated by Actual Experience," which was followed by a discussion. After lunch a paper by Mr. P. M. Heath, town clerk, Manchester, and an honorary solicitor of the Association, on "The Legal Aspect of the Question of Electrolysis," was read and discussed.

On Thursday the proceedings were to be opened with a paper on "Tramway Rolling Stock," by Mr. E. S. Rayner, general manager of the Hull city tramways, followed by a discussion on "Highways Costs Borne by Tramways," opened by Mr. H. Mattinson, general manager of the Manchester city tramways; and in the afternoon the subject for discussion was "The Regulation of Traffic at Tramway Stopping-places"; the London County Council had requested the Association to consider the question of promoting legislation to deal with this matter. In the evening the members of the Association were to be the guests of the Newcastle-on-Tyne Transport and Electricity Committee at dinner, and a presentation was to be made to Mr. J. M. McElroy.

The annual general meeting is to be held this morning, and in the afternoon there will be an excursion by motor omnibuses to Chollerford to visit the Roman camp of Cilurnum and the museum at "The Chesters," followed by a trip to Hexham Abbey, with high tea at Hexham before returning to Newcastle.

An abstract of Mr. Rayner's paper follows.

Tramway Rolling Stock.

By E. S. Rayner, M.I.E.E.,
General Manager and Engineer, Hull City Tramways.

Tramcar Trucks.—In the endeavour to emulate railway rolling stock practice the tramway designer has neglected the essential difference between the resilient sleeper track of the railways and the super-solid track of the tramways. Every conceivable device is used to make the tram-track absolutely rigid. I am not finding fault with this ideal—the circumstances demand it. But the mistake from which tramways are suffering is that we have attempted to build our rolling stock on the same principles; rigidity has been our fetish. In my opinion, nearly all our troubles are traceable directly or indirectly to this rigidity together with the excessive unsprung weight on our axles and the very inadequate springing of the remainder of the tramcar.

It is obviously impossible to have a resilient tramway track; we must, therefore, provide the necessary resiliency in the design of our rolling stock. We must have lighter cars, and that means lighter equipment.

Mr. Munro, in his paper on "Railless Electric Traction," gives the comparative weight of double-deck vehicles per seat as follows:—Petrol bus 256.4 lb. per seat, railless 297 lb. per seat, tramcar 440 lb. per seat, showing that tramcars are very nearly 50 per cent. heavier than railless. These figures represent a total weight of about 7¼ tons in the case of the railless vehicle and anything from 11 to 15 tons in the case of the tramcar. This weight should easily be below 9 tons.

Mr. Spencer, in his paper, complained that there had been no material change in tramcars, and I agree with him. The motors are better and heavier; the equipment is better and heavier; the bodies are better and heavier. In fact, if a tram could talk it would Coué:—"Every day and in every way I feel heavier and heavier." But the bad initial faults still remain—unsprung weight, bad brakes, overhung bodies and the rest. It is something of an achievement to carry a 28-ft. or 30-ft. body on a 6-ft. wheel base, as satisfactorily as we do, but it is wrong. There is no reason why tramcar construction should not follow the lines of motor vehicles. Their conditions of service are infinitely worse than ours: bad roads as compared to a smooth rail; the addition of a self-contained power unit; and last, but not least, a steering device. The outstanding feature is the small amount of unsprung weight in their chassis as compared to a tramcar truck. This, of course, is due to the type of drive adopted by them—the propeller shaft with its bevel or worm gearing.

There is no insurmountable difficulty in adapting this type of drive for tramway work. The advantages are obvious, and far outweigh the disadvantages. The evil of unsprung motors disappears.

If a worm drive is used the gear ratio can be increased, the speed of the motors increased, and the weight reduced. A smooth start is obtained with a comparatively low starting current. The size of the gear is much reduced, the road clearance can be increased to safe dimensions, and smaller wheels can be used.

All this has been done, and well done, by the motor vehicle, and the latest production of the railless vehicle is a most efficient machine.

Another bad feature of tramway work is undoubtedly the solid axle without the interposition of a differential. In taking a right-angle turn with a 40-ft. radius curve, the distance to be travelled by the wheel on the outside of the curve is 7.46 ft. more than the wheel on the inside of the curve travels, and a large amount of slip has to take place between the wheels and the rails with corresponding wear

and tear. Nearly the whole of this could be eliminated by the use of a split axle. This can be obtained by the use of a differential, or by adopting a variation of the type of axle which is used on the railless vehicle with its double worm drive and a motor for each half of the axle.

We have not taken the advantage which ought to have been taken of roller and ball bearings, due largely to the fact that in nearly every case it would mean conversion and adaptation (the conversion of the manager perhaps being the most difficult part of the work.) The saving in friction amounts to about 20 per cent., but the principal saving will be in the decreased starting effort and the decrease in the cost of lubrication, attention, inspection and renewal; if all the tramway rolling stock were fitted with properly designed roller or ball bearings throughout, the greasing staff could be reduced by 50 per cent., and the repair bill cut down by a similar amount. We should have no dropped armatures, smoking axle boxes, or worn axles, and if you set the cost of the ball or roller bearings against all these items you will find that they are well in credit. We have had ball bearings on some of our motors for years and they have required practically no attention and show very little wear.

Tramcar brakes badly need re-designing—particularly the hand brake, with its heavy lever bars and massive brake shoes. The weight of the brake gear on an ordinary truck is about 600 lb., whereas the brake gear on a motor vehicle weighs about 1 cwt.

I see no serious difficulty in applying the ordinary internal expanding brake of a motor-car to tramcar practice; we can obtain equal braking power with a fraction of the force required under the existing design. In fact, there is no real reason why a foot brake should not be used. The weight of a truck designed on these lines could be decreased at least 25 per cent., and it would allow the body to be kept very much lower than it is with the present design.

A set of wheels and axles with 4½-in. axles on a single-truck car weighs 2,158 lb. Many years ago in America railway disk wheels were used with great success. The value of a disk wheel in the case of tramcar trucks would be the comparatively simple problem of fixing a brake drum to the inside of it. Whilst reducing the weight of the truck and body one is able to reduce the size and weight of the wheels and axles.

Effect of Rolling Stock on the Track.—Not only is corrugation produced by our badly designed trucks, but the heavy wear and tear of rails and foundations is due to the same cause. I have recently taken out the car-miles per mile of rail for the whole of Hull system since it was installed, and obtained some interesting results. On sections that it has been necessary to re-lay the mileage varied from 6,221,200 car-miles in the centre of the City, to 3,007,000 car-miles a mile or more from the centre. In both cases the wear and condition of the rails was approximately the same; roughly speaking, the figures showed that the wear was proportional to the average speed. The reason for renewal was not altogether the wear, but the fact that we have been troubled for some time past with rail fractures; the metal is badly crystalline. Taking the highest figure given, this means a life of approximately 80,000,000 ton-miles, and the lowest figure 40,000,000 ton-miles.

An 80-lb. rail on the G.N. main line on a rising grade of 1 in 200 gave from 100,000,000 to 120,000,000 ton-miles with a life of 18 years. When you consider the weight and speed of railway trains with engines of 130 tons and over, and speeds up to 70 m.p.h., and compare tramcars of 12 or 14 tons and speeds up to 20 miles per hour, it is obvious that there is something radically wrong. It is undoubtedly due to their resilient track that railways are able to do so much better. We cannot have a resilient track, we must therefore have resilient rolling stock.

Other troubles are due to the same cause: absorption of vibration. With properly sprung rolling stock, this vibration can be very considerably reduced, if not eliminated, and the saving in the cost of track maintenance will go a long way to pay the bill.

I had hoped to give some details of the proposed new tramcar on which we are working, but matters are not far enough advanced to give more than a general outline. It has a split back axle with a double worm drive, and two high-speed motors suspended clear of the axle. The wheels other than the drivers will be free. Drum brakes will be fitted, and ball and roller bearings throughout. The body will be kept low, and platform cantilevers will be omitted. A continuous frame will carry the body. The springing will be as easy as possible and the weight will be cut down to the lowest possible figure compatible with safety and stability. These are the ideals; it remains to be seen how nearly we attain them.

A Suction-Cleaner Film.—Among the recent films made by Messrs. Pathé Frères is one "featuring" a "Handyvac" electric suction cleaner (The Hotpoint Electric Appliance Co., Ltd.) in the *rôle* of horse-grooming machine—a novel application which certainly has great possibilities.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

G.E.C. Wall Plugs.

A new line of wall plugs and sockets, of 5, 15, and 30 amperes' capacity, which the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has just developed comply in every respect with British Engineering Standard Association Specification No. 73 (1919).

The socket bases in these plugs are of best English vitreous porcelain, the hardwood covers being secured by a brass

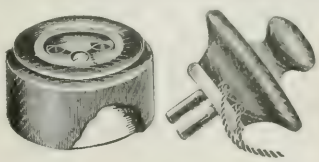


Fig. 1.—G.E.C. Wall Plug and Socket.

screw, thus dispensing with a thread on the base. The plugs are of well-seasoned lignum vitæ, and have correctly dimensioned hand shields and handles. The metal parts throughout the series are made strictly to limit gauge, so that perfect contact is assured.

A typical plug and socket is illustrated in fig. 1.

A New "Arora" Fire.

The accompanying illustration (fig. 2) depicts a new design of electric fire recently produced by The Arora Co., Loughborough, Leicestershire. This fire is made of cast iron and has a sheet iron back with four 750-W standard "Arora" firebars. Each bar is supported by two screws which also form the electrical connection to bus-bars of rigid construction, insulated from the frame. The bars can be changed without disturbing any wiring.

A two-circuit rotary switch in the first position puts all four bars on circuit, in the second position puts the two top

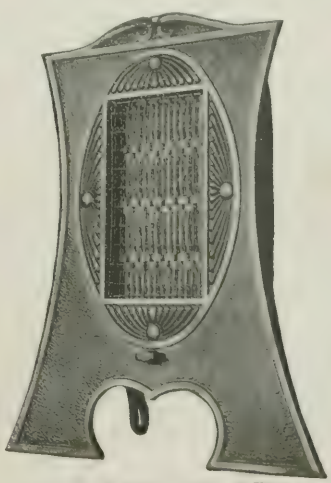


Fig. 2.—A New "Arora" Fire.

bars on circuit, and in the third position the two bottom bars. The fourth position of the switch cuts them all off.

If one of the top pair of bars is coupled to the "live" terminals direct then the four switch positions will put on circuit, 4 bars, 3 bars, 2 bars, and 1 bar.

The fire is supplied complete with wire handle and two yards of heavy flexible cable.

The standard loading is 3 kW; the dimensions are: height, 24 in.; width, 24 in.; and base 7 in. The weight is 27 lb. The fire is produced in a variety of finishes.

The "Esla" Overhead Line Fuse Connector.

Now that electricity is finding its way into the outlying districts, small towns, and villages, by means of overhead conductors and distributors, every device which increases the reliability of the supply and reduces the cost of means of distribution is to be welcomed. Such a device is the overhead line fuse connector, invented by Mr. Haydn Harrison

and manufactured by the Electric Street Lighting Apparatus Co., of Canterbury.

This simple piece of apparatus not only cheapens the cost of connecting service wires, but also does away with the expense of supplying and fixing service fuses in consumers' houses; in addition, it increases the reliability of the distribution by preventing sectional fuses isolating districts due to a fault in a service. It is also used as a section fuse connector, thus doing away with the expensive and unsightly section fuse boxes, now mounted on the poles, or buildings, supporting the overhead mains.

The apparatus consists of a simple connector A (see fig. 3), which is clamped on to the overhead conductor C by means of a single nut or screw B, which is locked by soft copper strip E. An insulating sleeve S contains another connector G and screws on to connector A. This sleeve contains a special fuse F, which is held in contact with the connectors by the spring washer D. To remove or replace the fuse, it is only necessary to unscrew the sleeve and extract the fuse, which slides out easily. It will be noted that this operation can be carried out without any live part being touched as it is only necessary to handle the insulating sleeve, which is provided with a projection to prevent the hand coming in contact with the live wire, and the fuse cannot be touched while it is in contact with any conductor.

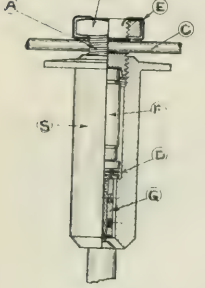


Fig. 3.

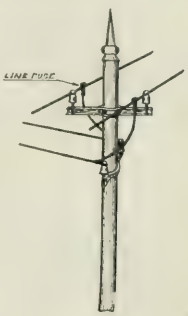


Fig. 4.

The "Esla" Overhead Line Fuse Connector.

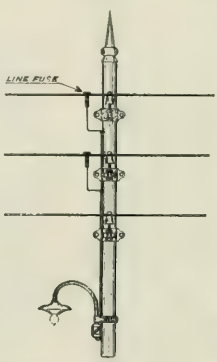


Fig. 5.

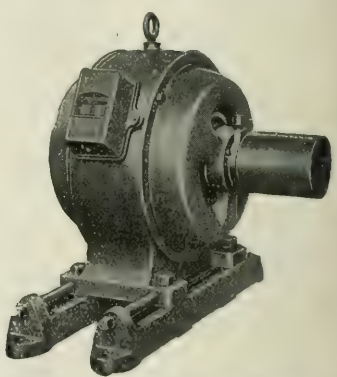


Fig. 6.—Battery-Charging Motor-Generator.

These fuse connectors are particularly suitable for sections or services up to 20 A; a larger size is made for use up to 60 A, but in no case is this apparatus intended to take the tensile strain of a conductor, as will be noted from the sketches, figs. 4 and 5, of the fuse connector in use.

Battery-charging Motor-Generator.

A convenient and efficient form of motor-generator for charging the secondary batteries of automobiles, &c., has been designed by Messrs. Howells & Co., Bank Chambers, 329, High Holborn, W.C.1. This is a single-carcase machine (fig. 6) with electrically-separate motor and generator windings built up on the same 1¼-in. shaft mounted on ball bearings. The motor can be wound for 1, 2, or 3-phase current, and the most suitable form of starting gear is supplied in each case. The dynamo is a two-pole, shunt wound machine with ample commutator and brush contact surface. The generator is designed to give an output of 500 W at any desired pressure. The usual design is for 30 V, reducible by a shunt regulator to 12 V.

The overall length of the machine is 18.5 in., the height is 11.5 in., and the width including terminal box is 11.5 in. The case is finely finished with grey enamel.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Estimating for Wiring Installations.

Having read with interest the article and correspondence on estimating for internal wiring, it has surprised me that the question of labour has not been considered as one of the chief reasons for the range of prices submitted for the same job.

A ratio in price of 2 to 1 is common for jobs of 200 lights, even where certain grades of materials are specified and the samples submitted with the highest and lowest tenders respectively have been of exactly the same make.

My experience shows me that certain contractors have trained their boys in such a manner that at the age of 17 or 18 years they are quite capable of doing a decent average job against any man drawing the full local rate of wages.

By using this class of labour under supervision these firms get the work every time when price counts, as on "plain pendant" jobs the labour cost amounts to practically half the total when men on the full local rate are employed.

I quite agree that architects as a general rule send out a specification which does more harm than good. It is a common occurrence to spend a quarter of an hour on the 'phone settling what is to be included and what is to be an extra; whether close joint or screwed conduit is to be allowed for; the grade of cable and type of switch and lamp holder, &c., to be used, and then to give it up and quote on what you know will make a good job—and lose it by a 2 to 1 ratio.

To standardise materials would be to standardise prices, and this would be of no benefit to the contractor or anyone else.

I have found that where the local supply authorities have been asked to assist in preparing specifications, they themselves, the customer, and the contractor of repute, have all felt the benefit of such action.

In the large majority of cases, however, the only interest taken by the supply authorities occurs when they put the Megger on. But their reading, however high, does not necessarily mean a good job, and the sooner their willingness to help is taken advantage of, the sooner shall we see a stop put to the ever-increasing number of "cheap jacks" with which the trade is becoming flooded.

Delta.

Nottingham, *September 11th*, 1922.

Lamp Discounts.

Your correspondent "A Small, but Hard Hit Contractor" is surely wrong when he writes: "There would not be a greater sale for lamps if they were cheaper." Every reduction in price of any article pertaining to electricity must encourage its use. Lowering the cost of an electrical installation or reducing the price of energy assists in increasing the demand.

If your correspondent does not like to be "de-graded" by the "ring" firms and is not satisfied with the discounts allowed him by the E.L.M.A., why does he deal with them? There are lamp manufacturers outside the "ring" who are making lamps at least as efficient as "ring" lamps, and having brought their prices down, still allow the contractor and factor liberal discounts and render them equally good service. This is proved by the growing number of important undertakings which are purchasing non-ring lamps, and I understand that the Electrical Contractors' Association of Scotland has dropped the E.L.M.A. and made an arrangement to sell a well-known lamp of the non-ring variety.

The Scot knows a good thing when he sees it, and also which side his bread is buttered, and here is another proof of it.

Ashley P. Pope.

London, *September 11th*, 1922.

Tube Railway Risks.

In your issue of July 14th, on page 39, there is a paragraph headed "Tube Railway Risks," in which comment is made about the accident on the Interborough subway on July 6th. A report from the New York correspondent of the *Morning Post* is quoted, and your readers are informed that there were three killed and many injured. The facts are that no one was killed and no case of serious injury occurred, most of the latter being prostrations due to heat and excitement incident to using the emergency exits, &c. That so much at-

tention and publicity was given to this ordinary mishap may be explained only by the desire on the part of certain of New York's gutter press to make a sensation for the purpose of making sales, but, of course, no newspaper correspondent will cable a later contradiction of an unfounded story of disaster and death. Though there are many defects in the manner of operation of the railway mentioned, the fact cannot be denied that it is remarkably free from serious accidents, and the danger of fire is remote, as the rolling stock is now of steel. The fire extinguishers used in putting out the flames of burning insulation, which panic-mongers said gave out deadly phosgene gas, causing the mythical deaths, were of the well-known carbon tetrachloride type, which have been on the market for years, and used in numerous small fires without pronounced ill-effects upon human beings.

I trust you will be able to place these remarks before your readers.

A. Bliden.

New York, *August 29th*, 1922.

[We are glad to know that the facts were exaggerated. We dealt with the matter of the fire extinguishers in our last issue, p. 346, giving the results of investigations made by the New York Transit Commission, from which it appeared that no blame attached to the use of carbon tetrachloride.—Eds. Elec. Rev.]

Power Station Engineers' Salaries.

I see our oppressors are at it again. Several years ago I left the electricity supply industry owing to the poor remuneration; I did not see the fun of wasting my brains on a lot of parvenu employers for little more than a labourer's wage.

Several months ago I returned to the supply industry under the schedule. I thought the industry had become sane; it had a National Joint Board to settle salaries and holidays, sick pay and other things, and generally see that employés had justice; however, I am wondering if I have made a mistake. The first jag I got was a reduction of salary on July 1st last. According to the Joint Board pamphlet, salaries are reviewed every three months and rise or fall with the retail cost of living; during the three months ending July 1st there had been an increase in the cost of living, therefore I expected an increase of salary, but got a reduction. I wrote the Joint Board about it, and so far have only received a stupid evasive sort of reply.

The next jag I got was when I opened my Review last week. I find the employers are having a conference with the E.P.E.A. and are calmly proposing to scrap the schedule and adopt a lot of silly and impertinent proposals of their own; it appears that the British employer as a class has not lost any of his arrogance and does not understand anything except a strike.

It is a great pity the E.P.E.A. did not support its industrial members in the early days; the employers know all about the loss of members and think they can now take advantage. However, people usually do not make the same mistake twice, and the question arises whether we had better wake up and rally round the E.P.E.A. banner and thoroughly smash the dishonest employer gang.

There can be no interest in work while this uncertainty continues; we want efficiency first, not dividends—low pay will not get efficiency and neither will uncertainty.

Power.

September 11th, 1922.

The Village Power Station.

Mr. A. N. Rye, quite properly, speaks as he has found things. May I add that I also wrote as I have found them?

Mr. Rye is entitled to his opinion and I to mine. In closing, I would remind Mr. Rye of *one* little difference between us. He is the head of an organisation having powerful friends in the financial, manufacturing, and organising branches of our industry; I work for, and at the request of, separate clients.

Arcadia.

September 11th, 1922.

Electricity Supply Voltages.

In your leader in the current issue of the Review you refer to my advocacy of a lower pressure than 200-250 volts for lamps and appliances supplied with alternating current, but you do not mention what is part and parcel of this proposal, *viz.*, a much higher pressure of distribution, *viz.*, 2,500-3,000 volts. It is important to distinguish between the pressures of distribution and of utilisation which, though often one and the same, need not be so. If we are to get heavy heating and cooking loads, economy demands much higher pressures than 400-440 volts for distribution, but for safety of utilisation, 250 volts is as high as, in the opinion you express in your article, it is desirable to go, while in my opinion it is undesirably high. This change would be only one more step in the direction of Dr. Ferranti's Deptford scheme, which was 10,000 volts, 2,400 volts, and 100 volts or 50 volts in the houses, and his general principles of the 'eighties are the practice of to-day and to-morrow.

You agree that though, to the honour of manufacturers, they have produced good 220-volt lamps, yet the 100-volt lamp is better; ask the makers of small motors for 200-240 volts whether they would welcome 100 volts or not. The fact is that for the consumer and the lamp and appliance maker and for the wiring contractor there are *no* advantages in 200-240 volts over, say, 100 volts, while for the distributor 400-440 volts is a miserably low pressure.

It is the wonderful flexibility of alternating current in respect of pressure which is the chief justification of its practically well-nigh universal use for new systems; it seems most unfortunate that custom should fetter it with the limitations as to pressure which, commercially speaking, are inseparable from direct current.

C. H. Wordingham.

Westminster, *September 12th*, 1922.

REVIEWS.

Employé Training: A Study of Education and Training Departments in Various Corporations. By J. V. L. Morris, Ph.D. Pp. xxiv+312; 4 figs. London: McGraw Hill Book Co., Inc. 1921. Price 18s. net.

In view of the ever-increasing keenness of the struggle for commercial and industrial supremacy it is essential that we should occasionally pause and pass in review the methods upon which we are depending for the efficient training of our industrial forces. Since everyone, from the marshals and captains of industry to the humblest worker in the ranks participates equally in national industrial success or failure, it is desirable to survey the whole field of industrial training, and this with a view, not merely to the present requirements of industry, but with a view to the requirements of a decade hence. Our war and post-war experience should suffice to convince us of the difficulties of rapid training; it is impossible to have a well-trained industrial army to-morrow by beginning its training to-day, and it will be too late to develop schemes of industrial education when by our lack of training we have lost our trade.

The book before us is a pointed reminder of what is being done in this matter by our cousins across the Atlantic, and is consequently worthy of the attention of employers of labour, educationists, and workers alike. We would add that even cabinet ministers might do well to read, mark, learn, and inwardly digest the schemes of training by means of which the Amercian commercial and industrial corporations are trusting to win an even greater share of the world's trade than they already hold.

"Employé Training" is a study of the education and training departments in various American corporations, and the author says that it has been undertaken in order to ascertain to what extent manufacturing industry can be relied upon to educate and train its own workers. The necessity of such an investigation being undertaken in this country comes home to us with added force when we remember that the Education Act provisions for continuation education have been indefinitely postponed, and that if our industrial adolescents are to be given any training at all beyond the truncated curriculum of the elementary schools it will probably depend upon the will and capacity of their employers to provide it. That some British employers have already undertaken the responsibility for training their employés is well known to us, and the rapidly increasing number of men so trained is doing much to strengthen our industrial position. The existence of such organisations as the Association for Education in Industry is an earnest of the more general recognition of the necessity for industrial training, but whereas the movement in this country is limited, and often regarded as an embellishment rather than an essential part of the industry, in America the training of employés is undertaken in earnest by practically all the great manufacturing companies.

During the making of this book Dr. Morris visited forty establishments, and, while he does not claim that it is in any sense a complete survey, it is certainly a representative one. Industries employing from 500 to 50,000 were investigated, ranging from the highly-organised electrical manufacturing, rubber, and automobile industries, to small isolated cable and crane works. Wherever possible the educational work was seen in actual operation; house organs and apprenticeship announcements were consulted, and the descriptions were in all cases submitted to the training executive before final writing.

The various companies have been grouped according as they provide: (1) comprehensive programmes for apprenticeship and special training; (2) programmes emphasising apprenticeship; (3) programmes emphasising special training; or (4) special programmes of technical instruction. The first chapter deals with four electrical works of type 1, *viz.*, Westinghouse Electric Co., of Pittsburg; General Electric Co., of Schenectady; G.E.C., of West Lynn; and the Western Electric Co. Chapter 2 deals with the Goodyear Tyre, Ford Motor, and Panhard Motor Companies. These seven examples cover every variety of industrial educational activity: apprenticeship, pre-graduate and post-graduate pupilage, works schools, night schools, Americanisation

[illegible] classes, training of learners, instructor and testers, intensive courses for [illegible] and other vocational and vocational schools are described in chapters devoted to these comprehensive problems.

Among the programmes described in somewhat smaller detail, one of the most interesting is that of the National Cash Register Co. Here the apprenticeship scheme is organised in a most elaborate manner, and full details are given in the book of the [illegible] shop report routine and record-keeping systems.

Under the heading "Outlined Apprenticeship Modern Practice," a large number of schemes of apprentice training are given in Section II of the book. Among the companies in whose educational programmes the idea of apprenticeship is emphasised may be mentioned the Brown & Sharp Manufacturing Co., the Warner & Swasey Co., Yale Manufacturing Co., Westinghouse Air-Brake Co., and the Weston Electrical Instrument Co. Separate chapters are devoted to apprenticeship in shipbuilding, railroad and locomotive shops, and the printing industry.

Many corporations, for whose purposes apprenticeship seemed unsuitable, have nevertheless found it desirable to introduce some form of special training for their juvenile employés. Six examples of this have been studied by Dr. Morris, and are referred to in detail in Section III.

Taking the whole field surveyed in this volume, covering the iron and steel, engineering, shipbuilding, railroad, and printing industries, three main conclusions present themselves. First, there is abundant evidence to controvert the rather prevalent opinion that apprenticeship is wholly dead. Secondly, it is demonstrated by this study that the larger American corporations are eminently capable of undertaking the training of their own employés, and that even in works employing fewer than 1,000 men the organisation of educational and training departments has been justified by successful results. Thirdly, there can be no doubt that the all-important factor in the success of any works education scheme is the appointment of a chief, competent to handle all the responsibilities of such a department. Experience has shown that he need not be experienced in the particular industry, or even in industrial training, but, to quote Dr. Morris's book, "he must be a good executive, a leader of men; he must appreciate the principles governing effective training; he must understand the works organisation, he must co-operate with all departments; he should be a man big enough to head up to the general manager and to work on a par with the various superintendents."

Dr. Morris's book is in every sense a masterly survey of employé training in America, and therefore demands the careful attention of all who have to do with the training of the industrial forces of this country.

Labour Trusts: Their Pretensions, Their Methods, and Their Influence on the State. By Theodore Rich. Pp. 32. London, 1922: Boswell Printing & Publishing Co., Ltd. Price 6d.

This little pamphlet is based upon a lecture given at St. Stephen's Club, Westminster, on December 14th, 1921. Since it is only by the spread of knowledge of the true facts, and of the laws which govern the carrying on of industry that any alleviation of labour unrest can be brought about, it is well that the matter should be discussed from all sides, and that all points of view should be considered.

It has been usefully remarked that "the right to discuss a subject involves the duty of trying to understand it." The ability to think constructively can be materially assisted by the consideration of the views of those who have attempted to express their ideas. The thoughtful reader will practise a kind of mental selection, and will accept those conclusions which his experience teaches him to be well-founded, rejecting those which he recognises as unsound, and reserving for further consideration those which have not come within his purview, or of the truth of which he is uncertain.

Major Rich has certainly formed views of his own, and he has endeavoured to express them. That being the case, they are entitled to consideration, as representing a point of view bearing upon the industrial situation. We suppose he would admit at once, possibly proudly, that he is a "diehard," and his creed would begin with the words: "I believe in *The Morning Post*." Down with all Sheenies, Huns, Chinks, Yanks, Dagoes, and Bolsheviks! They, particularly the first and the last, are responsible for misleading the British working man, who "is a reasonable fellow once you can get at him, and reason with him."

Perhaps we should explain that "Labour Trusts" is Major Rich's name for trade unions. He has considerable right on his side in resenting their tyranny over the individual. It is always the case that revolt against tyranny of one kind results in the establishment of tyranny of another kind. Yet we must not lose sight of what would be the state of things if the workers could not take united action. Major Rich accuses the Government of making it necessary for a man to join a trade union before he can be represented in labour matters. It is within the experience of all who have been in touch with the engineering industry that it was only by the formation of a trade union that the draughtsmen were able to get their pay adjusted. To the Reviewer's knowledge a deputation of draughtsmen was addressed in opprobrious language and sent empty away for the simple and openly avowed reason that the persons composing it were not members of a trade union. The omission having been rectified by the formation of a union, the reception afforded to the next deputation was of a very different character, all demands being immediately conceded. Is it surprising, then, that unions are jealous that all workers shall be included within their ranks?

"Ca' canny" is complained of as a cause of high manufacturing costs. The complaint is perfectly just and reasonable. It is necessary to improve the load factor of the worker, or he cannot work at a profitable rate. If the electricity station can work all day at a reasonable load, it will generate energy at a low cost. If the same number of kWh are required to be generated in a couple of hours, with little or no demand for the rest of the day, they will cost much more. The motive behind "ca' canny" is the provision of a job for someone else. Alas for the futility of good intentions! The result is that overhead charges are forced up so that more unemployment is caused. Yet "ca' canny" is practised by merchants, by manufacturers, by farmers, and by employers of every class. The fruit grower lets his fruit rot ungathered rather than sell it for what it will fetch. The diamond merchant controls the supply with the utmost care, so that prices shall not be lowered.

Industrial peace will not be brought about by changes of government. Industrial unrest is not due to one cause only, but to many. The utmost that can be done is to remedy the causes one by one, endeavouring always to take them in order of urgency.

We said at first that Major Rich had "endeavoured" to express his views, and we used the word advisedly. His views are entitled to consideration, but as a literary production the pamphlet is simply atrocious. It bears every sign of having been hurriedly typed, sent without correction to the printers, and passed for publication without reading. The result is scarcely coherent. Were we to give examples we could fill pages of this paper. We shall choose one only, from the last page: "An island in a Northern climate, without flourishing industry, can only keep a small population going, the woolsack is a reminder of this." Nay! We are afraid that, like Mr. Bronson, we are "not equal to the intellectual pressure" of this allusion. It is a pity that a lecture which was evidently well received should be spoiled by lack of editing.

Economics of Electrical Distribution. By P. O. Reyneau and H. P. Seelye. Pp. vii+209; 59 figs. London: McGraw Hill Book Co., Inc. Price 12s. 6d.

The importance of economics to engineers within reach of the higher administrative positions of electricity supply undertakings in very obvious. The number of text-books available for study is small, so that the book under review should be of very considerable interest, at least to the above-mentioned class.

The subject is dealt with from a general standpoint, so that the fact of the examples being wholly American is not a serious drawback.

The discussion of transmission lines very naturally occupies a large portion of the book, and the work on this subject serves as a model for the method of investigation of cost problems on minor parts of distribution systems.

The influence of the characteristics of the load on energy costs is very fully dealt with. The method of treatment is to consider separately and collectively the effects of power balance, demand, load, and diversity factors.

Only a.c. distribution is dealt with, and this is decidedly unfortunate, as an examination of the economics of the great d.c. systems used in America would have been extremely interesting.

The style of the book is clear, and the authors are evidently deeply in earnest. The introductory and final stages are apt to be irritating, due to repeated statements of the same facts.

This book is by no means easy to read in many parts, but the reviewer is of the opinion that it would be well worth the while of any electrical engineer to give it careful study.

The work of the publishers would be difficult to improve on.

Electrical Supplies in South Africa.—The *South African Mining and Engineering Journal*, of Johannesburg, dated August 12th, states that business in electrical goods was slack—little doing in town, not much coming to hand along the Reef, and country activity showing itself more in the shape of inquiries than orders. Still, inquiries indicate that trade is moving or about to move, and it is certain that from the various inquiries for materials received no long time would probably elapse before business resulting therefrom would ensue. Lamps are now 14s. to 15s. wholesale, 18s. retail. Stocks on hand in all lines are good and are constantly being replenished by new consignments. Prices are very firm oversea, and, notwithstanding a few reductions presently occurring, future quotations are found to be higher, as the market both in Britain and on the Continent is firming.

BUSINESS NOTES.

Bankruptcy Proceedings.—J. Jones and J. R. Jones (J. Jones & Son), electrical engineers, 7, Chapel Street, Penzance.—Trustee: Mr. W. C. Pezzack, Public Buildings, Penzance, released May 30th.

T. D. Waring, electrical engineer, late of 18, Waterloo Place, Coney Street, York. Trustee: Mr. D. S. Mackay, Official Receiver, Red House, Duncombe Place, York, released June 12th.

J. F. Ludlow and R. R. Ludlow (Ludlow Bros.), electrical contractors, 196, Church Road, Redfield, Bristol. Last day for proofs for dividend September 23rd. Trustee: F. W. Darley, Official Receiver, 26, Baldwin Street, Bristol.

G. G. Grieve and A. A. Manges (Up-to-date Electrical and Mechanical Engineers), 14, West Bute Street, late 236, Bute Street, Cardiff.—The adjourned public examination of these debtors was held recently at the Law Courts, Cathays Park, Cardiff. The liabilities were returned at £619 1s. 3d., against assets of £114 6s. 8d., or a deficiency of £504 14s. 7d. Debtors attributed their failure to keen competition, the depression in trade and high rent. The examination was closed.

H. J. A. Maullin (Wilton Engineering Co.), electrical engineer, 124, Devonshire Street, Birmingham.—Receiving order made September 8th, on debtor's own petition.

M. O. Heckels, electrical wholesaler and agent, 643, Welbeck Street and Star Buildings, Northumberland Street, Newcastle-on-Tyne.—Receiving order made September 8th, on debtor's own petition.

Company Liquidations.—W. E. Blake, Ltd.—A meeting of members is called for October 11th at 3-7, Southampton Street, Strand, W.C., to hear an account of the winding-up from the liquidator, Mr. H. Everett.

Bedesco, Ltd.—Particulars of claims to be sent to the liquidator, Mr. A. E. Quaife, 155, Fenchurch Street, E.C., by October 12th.

Guildford Electricity Supply Co., Ltd.—A meeting of members is called for October 20th, at 115, High Street, Guildford, to hear an account of the winding-up from the liquidator, Mr. B. D. Holroyd.

Electrical Industries, Ltd., of 9-10, Pancras Lane, E.C.—First and final dividend of 5 1/7d., payable at the Official Receiver's offices, Carey Street, W.C.

Dissolutions of Partnership.—H. F. Lane & Co., automobile and electrical engineers, 110, Crawford Street, W.—Messrs. H. F. Lane and G. Love have dissolved partnership. Mr. Lane will attend to debts and continue the business.

E. Preston & Co., electrical engineers and gas fitters, 42, Grange Road West, Birkenhead.—Mr. J. McKenzie and Mr. W. H. Preston have dissolved partnership. Debts will be attended to by Mr. McKenzie, who will continue the business under the same style.

E. B. Parr & Co., engineering, electrical, and general pattern and model makers, &c., 224, Bermondsey Street, S.E.—Messrs. E. G. R. Parr, W. E. R. Parr, H. K. R. Sutton, A. C. Parr, and E. H. Parr have dissolved partnership. Debts will be attended to by Messrs. E. G. R. and W. E. R. Parr, who will continue the business.

Unit Electrical Co., Titan Tire & Rubber Co., and Cousens and Ellerby, electrical engineers, rubber manufacturers and rope and twine merchants.—Mr. G. P. Ellerby and Mr. G. H. Carter have dissolved partnership. Mr. Ellerby will attend to the debts of the rope and twine departments, and Mr. Carter those of the electrical engineering and rubber manufacturing departments.

Trade Announcements.—We are informed that the business of Messrs. L. A. Booth & Co., electrical engineers and contractors, of 10, North End Road, Golders Green, which is owned by Messrs. Wm. J. A. Keene, Ltd., of Palmers Green, will henceforward be carried on under the name of Wm. J. A. Keene, Ltd., at 10, North End Road, Golders Green, N.W.11. Mr. L. A. Booth is no longer in any way connected with the firm.

Messrs. Wood & Rintoul, 52, Greek Street Chambers, Park Row, Leeds, have been appointed representatives for Yorkshire and Lincolnshire of the Wardle Engineering Co., Ltd., Manchester.

Messrs. Shenton & Co., electrical manufacturers and merchants, of Park Lane, Queen Street, Cardiff, have removed to 11, Moira Terrace, Cardiff. Telephone No.: 441.

The Ironclad Switchgear Co., Ltd., informs us that its new London address is: 23, Queen Anne's Gate, Westminster, S.W., where large stocks will be available within a few days. The London office will deal with inquiries and orders emanating from South Wales, Midlands, East Coast, Southern Counties, and overseas.

Messrs. J. G. Proger & Sons, heating, lighting, ventilating, and sanitary engineers, 12-13, Trinity Street, Cardiff, will shortly remove to 17, St. Andrew's Crescent, in the same city.

Messrs. Hamnet & Andrew, 72, Rosamond Street East, All Saints, Manchester, have been appointed sales agents for Lancashire and Cheshire and surrounding districts by Messrs. Brasse, Ltd., for "Secura" insulating sleeves.

Although a small fire recently broke out at the premises of the London Electric Stores, in Oxendon Street, Haymarket, business will be carried on as usual.

Receivership.—Rayner & Heald, Ltd.—Mr. S. Heald was appointed receiver and manager on September 5th. He informs us that debentures to the extent of £10,000 were issued in 1919, and it is unlikely that sufficient will be realised to satisfy the debenture holders' claims.

Catalogues and Lists.—Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publication No. 325, giving illustrations and prices of broadcast receivers for wireless telegraphy and telephony; and No. 329, describing the "Sterling" intervalve transformer—priced.

Messrs. John Jardine, Ltd., Deering Street, Nottingham.—Sheet No. 70, illustrating and describing "stalk hangers" for shafting.

The Piggott Electrical Co., Ltd., 24, New Bridge Street, E.C.4.—"Electrical Plant and Monthly Sales Register" for September.

London Electric Wire Co. & Smiths, Ltd., Playhouse Yard, Golden Lane, London, E.C.1.—New issue of the company's "wire tables," giving data regarding British standard sizes of annealed copper wires, showing primary, secondary, and alternative sizes from 0.001 to 0.5 in. diameter, wire gauges in common use, B.E.S.A. standards for wires, cables, and flexibles, nickel chrome and Eureka wires, fuse tables, logarithms, &c.

Messrs. Bruntons, Wire Mills, Musselburgh, Scotland.—An illustrated pamphlet describing the "Brunton" torsion machine for wire.

The Cambridge & Paul Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A mailing card illustrating and describing the "Cambridge" portable CO_2 and temperature recorder.

Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C.1.—September price list of d.c. motors in stock.

Price's Electrical Supplies, Ltd., Caxton House, 58, Great Charles Street, Birmingham.—Reduced price list of electric lamps.

Messrs. S. Guiterman & Co., Ltd., 35 and 36, Aldermanbury, E.C.2.—Two illustrated and priced pamphlets dealing with the "Adjusto-Lite" lamp fitting.

Messrs. A. H. Hunt, Ltd., Tunstall Road, Croydon.—Four coloured showcards, three advertising "Hellesen" dry batteries of various types, and the other illustrating an electric hand lamp.

The Electrical Mineral Products, Ltd. (Gartheiniog Slate Quarries), 42, Blackfriars Road, S.E.1.—A price list of planed slate slabs of various areas and thicknesses.

Westinghouse Electric International Co., New York, U.S.A.—A pamphlet, illustrated in colour, advertising the firm's railway, mining, and hydro-electric equipment.

Catalogues Wanted.—Mr. J. T. Harvey, electrical contractor, 88, Kimberley Road, Cambridge, is desirous of obtaining current issues of catalogues and price lists.

Copper and Lead Prices.—Messrs. F. Smith & Co. report September 12th:—Copper (electrolytic) bars, £71 5s., 5s. increase; do. do. sheets, no change; do. do. wire rods, £81 5s., 5s. increase; do. do. h.c. wire, no change.

Messrs. James & Shakespeare report September 13th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £25 5s., 5s. decrease.

Wireless in Germany.—The Drahtloser Uebersee Verkehr Aktien Gesellschaft (Wireless Overseas Traffic Company) of Berlin, with controlling stations at Nauen, Teltow, and Eilvese (for Hanover), is meeting the anticipated extension of wireless communication by an increase of capital to the extent of fifty million marks (at present rates £10,000). The prospectus gives some interesting facts of the increased use of wireless on the part of the people. For communication with the United States alone, in 1920, two and a half million words were transmitted. In 1921 the total was eight and a half millions. During the first quarter of the current year the number rose to over three millions, or at the rate of twelve million words for the year.—*The Times.*

Salesmanship Conferences. — The British Electrical Development Association is arranging a series of salesmanship conferences in Newcastle during the coming winter. The first of these will be held on October 12th at the Drawing Room Café, and will be opened by Mr. J. W. Beauchamp. The conferences will be held monthly, and details may be obtained from Mr. W. F. T. Pinkney, c/o the Newcastle-upon-Tyne Electric Supply Co., Ltd., Royal Exchange Buildings, Newcastle-upon-Tyne.

Exports to Ulster.—As many English exporters are under the impression that the necessity of obtaining permits for the importation of certain goods into the Irish Free State applies also to Ulster, we are asked by the "Ulster Association for Peace with Honour" to state that this is not the case.

Local Exhibition.—At a recent meeting of the Swansea Corporation Electricity Committee, the borough electrical engineer (Mr. J. W. Burr) referred to the forthcoming Electrical Exhibition at Swansea (October 2nd to 14th), and said the committee would be interested to hear that the whole of the available space for stands at the Drill Hall had been taken up. Practically all the large firms manufacturing electrical apparatus were exhibiting, and there was no doubt it would be one of the finest electrical exhibitions ever held in Wales. A sub-committee was appointed to arrange the advertising and other details.

Indian Import Duties on Accumulators.—(1) Enclosed splash-proof type for motor vehicles, 30 per cent. *ad valorem*. (2) Enclosed splash-proof special type for electric traction, 15 per cent. *ad valorem*. (3) Special type for train lighting frequently imported and always recognised as part of a system, 10 per cent. *ad valorem*. (4) Other types used in direct connection with a prime mover whether for power storage or other purposes, 2½ per cent. *ad valorem*.—*Reuter's Trade Service* (Calcutta).

A Preston Guild Tableau.—One of the features of interest in the trade procession which was a part of the proceedings during the Preston Guild celebrations was the display of the Lancashire Dynamo & Motor Co., Ltd. This was a five-ton electric lorry bearing tableaux contrasting the old way of hammering with the new, electrical, way. At one end was a prehistoric blacksmith operating a rough mechanical hammer



A Preston Guild Tableau.

constructed of logs and green timber. The other tableau was a modern pneumatic hammer belt-driven by a "Lancashire" motor. The accompanying illustration depicts the display.

The English Electric Co., Ltd., had a display showing the progress of artificial lighting, locomotion, and "wireless."

Carron Company Developments.—Carron Company has recently opened new stockrooms and workshops at 15, Upper Thames Street, E.C.4, where an up-to-date building has just been erected complete with every modern appliance for the economic and speedy handling of orders. Goods are dispatched from the company's works at Carron, Stirlingshire, *via* its own fleet of steamers, the "Carron Line," to its wharf on the Thames, and thence by barge direct to the new warehouse, which has an entrance to the river. After testing and checking, orders are thence dispatched by means of a new fleet of motor vehicles, with the result that practically immediate delivery should be possible of any of the firm's products which may be required. An up-to-date workshop and also a trade counter are features of the new premises, and in addition to the existing trade showrooms at 50, Berners Street, W.1, and at 15, Upper Thames Street, which will be retained, an additional showroom will shortly be opened at the latter address, which will be devoted exclusively to heavy cooking apparatus for marine and industrial use which has long been a special feature of the firm's business.

India's Import Trade.—In forwarding to the Department of Overseas Trade a summary of India's import trade during the first quarter of the statistical year, H.M. Senior Trade Commissioner at Calcutta states that the total imports of merchandise into India for the three months April-June declined from 66 crores of rupees, in 1921, to 53 crores, in the corresponding period of the present year. It is satisfactory to note that the United Kingdom increased its share from 58 to 62 per cent., as contrasted with a reduction in the share of the United States from 11.6 to 7 per cent., and in the case of Japan from 6.7 to 5 per cent. German shipments, however, rose from 1.9 to 5.7 per cent., and those from Belgium from 2.2 to 2.7 per cent. It is not surprising that the prodigious imports of machinery and millwork of last year have not been maintained. The total imports in the first quarter fell from 10 to 6.4 crores.

The import of electrical machinery fell from 112 to 94 lacs. The British share increased from 71 to 74 lacs, in contrast to the decline in American imports from 36 to 12¾ lacs.

Last year's very heavy imports of electrical instruments and apparatus were not maintained, and the figures were reduced from 159 to 66 lacs. The British share fell from 113 to 46 lacs, that of the United States of America from 35 to 7 lacs, and that of the Netherlands from 2 to 1 lacs. Italy increased her proportion from 4.9 to 5.6 lacs, and the share of unclassified countries increased slightly from 3 to 4½ lacs.

Mazda Lamps.—Price Reductions Below Pre-war Prices.—A substantial decrease in the price of Mazda lamps came into effect on September 1st, the new prices being in several cases below pre-war level. Labour and materials still cost a good deal more than in 1914, and one might naturally expect present prices to be proportionately higher than they were before the war. That Mazda lamps actually cost less than in those days is attributed mainly to progressive reductions in manufacturing costs consequent upon increased demand, higher production, and improved methods.

In addition to the standard lamps referred to above, the prices of Mazda Candle, Tubular, and Train-Lighting lamps have also been reduced. Full information upon the new prices, together with generous supplies of advertising matter, may be obtained from the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C.4.

Book Notices.—*The Decimal Educator*, Vol. V, No. 17, September. London: The Decimal Association. Price 6d.—In this issue are a report of the sixth General Conference of Weights and Measures; a note on a system of decimal coinage propounded by Mr. T. Lawton; a review of Mr. W. A. Appleton's recent book on Labour policy; and many other items of interest and educational value.

The *Journal* of the South African Institution of Engineers, Vol. XXI, No. 1, August, 1922. Johannesburg: The Institution. Price 2s.—This issue contains the presidential address of Mr. J. W. Kirkland; a paper on "Home-made Apparatus for Welding Hollow Steel," by Mr. G. T. Andrews; a list of South African patents; and an index to Volume XX.

"Science Abstracts" A and B. Vol. XXV, Part 7, No. 295, July 31st, 1922. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

"Diesel Engines for Land and Marine Work," by A. P. Chalkley. Fifth edition. Pp. xviii+330; figs. 161. 21s. net.

"Manual of Reinforced Concrete," by C. F. Marsh and W. Dunn. Pp. xvi+504; 207 figs. Price 21s. net. London: Constable & Co., Ltd.

"Sparking Plugs," by A. P. Young and H. Warren. Pp. xii+106; 61 figs. London: Sir Isaac Pitman & Sons. Price 2s. 6d. net.

"Patents for Inventions," by J. E. Walker and R. B. Foster. Pp. xiii+377. London: Sir Isaac Pitman & Sons. Price 21s. net.

"Industrial Negotiations and Agreements," with a foreword by the Rt. Hon. J. R. Clynes, M.P. Pp. 76. Price 2s.

"The Fair Wages Clauses," pp. 16. Price 3d. London: The National Joint Council of the Labour Movement.

The Norwegian Fair.—The annual fair at Christiania has been a great success, and up to the present has been visited by more than 100,000 persons. Considerable orders have been received, and the exhibitors declare themselves very satisfied with the result of the fair.—*Reuter* (Christiania, September 9th).

Vienna International Fair.—The third International Fair was opened by the Federal President, Herr Hainisch, on September 10th. The number of exhibitors is four thousand 7 per cent. of whom are foreigners.—*Reuter* (Vienna).

Our Foreign Trade.—August Figures.—The following were the values of imports and exports of electrical goods and machinery during August, 1922:—

	August, 1922.	Inc. or dec.	Inc. or dec. 8 months, 1922.
Imports—	£	£	£
Electrical goods and apparatus	143,198	+ 51,526	− 576,519
Machinery ...	764,336	+ 87,936	− 3,111,609
Exports—			
Electrical goods and apparatus	644,749	261,171	− 4,846,608
Machinery ...	4,363,798	− 788,907	−18,875,287
Re-exports—			
Electrical goods and apparatus	8,210	3,615	46,223
Machinery ...	120,468	− 65,059	− 178,590

Lead Report.—Messrs. James Forster & Co., in their report dated September 9th, say:—Closing prices yesterday were practically the same as last week, at £24 5s. for the current month and £23 7s. 6d. for December. All metals have been quiet this week, and interest in lead has chiefly been shown for the December position. Transactions total about 3,600 tons. Lead continues to come in freely—about 3,000 tons appearing in the Customs entry so far this month for London and Liverpool alone, of which 1,800 tons is from Burma.

Scottish Motor Exhibition.—The Kelvin Hall Committee of the Glasgow Corporation recommends that the Scottish Motor Trade Association be granted the use of the hall from January 26th to February 3rd, 1923, at a rental of £1,850.

New United States Tariff Bill.—It is understood that a compromise was reached on September 9th at a conference between members of the House of Representatives and the Senate on the question of valuation, which forms the basis for duties in the new Tariff Bill. The Senate Finance Committee, in revising the Bill, rejected the American valuation scheme of the House of Representatives, substituting for it a modified form of foreign valuation.—*Reuter* (Washington).

For Sale.—By direction of the Disposal Board, Mr. C. D. Phillips will sell by auction, on October 3rd and following days at H.M. Factory, Pembrey, South Wales, plant and machinery, including boilers, pumps, electric motors and starters, electrical and miscellaneous stores, &c.

By instructions from the Sun Electrical Co., on account of the transfer to their new works, Messrs. H. Butcher & Co. will sell by auction on September 22nd, at 57 and 59, Neal Street, Long Acre, W.C., surplus plant, machine tools, stores, &c. (See our advertisement pages.)

Chinese Notes.—The Hsiao Huang Electric Co., of Huang Ch'iao, and the Changshu Electric Light Co., Ltd., of Changshu Kiangsu, have been registered.

The Foochow Telephone Co. has decided to increase its capital from $250,000 to $400,000.

New French Companies.—There has been formed at Lille (202, Rue du Faubourg de Douai) the Ateliers Electro-techniques du Nord for all operations relating to the industry and trade in electrical apparatus and their applications. The capital is 1,100,000 fr. in 500-franc shares, of which 1,200 are allotted to M. Henaut as consideration for his assets.

Manufacture d'Isolants Céramiques de la Drôme is the new title of the Société Francaise des Etablissements N.I.O.C.A., which has taken in the Manufacture Lyonnaise d'Isolants Céramiques (Société Raymond Durand et Cie.). The capital of the company is 700,000 fr., and its object the making of all articles related to electricity. Its offices are at St. Vallier (Drôme).

La Société Lorraine de Distribution de Gaz et d'Electricité has been constituted as a limited liability company at Montigny-les-Metz (Moselle), with a capital of 500,000 fr.

Les Secteurs Electriques de Provence has been formed in Paris (157, Rue Pereire) for the distribution of electricity for all purposes, with a capital of 400,000 fr., to be raised eventually to 5,000,000 fr. 760 of the shares (500 fr.) are allotted to the Omnium Francaise d'Electricité as consideration for its assets.

Oil-fuel Appliance Exhibition.—An international exhibition of appliances for the use of oil fuels is to be held in Paris, during October, under the auspices of the French Society of Industrial Chemistry.

Belgian State Railway Contracts.—The Commercial Secretary to H.M. Embassy at Brussels has forwarded extracts from the *Chronique des Travaux Publics* regarding a certain clause to be added to the existing "*Cahier des Charges Spéciaux*," under which foreign firms will, in future, have to state the place where the goods, the subject of the tender, are produced or manufactured when submitting tenders for Belgian State Railway contracts. United Kingdom firms may consult the extracts referred to on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (quoting reference No. 16598 F.W.).—*Board of Trade Journal.*

New Belgian Companies.—A co-operative electrical company styled the Electricité de Pecq-Estaimbourg, Nechin et Extentions has been formed at Tournai for the distribution of electric current in the federated communes named.

Ummels et Co. is the name of a firm registered as a company at Liége (29, Quai des Tanneurs). Its scope is electrical installations of all kinds and the manufacture of, and trade in, electrical materials.

G. Ludewig et V. Simonis, fournitures générales d'électricité is the designation of a company embodied at Liége (14, Quai de la Batt) for the objects indicated in its title.

Australian Engineering Wages.—Employés in the engineering industry are betraying signs of restlessness following the heavy reduction in wages which became operative on June 30th. In some country centres in Victoria direct action has been hinted at, but it is not thought that strike measures will be resorted to. The award reduced the pay of tradesmen from £6 2s. 6d. to £5 3s. 8d., and a recent meeting of about 700 Melbourne members of the A.E.U. decided not to resist the award, particularly as the questions of hours, classification, and some other rates, are to be dealt with by the Arbitration Court on August 1st. Meetings held in other States to consider the new award have expressed great dissatisfaction with the drastic reduction, but hitherto no stoppages have occurred. A considerable amount of unemployment exists in the iron and steel trades, and it is estimated that somewhere about 350 engineering tradesmen are idle in Melbourne. The proprietor of one of the largest engineering shops in the city recently declared that it was a case of "scraping along" to keep the men in the works employed.—*Reuter's Trade Service* (Melbourne).

Electricity Meters in Sydney, New South Wales.—At a recent meeting of the Sydney City Council electricity committee the deputy general manager of the Electricity Department reported that the Electricity Meter Manufacturing Co., of Sydney, had been paid £3,188 in excess of the market values ruling for meters at the time the several orders were placed. This was done with a view to assisting the company to establish the meter industry in Sydney. The first subsidy was in November, 1920, when the Council agreed to pay the company £1,000 more than it could otherwise have bought 1,000 meters for in the open market at the time.

Pending the receipt of a letter addressed to the Town Clerk by the company, the committee postponed till the next meeting its recommendation as to whether or not another order should be given to this company for meters, which it was pointed out, would be 7s. each above the price at which similar meters were quoted in England on June 30th last.

Mr. J. Bryden Brown (director of the Electricity Meter Manufacturing Co.) is reported to have said that he expected a duty of 27½ per cent. to be imposed on electricity meters imported from England, and 40 per cent. on meters imported from America. This, he claimed, would still show the Council a saving in purchasing the Sydney-made meter, which would be superior to the English meter now quoted to the Council at 33s.—*Sydney Daily Telegraph.*

A Works Visit.—At the invitation of the Brush Electrical Engineering Co., Ltd., Loughborough, a party of students from the Leicester Technical School paid a visit to the company's works on September 1st. The party was divided up under guides for a tour of inspection of the works and the firm's various manufactures.

Considerable interest was taken in the Brush-Ljungstrom steam turbine and the turbo-generator sets, the tramway and rolling stock departments, and the transformer department. At the conclusion of the tour, tea was provided by the directors, after which a few words of welcome by Mr. Brotherton, the works manager, were acknowledged by a hearty vote of thanks by Mr. Taylor, head of the engineering department of the Leicester Technical School.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries. Any firm desiring to enter an objection to any of the applications has one month in which to do so from the dates mentioned below. In the case of foreign firms the name of the British representatives to which the objections must be sent is also given.

Hobart. No. 413,688. Class 6. Electrical food-preparing machinery. The Hobart Manufacturing Co., Ltd., Hobart House, Charterhouse Street, London, E.C. August 9th, 1922.

Meghi. No. 426,279. Class 6. Wiring looms for commutators of motor-car engines. The Reliance Works Co., Ltd., Ryde Terrace, Floating Bridge, Southampton. August 9th, 1922.

Radiovox. No. 425,223. Class 8. Philosophical and scientific instruments and apparatus. Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C. August 9th, 1922.

Ethophone. No. 426,144. Class 8. Receiving and transmitting apparatus for wireless telegraphy or telephony. Burndept, Ltd., Aerial Works, Blackheath, S.E.16. August 9th, 1922.

Bakelaque Insulation, Best British Manufacture (lettering and design) electrical insulating material. Attwater & Sons, Hopwood Street Mills, Preston. August 9th, 1922.

Octherm. No. 426,093. Class 4. Carbons for electrical purposes and graphite, raw and partly manufactured. Eugen Conradty, trading as C. Conradty, 9, Spittlertorgraben, Nuremburg, Germany. August 16th, 1922.

Apollo. No. 426,704. Class 8. Wireless telephony and similar apparatus. Craies & Stavridi, Apollo House, 4, Bunhill Row, London, E.C. August 16th, 1922.

Pesco. No. 426,941. Class 11. Electric accumulators and batteries for medical purposes. Mitchells' Electric and Wireless, Ltd., McDermott Road, Peckham, S.E. August 16th, 1922.

B.W. (lettering and design). No. 426,786. All goods in Class 8. Wireless Appliances, Ltd., Palace House, Shaftesbury Avenue, London, W.C. August 23rd, 1922.

Magnophone. No. 426,890. Class 8. Wireless telegraph and telephone apparatus. Edward E. Rosen & Co., City House, 158, City Road, London, E.C. August 23rd, 1922.

Symophon. No. 426,937. Class 8. Wireless communicating instruments and apparatus. Mitchells' Electric and Wireless, Ltd., McDermott Road, Peckham, S.E. August 23rd, 1922.

Sep. No. 425,924. Class 13. Sparking plugs. The Lion Sparking Plug Co., 175, Rue Gray, Brussels, Belgium (Albert L. Mond, 19, Southampton Buildings, Chancery Lane, London, W.C.). August 16th, 1922.

Nichrome. No. 425,537. Class 8. Electrical resistances. The British Driver-Harris Co., Ltd., Caythorn Mill, Albion Street, Manchester. August 23rd, 1922.

Fardon. No. 426,655. All goods in Class 8. Wireless Speciality Apparatus Co., 13, State Street, Boston, U.S.A.

(Marks & Clerk, 57-58, Lincoln's Inn Fields, London, W.C.). August 23rd, 1922.

Telecepta. No. 42[illegible]. Class 8. Wireless communicating instruments and apparatus. Mitchells' Electric and Wireless, Ltd., McDermott Road, Peckham, S.E. August 23rd, 1922.

Aethercepta. No. 426,939. Class 8. Wireless communicating instruments and apparatus. Mitchells' Electric and Wireless, Ltd., McDermott Road, Peckham, S.E. August 23rd, 1922.

Wirelocepta. No. 426,940. Class 8. Wireless communicating instruments and apparatus. Mitchells' Electric and Wireless, Ltd., McDermott Road, Peckham, S.E. August 23rd, 1922.

Savolite. No. 424,534. Class 13. Electric lamps (ordinary [illegible]). Van de Hoofdfabriek der Philips Gloeilampenfabrieken, Eindhoven, Holland (Boult, Wade & Tennant, 112, Hatton Garden, London, E.C.). August 23rd, 1922.

Watliff Co. Commutator Engineers (lettering and design). No. 424,476. Class 6. Commutators and commutator bars for electric motors and generators. Watliff Co., 38, Webb's Road, Battersea, London, S.W. August 30th, 1922.

Owl (design). No. 425,631. Class 6. Electric horns and [illegible]. Thomas S. Rogers, 25, Edmund Road, Alum Rock, Birmingham. August 30th, 1922.

Midland Trade.—A Midland correspondent reports:—[illegible] is consistent of opinion among representative manufacturers and commercial men in Birmingham that the worst of the industrial depression has been passed. The outlook is distinctly better than recently: more labour, particularly in the metal trades, is being absorbed into industry, and consumption of current for power purposes is increasing at a satisfactory rate. Applications for services to the Electric Supply Department are numerous. As to the electrical industry itself (which is still rather quiet), it is reported that one large company is engaged on an important contract for generating plant for Sydney. Lighting sets for large private houses are also reported to be in better demand. The brass trade is fairly busy in electrical and kindred fittings. There is undoubtedly a rather more optimistic tone in industry generally, but obviously recovery can only be brought about slowly.

Outing.—The annual outing of the employés of the D.P. Battery Co., Ltd., Bakewell, took place on September 9th. Blackpool was again visited, and by special arrangement the party, which numbered about 200, travelled in reserved saloons on a special excursion train which left shortly before 5 a.m. Blackpool was reached in good time, and as the return train did not leave before 10 p.m. a full day was available in which to visit the pleasure beach and the various other attractions which Blackpool provides.

LIGHTING AND POWER NOTES.

Atherton.—Year's Working.—There was a net surplus on the electricity undertaking of £958. This has been transferred to the reserve fund account.

Australia.—Victorian Water Power Resources.—The Victorian Electricity Commission has formulated a scheme for utilising the hydro-electric resources of the State. Based on the Sugarloaf reservoir, on the Goulburn River, the project, when completed, will furnish electrical energy to Echuca, Shepparton, and Albury. The whole of the present probable electric power consumption of this territory has been found to comprise about 6,000,000 kWh per annum, with the prospect of an increase within a few years to more than double this amount. There will be five power houses, all of which will feed into a common sub-station, situated about eight miles from Sugarloaf, whence transmission lines, operating at 66,000 V, will run to the various power centres, and also connect, on the northern outskirts of Melbourne, with the latter's high-pressure network from Morwell. The estimated cost of the scheme is £[illegible]2,320. The scheme is to be completed by [illegible], but the commission has recommended that work on the transmission lines be first proceeded with, and the total [illegible] four years.

Newcastle (N.S.W.).—Last year 1,900 new consumers were added to the list of users of electricity in the municipality, and to meet the increasing demand for electricity for light [illegible] Council has decided to borrow £50,000 for additional plant.

Bankstown (N.S.W.).—The Town Council has approved a plan to borrow £30,000 at 6 per cent. in order to install an electric lighting system in the town.

[illegible] the Town Council proposes to borrow £21,000 to establish an electricity undertaking.—*Reuter's Trade Service* (Melbourne).

Brazil.—Electricity Supply Extensions.—A Liverpool firm of electrical contractors has received a substantial order from Brazil, placed by Messrs. Superville, Barbará, Buxton, Guilaym y Cia., who recently purchased from the Companhia Telefonica, Rio Grandense, the important electrical station of Bagé. The Brazilian company proposes to introduce various [illegible] and duty [illegible] be placed in the country.—*Reuter's Trade Service.*

Caerphilly.—Loan Sanctioned.—The Urban District Council has received sanction to a loan of £8,400 towards an electrical undertaking for the area. The amount includes £1,000 for estimated extensions in the next three years.

Continental.—Holland.—H.M. Consul-General at Rotterdam has forwarded to the Department of Overseas Trade extracts from the Dutch Press of recent dates concerning proposed undertakings which may lead to openings for British trade. A decision has been taken by the Town Council of Weesp in favour of the electrification of the municipality. For that purpose a loan of gld. 120,000 will be issued. The Town Council of Gouda has voted the sum of gld. 100,000 for a boiler with a heating surface of 305 sq. m. and further materials for the electric power station.

France. — The Compagnie Parisienne de Distribution d'Electricité has drawn up an extensive programme of improvement, involving an outlay of 548,000,000 fr. The programme is divided into three sections. A section comprising: extension of generating stations (94,000,000 fr.); extension of sub-stations and the building of a new sub-station (23,000,000 fr.); high-pressure feeders (18,000,000 fr.); high- and low-pressure distributors (33,000,000 fr.); high- and low-pressure networks (26,000,000 fr.); consumers' transformers, services, and meters (33,700,000 fr.); improvements of public lighting (3,800,000 fr.). After completion of the foregoing, B and C sections will be taken in hand, the former in order to raise the power of the company's installations to 235,000 kW; the latter in order to prepare the way for the adoption of a frequency of 50 cycles throughout the company's network. The sum allotted to these two sections is 34,000,000 fr.

Italy.—Since 1910 the Italian Company for the Utilisation of the Water Resources of Venetia has been engaged on a scheme for deriving electrical power from the waters of the Lake of S. Croce. The results were so good that plans were drawn up for the complete exploitation of the water power in this area, and the necessary works were started immediately after the war. In the 1910 scheme water was taken from the lake, which is 380 metres above sea-level, through a pressure tunnel having a capacity of 20 cubic metres a second, to the valley of the Meschio, and utilised in a power station at Fadalto, which contained three generating units of 4,500 h.p. each and one of 8,000 h.p., working with a fall of 95 metres. Flowing down the valley to the Lago Morto, 275 metres above the sea, the water fed a second power station at Nove, where the installation was of 17,000 h.p., and then passed to a third station at S. Floriano, a little below Nove, where the generating capacity was only small. The new plant is parallel with the first, with the difference that the quantity of water stored in the Lake of S. Croce is increased from 40 to 120 million cubic metres. The lake is fed by water from the River Piave, and the tunnel leading from it to Fadalto has a capacity of 100 cubic metres a second. In the new station at Fadalto, situated close to the old one, six new turbines of 24,000 h.p. each, are to be installed, bringing up the total capacity at this point to 166,000 h.p. The fall available varies from 84 to 110 metres, according to the level of the water in the lake. At Nove four 24,000-h.p. turbines are to be installed in a new power-house, raising the total capacity to 115,000 h.p. Later, the water from Nove will be partially utilised at S. Floriano, where the station will be enlarged to 5,000 h.p., and the remainder will be diverted through a new canal to the River Livenza, where there is a fall of 124 metres, and three 24,000-h.p. turbines will ultimately be installed. The turbines, three of which have already been finished by a Milan firm, will be coupled to alternators generating at 6,600 volts, 42 periods, the pressure being raised to 55,000 and 110,000 volts for transmission. *Times Trade Supplement.*

China.—Fushun.—The third power house of the Fushun Collieries is now in operation, with a capacity of 12,500 kilowatts, bringing the total capacity of the colliery supply up to 30,000 kilowatts. Pulverised coal fuel is used, the installation being of the Holbeck system using three crushers worked by a 75-h.p. motor and crushing up to five tons per hour. It is expected that the pulverised coal fuel principle will be extended to other plants later on, as it is considered that the pulverising allows of certain low-grade coals being used in the mixture which are otherwise wasted.—*Eastern Engineering.*

Crewe.—Loan.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £2,500 for plant, switchgear, &c., being part of the £10,000 applied for. The Electricity Commissioners have requested the Council to forward further information before giving sanction to the remaining amount.

Dover.—Loan Sanctioned.—The Town Council has received sanction to a loan of £1,108 for super-heaters at the electricity works.

Owing to the success of electric cookers let out on hire, the Town Council has decided to expend £200 on a further supply.

East Grinstead.—Electricity Scheme.—The Urban Council has decided to proceed with an electricity scheme for the town. The estimated capital outlay is £20,000.

(*Continued on page 381.*)

THE CROYDON ELECTRICITY UNDERTAKING.

Recent Reconstruction.

The County Borough of Croydon, consisting of Croydon, Selhurst, Thornton Heath, Norbury, Upper Norwood, South Norwood, Addiscombe, Purley and Waddon, lies on the southern border of the County of London, and has a population of close on 200,000. The area is mainly a residential one; there are very few industrial works of any size, so that the electricity supply undertaking has been unable, so far, to build up a day load at all comparable to the lighting demand.

The system as originally installed by Sir Alexander Kennedy in 1898 was single-phase, 60 periods, but in 1901 the Corporation converted the horse tramway to electric traction, and installed d.c. machines to cope with this demand. As the centre of Croydon was a large shopping area with a fair demand from small motor users, it was changed over to d.c. supply at the same time, so that there were always three sets of generators running to supply the three systems.

When Mr. A. C. Cramb became chief engineer in 1901 he decided that a low-pressure d.c. distribution system in such a scattered area would be very wasteful, and that high-pressure a.c. distribution with static substations would best meet the needs of the district, so he stopped any further d.c. extensions.

With neither hiring nor selling powers, the earlier efforts to develop a day load were severely handicapped, but by persistent effort a domestic load was gradually built up which, along with the tramway supply, gave a fairly good load factor, and prices were reduced in 1913 to 3½d. per kWh for lighting and to 1d. per kWh for domestic purposes.

It was early obvious to Mr. Cramb that he must unify the system of generation, but as he had made a profit every year with his numerous small sets, and large sums were handed over for the relief of rates, his committee did not take the suggestion of reconstruction seriously. During the war, however, when the lighting output was heavily restricted and the cost of coal and wages increased, the question of reorganising the supply could no longer be ignored, though it had to be deferred as Croydon was not an important munitions producing area. After the war the Electricity Committee, on the advice of the engineer, obtained a second opinion which fully endorsed Mr. Cramb's former recommendations, and he was instructed to reorganise the works.

The largest of the eleven existing sets in the works was of 1,000 kW. Mr. Cramb advised the installation of two 5,000-kW and one 3,000-kW three-phase sets, generating at 6,300 volts. He proposed to divide the single-phase a.c. network into two, install three sets of 1,500-kVA Scott-connected transformers, and feed one half of his single-phase network from one phase of the two-phase system thus produced and the other half of his network from the other phase, using the hospital bar of the existing feeder board for the second phase. At the same time he advised a change of frequency from 60 to the standard frequency of 50, although this would render obsolete all his existing single-phase reciprocating-engine generator sets, as well as the older types of air-cooled transformers in substations which overheated at comparatively light loads. In his opinion, the ability to link up with neighbouring undertakings at a future date outweighed the cost of such a change.

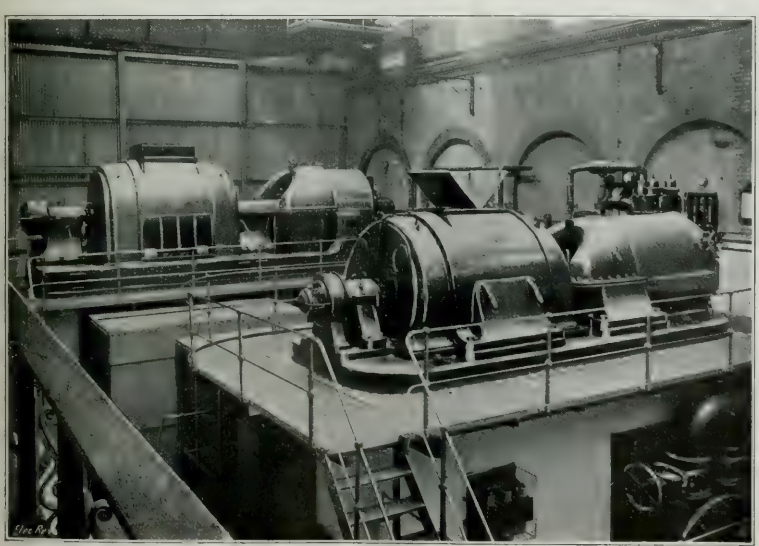


Fig. 1.—New Turbo-alternator Sets.

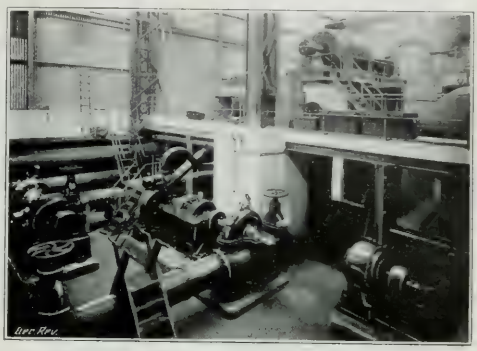


Fig. 2.—Circulating Water Pumps.

For the supply to the d.c. area and the tramways, four converters were to be installed.

To accommodate the necessary three-phase switchgear a new building was required at the side of the engine room (fig. 10), and as it was difficult to make the existing d.c. switchboard conform to modern practice in its old position, it was decided to transfer it from a side gallery of the engine room into part of the new switchgear building, and opportunity was to be taken to bring the equipment on the board up to date; the gallery in the engine room which would

thus be freed was to be used for the remote-control panels of the three-phase switchgear.

The position was complicated by the fact that the load was so heavy that every engine, pump, and boiler was working up to its limit, and the only time that was available to make room for new plant was during the summer "Daylight Saving" period. The problem was tackled by Mr. Cramb with characteristic thoroughness. The 20-ton main hand-operated crane was stiffened and electrified with the direct labour of his repair staff. He extended the engine room by 24 ft., displaced two 750-kW reciprocating sets, one of which was at the end of the building, and thus obtained sufficient room to install three turbo-sets.



Fig. 3.—D.C. Converter and Feeder Switchboards.

The order for the two 5,000-kW turbines (fig. 1) was placed with the Metropolitan-Vickers Electrical Co., Ltd., and that for the condensing plant was placed with Messrs. Hick, Hargreaves & Co., Ltd., their "Ejectair" being used to maintain vacuum instead of the ordinary air pumps. The 3,000-kW turbo set was of Messrs. Brown, Boveri & Co.'s manufacture (fig. 1), with Cole, Marchent and Morley condensers, also fitted with ejector air pumps. The Metropolitan-Vickers Electrical Co., being the main contractor, this unit was in stock, and was purchased to enable the two sets to be erected at the earliest possible moment, so that a change over on to the new system could be made to meet the increasing load.

The condensing water is cooled in towers, and orders were placed with the Davenport Engineering Co. for three towers of 240,000 lb. each. The make-up water for the towers, as well as for the boilers, is pumped from an artesian well 400 ft. deep, and the whole of the water is softened by a vertical Boby softener. It was found that softening the make-up water was far cheaper than cleaning the tubes, and that with softened water it was possible to run efficiently for several months without having to put a brush through the condenser tubes, and scale troubles have entirely disappeared.

Two of the circulating pumps (fig. 2), one for the 5,000-kW and one for the 3,000-kW sets, are motor driven, but the pump for the second 5,000-kW set is driven by a 160-b.h.p. De Laval steam turbine to enable the undertaking to commence condensing again in the event of a total shut down. The exhaust steam from this turbine is passed through a feed-water heater, and as it amounts to 5,000 lb. of steam per hour at full load, the effect on the feed temperature is appreciable. Venturi tubes with continuous recording and integrating recorders have been fitted to all condensate pipes and feed pump discharges. The glands of the Metropolitan-Vickers turbines are water sealed, and it is possible to check the condensate from each turbine by means of Venturi and Lea recorders. Repeated tests carried out over periods of days, weeks, and even on one occasion of two months, showed a variation of less than 1½ per cent. between the total readings as registered by the Lea recorder and the Venturi instruments.

The Metropolitan-Vickers Electrical Co. also secured the contract for the remotely-controlled 3-phase e.h.p. switchgear (fig. 4). The equipment is mounted in moulded-stone cubicles with iron doors at the back and front; the control board is of the push-button type, operating from an existing 120-volt battery formerly used for exciting the old alternators. The kWh generated are balanced against those sent out to converters, Scott-connected transformers, and feeders, so that any error in any meter is detected by the variation in the sum of the meters.

Merz-Price protective gear is provided for the generators, Scott-connected transformers and La Cour converters, but for the rotary converters, where the mid-wire connection and special tappings in transformers for traction and lighting supplies introduced too many variable factors, core-balanced protection in conjunction with a polyphase overload inverse time-limit relay is provided. In the case of the three-phase feeders, the Merz-Hunter split-conductor system of protection

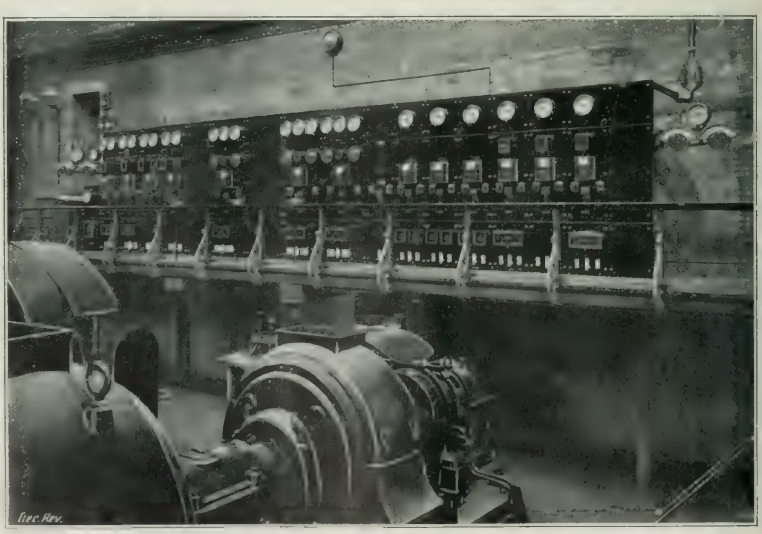


Fig. 4.—Remotely-controlled E.H.P. 3-phase Switchboard.

has been adopted. An automatic field-break switch is provided for each generator, and is actuated by the Merz-Price protective gear operating through a shunt trip coil and auxiliary switch. The Merz-Price gear also operates a set of steel shutters, which will automatically close the air exit of the alternator should a fault develop in the machine. To safeguard against the machine being run with these shutters closed, a Klaxon horn, which is operated from a battery, is sounded whenever the shutters close.

Dry air filters, consisting of three screens of cocoanut matting in series, are provided for each machine.

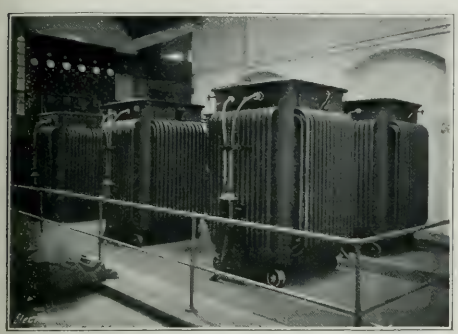


Fig. 5.—Scott-connected Transformers.

The matting can be cleaned very effectively by a portable vacuum cleaner, and has proved very effective.

The new d.c. switchgear (fig. 3) was manufactured by Messrs. Ferguson, Pailin & Co., but the main circuit breakers are of the Metropolitan-Vickers Electrical Co.'s construction. Aron meters installed at each end of the converter and generator sections of bus-bars meter all the d.c. sent out to the traction and lighting panels respectively, and with the readings of the three-phase a.c. meters on the converter panels, give the conversion losses, while the main d.c. meters act as a check on the sum of the kWh registered by the feeder meters. Throughout the reconstruction, special attention was given to installing the necessary apparatus to obtain data which could be balanced out so as to keep a check on losses, avoidable and otherwise.

Four converters (fig. 6) were installed at the generating station for supplying the tramways and the d.c. area. Messrs. Bruce Peebles & Co., Ltd., supplied a 500-kW and a 1,000-kW La Cour converter, and the British Thomson-Houston Co. supplied two 1,250-kW rotaries, with the British Electric Transformer Co.'s oil-cooled transformers.

Three sets of 1,500-kVA Scott-connected transformers (fig. 5) by the British Electric Transformer Co. convert from 3-phase, 6,300 volts, to 2-phase, 2,000 volts, and feed the existing single-phase feeder bus-bars (fig. 9). The ordinary running bar and the hospital bars of this board were connected to the two phases, the distribution area was divided into two, and the feeders from each area were connected to one of the phases. Messrs. Ferguson, Pailin & Co. were the makers of the six switch panels controlling the 2,000-volt side of the transformers, the panels being made similar to the existing Ferranti feeder board, and connected to it by means of extended bus-bar chambers. The Scott-connected transformers are protected by Merz-Price gear so connected that a fault in the transformer will trip both the 6,300-volt and 2,000-volt switches, and when the 6,300-volt switch is tripped by hand, it automatically trips out the 2,000-volt switch also, so that the latter cannot remain in when the 6,300-volt switch is "off."

The boiler-house plant consisted of four 8,500-lb. and two 12,000-lb. land-type, three 14,000-lb. marine type, and one 30,000-lb. land-type Babcock boilers, complete with superimposed steel economisers. (Orders have also been placed with Messrs. Clayton and Shuttleworth for a 35,000-lb. boiler, complete with steel economiser, having an overload capacity of 50,000 lb.)

During the coal strike in 1921, oil fuel was partially adopted, and afterwards the two 12,000-lb. boilers were permanently equipped for oil burning. By making a careful job of the brickwork it was possible to keep both boilers for peak work, and after use the burners were swung out, air doors were closed, and the hot brickwork maintained the pressure so well that the boilers were relied on for stand-by, and stand-by banked coal-burning boilers were eliminated.

A 10,000-gallon per hour Weir turbine pump displaced four reciprocating feed pumps, and a further pump of the same size is on order. The exhaust from the pump is discharged into the feed tank.

The dropping of the frequency from 60 to 50 periods made the change-over on to the new plant a complicated problem. It meant that the latter could not be synchronised with the old, and that a complete shut down of the old a.c. system and a start-up of the new would be necessary. Also, when the actual change was made,

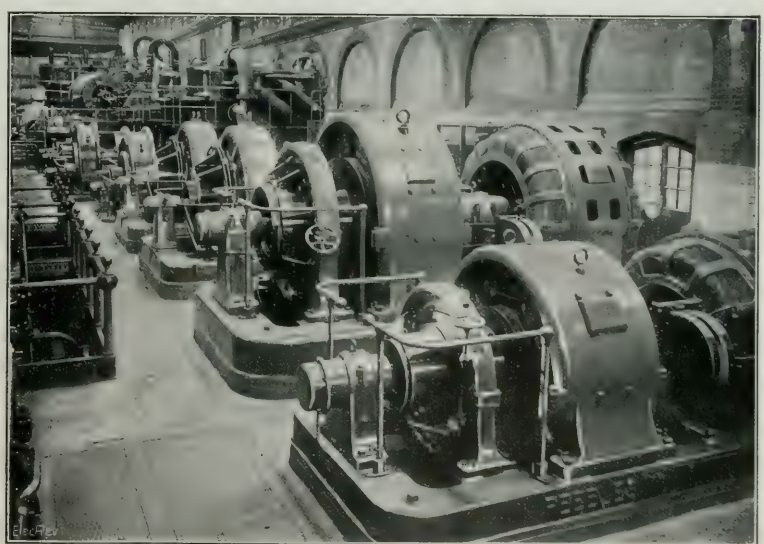


Fig. 6.—Four New Converters.

a tremendous amount of adjustment and alteration had to be made all over the system.

The total cost of the reconstruction amounted to well over £200,000, of which £185,000 was charged to capital, but the saving due to the new plant and to the better control over working which the new plant and reorganisation effected, has amply justified the bold policy of making a clean sweep of the old reciprocating

plant. The [illegible] has been nearly halved, the engine room staff has been reduced, and the repairs and maintenance charges are now moderate.

On the first year's working of the new plant a deficit of £19,000 was converted into a surplus of £26,000 on a revised tariff, which meant a reduction of £4,000, and yet during the greater portion of that year the saving effected was not so great as it is now, owing to the reorganisation being incomplete.

The charges for electricity have just been drastically overhauled, alternative "all in" tariffs being provided for business and domestic premises, with a running charge of 1½d. per kWh; power is charged for on a two-rate system, also with 1½d. per kWh as running charge; the charge to the tramways has been reduced to 1½d. per kWh after the first million kWh, and discounts for prompt payments range from 5 per cent. to 20 per cent., according to the size of the bill.

Although Croydon is not an industrial area, there are a number of small power consumers, but the principal hope for improved load factor lies in the domestic consumer. The Corporation has just sanctioned the expenditure of £2,000 as a nucleus for the hiring of cooking apparatus, and, judging by the output of an undertaking, or conversely the small amount of energy that is required per consumer for lighting, is well exhibited in the Croydon undertaking. There are about 9,500 consumers connected to the mains,



Fig. 8.—One of 27 Single-phase Transformer Sub-stations.



Fig. 7.—A Three-phase Sub-station.



Fig. 9.—Single-phase 2,000 V Feeder Switchboard.

applications which are coming in, there will be no difficulty in disposing within the next few months of cookers to that value. The difference a power load makes on the which total over 300 miles, and yet the energy sold amounts to only 10½ million kWh, of which four millions are used by the tramways, three millions for light-

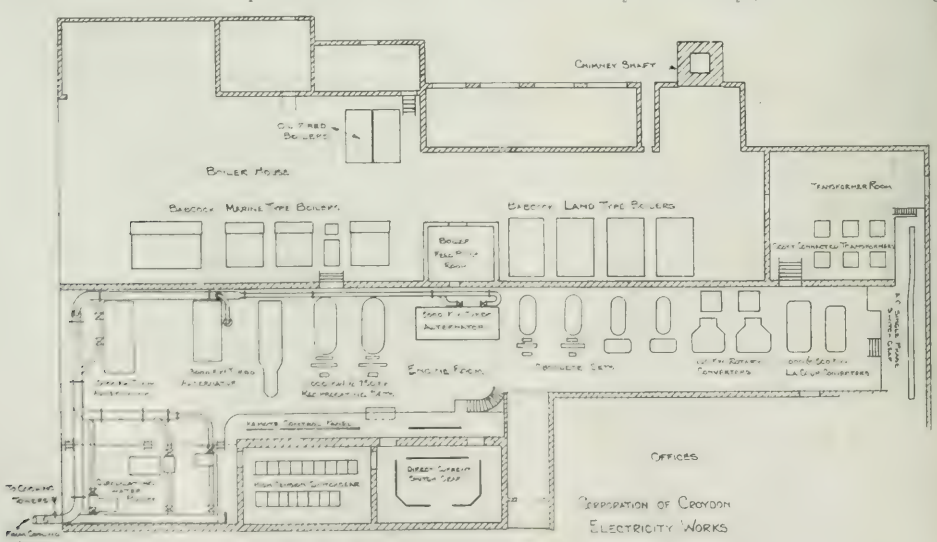


Fig. 10.—Plan of Electricity Works, Croydon.

ing. 2¼ millions for power, ¾ million for heating and domestic purposes, and ½ million for public lighting.

The load last winter varied from 6,300 kW in the afternoon to 350 kW at night, an extremely difficult load to meet efficiently in the boiler house, but with off-peak energy now available at just over 1d. a kWh it is expected that a better night load will be built up.

Croydon will always be hampered by having to pay from 15s. to 18s. a ton for transport charges on its fuel. All coal that comes by rail has to be transferred to the L.B. & S.C. Railway Co.'s lines, and it is too far away from the river and the sea to benefit by sea-borne coal, but in spite of that handicap, and the bad load factor due to its being a purely residential neighbourhood, the fuel cost has now been brought down to under 0.6d. per kWh sold, and the cost is still falling.

There is no doubt that the lower working cost due to reconstruction, and the better tariff that can be offered in consequence, will be exploited by Mr. Cramb to the utmost in building up a domestic load which will give him a load factor comparable with that obtained with power loads by some more fortunately situated engineers.

We are indebted to Mr. A. C. Cramb, borough electrical engineer of Croydon, for permission to publish the above notes, and to Mr. J. H. Parker, his deputy, for the photographs and other information regarding the undertaking.

LIGHTING AND POWER NOTES.

(*Continued from page* 376.)

Ecuador.—Water Power Plant.—Work is proceeding upon the installation of a new power plant for the use of the Quito Electric Light and Power Co. (Ecuador). The plant is located in the Chillo Valley, and will develop 3,000 h.p., but the falls utilised are capable of developing a total of 6,000 h.p. When the installation has been completed, and this is expected to be about November next, the Government will probably find it desirable to use the electric power provided to operate the Quito-Ibarrá railroad, the supply available proving ample for the purpose.—*Reuter's Trade Service.*

Forest of Dean.—Electricity Supply Scheme.—The Forest of Dean electric power scheme is still held up in consequence of a deadlock between its promoters and the proprietors of the Norchard Colliery Co. with regard to the area to be placed at the promoters' disposal in connection with the power station.

Gellygaer.—Proposed Power Station.—The question of erecting a power station at Hengoed is being considered by the U.D.C. in connection with the development of electricity supply.

Inverness.—Hydro-Electric Scheme.—The Town Clerk read letters at a recent meeting of the Town Council from Sir W. G. Armstrong, Whitworth & Co., Ltd., with reference to the local hydro-electric scheme. The company's negotiations with the Caledonian Canal Commissioners and the Ministry of Transport had been successful, and it had been able to formulate a scheme whereby sufficient power up to approximately two million kWh per annum could be obtained from the waters of the canal. The charge would be 1¼d. per kWh for power and 8d. for lighting. The Town Council approved of the scheme.

Lanarkshire.—Application for Orders.—The County Council is applying to the Electricity Commissioners for Special Orders under the Electricity Supply Acts, 1882-1919, in respect of a number of districts in the county.

Milford.—Site for New Station.—Mr. C. E. Newbon, chairman, at the annual meeting of the Milford Docks Co., stated that the company projected leasing a site on its property to a power supply undertaking which would supply electricity to the district and for dockside plant developments.

New Zealand.—Taumarunui.—The Borough Council has arranged a loan of £17,000 at 6 per cent. for a hydro-electric scheme, and it is anticipated that the works will be completed in 14 months. 18,000 h.p. will be provided.—*Reuter's Trade Service* (Melbourne).

Lake Coleridge Scheme.—Plans are complete for a second power station at Lake Coleridge, where already 9,000 kW are being generated by five of the six units originally provided for. The sixth unit will be ready in October, when the capacity will reach 12,000 kilowatts.—*Reuter's Trade Service* (Melbourne).

Rochdale.—Electricity in Bulk.—The Electricity Committee has decided to recommend that, subject to the approval of the South-East Lancashire Advisory Board, a further bulk supply of electricity be obtained from the Lancashire Electric Power Co., Ltd., for 10 years, and application is to be made to the Electricity Commissioners for sanction to borrow £20,625 in connection with the scheme.

Hire-Purchase System.—The Electricity Committee proposes, on the suggestion of the manager, to adopt a hire-purchase system for electric cooking stoves.

Salford.—Appointment of Engineer.—The Corporation decided at a recent meeting to appoint an electrical engineer, the salary suggested by the Electricity Committee being £1,250 per annum. At present the Committee has only a consulting engineer, and considers that with such a large undertaking it is unsatisfactory to try to carry on without an engineer.

South Shields.—Year's Working.—The annual report of the Electricity Supply Department (engineer: Mr. James Edgar) for the year ended March 31st last, records a total revenue from all sources of £84,756, as compared with £93,066 in the previous year. Working expenses totalled £41,999, as against £57,655, leaving a gross surplus of £42,757 (£35,411). After paying capital charges, &c., the result was a net profit of £8,684, which, although 15 per cent. below the previous year's profit, was satisfactory in view of the prevailing industrial conditions. The capital expenditure during the year was £39,317, of which £13,655 was for machinery, and £11,658 for a.c. mains. The energy sold was 6,733,983 kWh, as compared with 7,955,693 kWh. The works cost per kWh fell from 1.29d. to .94d.

Wallasey.—Price Reductions.—The Electricity Committee has recommended that the charges for electricity be reduced as follows:—Lighting from 6½d. to 6d. per kWh; heating, 2½d. to 2d. per kWh; power from 3¾d. to 3d. per kWh. The reductions will take place as from October 1st.

Walsall (Staffs.).—Price of Electricity.—When a flat rate of 2d. per lamp per week was charged the Town Council tenants for electric light, they used twice as much electricity as did the occupiers of houses that are supplied on the meter rate. The Council's tenants will therefore be made to pay in future for the energy they use.—*Daily Mail.*

Wellington (Somerset).—Electricity Supply.—The Urban Council is in communication with Taunton Corporation regarding a supply of electricity for the town.

Wolverhampton.—Year's Working.—The report on the working of the Electricity Department for the year ended March 31st last shows a total income of £103,255, as compared with £121,918 in the previous year. Working expenses amounted to £93,480 (£119,932), leaving a gross profit of £69,775 (£73,687). After meeting capital charges, &c., there was a net profit of £13,941. In the previous year there was a surplus of £27,064. The energy sold decreased from 21,559,351 to 16,208,656 kWh. An almost complete cessation in the demand for electricity by many works owing to the miners' strike accounted, in a large measure, for the reduced receipts. An interesting point in the report is that the decrease in revenue in 1921-22 of £28,663 was almost balanced by a decreased expenditure on coal of £28,223. Reductions in the charges for electricity were made at the end of the December, 1921, quarter, and the Electricity Committee has recommended a further reduction in the general percentage advances.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Provisional Order.—With regard to the Provisional Order being sought by the Corporation to extend the railless passenger vehicle service, the Town Clerk recently informed the Finance Committee that the Order had been made by the Minister of Transport, but the Parliamentary agents reported that the Ministry was unable to introduce the confirming Bill until the next session.

Brazil.—Railway Electrification.—The placing of contracts for the electrification of the Central Railway of Brazil is not proceeding with so much celerity as the Government could desire, while the class of bids so far received has not afforded the highest satisfaction. Of the offers submitted, four alone have been taken into consideration by the Government. These have been divided into six groups, including overhead distribution, sub-stations, locomotives, cars, signal system, and sheds and shops. Notice of the awards has yet to be received.—*Reuter's Trade Service.*

Continental.—Sweden.—Concerning the projected conversion to electric traction of the main line between Gothenburg and Stockholm, it may be recalled that the original estimate of the expenditure, as calculated in 1920, amounted to 105,000,000 kronen for the total length of 285 miles, of which 40,000,000 kr. was for the purchase of locomotives. Of this latter sum the renewal fund of the State Railways would have provided 30,000,000 kr., so that the funds to be raised would have been 75,000,000 kr. At the present time, according to informatiosn from Stockholm, the electrical department of the Swedish State Railway Administration is

engaged on an examination of the probable expenditure on the work under existing conditions, and in this connection the department has before it offers obtained from various sources for the execution of the work. It is impossible for this economic examination to be completed before the technical department of the electrification committee has finished its inquiry, although both are expected to terminate at the end of September. It is, however, stated that the American schemes submitted for the contract, proposing the use of high-pressure direct current, will not be adopted, but that the system employed on the Lappland iron ore railway will be recommended, with the difference that single-phase current is to be used instead of three-phase as on that line. It is calculated on this basis that the outlay on conversion of the Gothenburg-Stockholm railway, including locomotives, will amount to 50,000,000 kr., and the single-phase current would be taken from the existing three-phase network.

Dover.—Proposed Railless Tramcars.—The Tramways Committee has recommended the Town Council to adopt the railless car system for the route from New Bridge over the Pier Viaduct; also that powers for running railless cars in the town should be applied for.

Glasgow.—Extensions.—Parliamentary powers are to be sought authorising extensions to the tramways as follows, viz.:—Giffnock to Newton Mearns, two miles; Millerston to Stepps, one mile; University Avenue, from Bank Street to Byres Road, half mile; Renfield Street to Elmbank Street, *via* St. Vincent Street, and Elgin Street to the Clyde, *via* Portland Street, each five furlongs; and Scotstounhill to Dumbarton Road, 500 yards.

Huddersfield.—New Route.—With a view to relieving congestion of traffic in Leeds Road on the occasion of football matches, the Tramways Department is seeking permission to construct a loop line which will create a small circular route outside the football ground. It is proposed to lay a single track from the existing line in Leeds Road, proceeding along Bradley Mills Lane into Bradley Mills Road and joining up again in Leeds Road. The estimated cost is £5,300.

Ilkley.—Collision.—One of the Corporation's railless tramcars collided with a motor-car on the 3rd instant. The mudguards of the two vehicles became interlocked, and they crossed the pavement and ran into a hedge. Fortunately the passengers in both vehicles escaped injury.

India.—Proposed Tube Railways in Calcutta.—The Office of the High Commissioner in London for India has forwarded copies of a report on the possibilities of a tube railway in Calcutta between the East Indian Railway and the Eastern Bengal Railway, together with a book of plans and a longitudinal section. These documents can be inspected by representatives of United Kingdom firms interested on application to the Department of Overseas Trade (Room 49), 35, Old Queen Street, London, S.W.1, until September 20th, after which date they will be available for loan in order of application to firms in the provinces who are unable to have them inspected in London (Reference 9262/E.D./E.P.).—*Board of Trade Journal.*

Stoke-on-Trent. Accident. Eighteen persons were injured more or less seriously, in a smash caused by a runaway tramcar at Stoke-on-Trent early on September 6th. The tramcar, which was full of people, was proceeding downhill between Newcastle-under-Lyme and Hanley when a short circuit occurred in the controller on the driver's platform, and a considerable amount of smoke and flame were sent up into the driver's face. He stepped back, and, in attempting to reach the overhead switch to cut off the power, fell into the road. The tramcar continued at an ever-increasing speed down the gradient, collided with a cart, and smashed into a Post-Office motor van. Then it left the rails, and after travelling ten yards overturned on its side. The conductor endeavoured to apply the brake, but was unable to do so owing to a crowd of passengers trying to escape from the rear platform. Ten of the injured were treated at the North Staffordshire Infirmary. The driver and the conductor escaped injury.—*Evening News.*

Wakefield.—Doubling of Track.—The Corporation has sanctioned the doubling by the Yorkshire (W.R.) Electric Tramway Co. of the tramway track in Doncaster Road from the "White Bear Inn" for a distance of about 250 yards.

West Hartlepool.—Railless Traction.—According to the *Evening News*, railless electric vehicles are to be run on one section of the local tramway system.

Wigan.—Proposed Track Renewals.—The Corporation has under consideration the question of reconstructing the tramway on the Aspull route.

TELEGRAPH AND TELEPHONE NOTES.

Cable Service.—Reduction in Rates.—The Western Union Telegraph Co. gives notice of reduced rates for deferred telegrams between Great Britain and Ireland and places in British North America.

Chile.—Wireless Telegraphy.—The Chilean Government (Navy Department) has recently completed an important wireless station in Puerto Bories, Ultima Esperanza, situated in the southernmost part of the Republic. Similar stations have already been erected in the Magellan Territory, Tierra del Fuégo, and the Patagonian channel region, thus completing a wireless system which unites even the most remote parts of Chile with the rest of the country.—*Reuter's Trade Service.*

Ireland.—Strike.—The strike of Southern Irish postal workers took place at six o'clock on September 10th. All work was suspended in the post offices of the Irish Free State. It was announced at the General Post Office, London, that telegraphically London had been unable to obtain a reply from any Free State post office or newspaper office since 6 p.m. Telephonic communication also ceased. The postal workers are resisting a proposed reduction in wages. The final offer of the Provisional Government, to spread the reduction over three months, was rejected. The Free State Ministry for Home Affairs issued a statement refusing to recognise the right of Civil Servants to strike and declaring that picketing would not be allowed.—*Daily Mail.*

The Government on Monday evening issued a statement expressing the anticipation that it would be able to augment the limited telegraph service, which is being maintained, in the course of a couple of days.

The *Daily Telegraph* reports that on the 12th members of the supervising and superintending classes were suspended for refusing to perform work proper to their subordinates who are on strike. The Provisional Government announces that satisfactory progress has been made with the picking up of the various services. The telephone section is already coping with the full requirements of Government departments and what are known as essential services. The staff is being augmented, and it is hoped in a few days to extend the use of the telephone to other phases of activity. Telegrams from the six north-east counties, England, and abroad were accepted on Tuesday at Amiens Street telegraph office between 10 a.m. and 6 p.m. In addition to Dundalk and Belturbet, the Donegal post office remains open.

Poland.—Strike Ended.—The Polish postal telegraph employés' strike has ended. The Government has granted certain economic concessions, such as the supplying of fuel to workers on the deferred payment system, and also guaranteed a minimum wage based on the cost of living.—*The Times.*

The Telephone Service.—New Exchange.—A new telephone exchange was to be opened on September 9th at Maida Vale, in the old L.C.C. Fire Brigade Station, which was acquired at the beginning of the year. The new exchange, in addition to meeting the outstanding needs of the area, will relieve the Hampstead exchange, as 615 subscribers proper to the Maida Vale telephone area will at once be transferred from the Hampstead switchboard. A further 230 transfers will take place a fortnight later. Altogether two thousand subscribers can be accommodated in the new exchange, which is of modern central-battery type with lamp indicator signals. There are thirteen positions set apart for dealing with subscribers' calls, and seven junction positions accommodating two hundred junction circuits from other London exchanges, including the trunk and toll exchanges.—*The Times.*

According to the *Daily Chronicle*, another exchange, Wallington, will be opened in the London area on September 23rd, and new c.b. equipment was brought into use at the Barnet exchange on August 31st, which makes available accommodation for 1,600 subscribers' lines and 230 junction lines.

Leeds Street Kiosks.—Leeds Corporation and the Post Office Telephone Department are in negotiation with a view to the establishment of public telephone kiosks in certain positions in the streets. Two kiosks are expected to be placed, as a start, one on the footway island at the end of Vicar Lane—a big tramway terminus—and the other at the Boar Lane end of the tramway barriers in Briggate. Leeds will be the first city in Yorkshire to have public telephone kiosks in the streets, but Bradford and Wakefield are expected to follow quickly.

South Africa.—Long-distance Wireless.—The agreement concluded between the Union Government and the Marconi Co. for the erection of a high-power wireless station capable of direct communication with England is generally approved. The feature of the compact which finds most favour is that the Government does not invest anything in the undertaking. At the same time, the public interests are adequately safeguarded, while tenders for the steel masts and everything else capable of being made in the country will be invited locally. According to the *Daily Telegraph*, Marconi's Wireless Telegraph Co. undertakes to form a South African wireless company for the purpose of erecting, maintaining, and operating for at least ten years a station equipped with thermionic tube transmitters suitable for duplex commercial working between South Africa and Great Britain. This station will have twice the power of the great French station at St. Assisse, near Paris. The capital of this company will be not less than £500,000, of which at least four-fifths will be subscribed by Marconi's Wireless Telegraph Co., the balance being available for subscription in South Africa. A quorum of the directorate, including the managing director and a director representing the Union Government, is to be resident within the Union. The new company is to enjoy the full patent rights of the Marconi Co. for transoceanic communication. The Union

Government has the right of taking over the station at an independently-assessed value after ten years, or after any ten years' period thereafter. Telegraphic rates, so far as they affect communication with Imperial Government stations, will be arranged in joint consultation between the Imperial and Union Government authorities and the Marconi Co. An undertaking is given that the South African station shall be used as part of the Imperial system. It is hoped to complete the station within eighteen months.

Cable Communication.—Greatly improved cable facilities between England and South Africa are promised next year. Past heavy delays have, of course, been caused by conditions resulting from the World War, but the Eastern Telegraph Co., since the declaration of peace, has been working steadfastly to restore efficiency. New cables are now being laid down, which will relieve the present congestion and put the cable service in a position superior to that before the war.—*S.A. Mining and Engineering Journal.*

Syria.—Telegraph Concession.—A report received from the Syrian Committee at Cairo, Egypt, states that the French Mission has left Yemen, having obtained an important concession from Imam Yehia for the installation of a telegraph and telephone system. *Financier.*

Wireless Telegraphy.—Transatlantic Traffic.—From September 13th every postal, telegraph, and cable company office in the United States will accept messages for transmission to Great Britain by the transatlantic wireless circuits conducted by the Radio Corporation of America and Marconi's Wireless Telegraph Co.—*Financial Times.*

Wireless Telephony. — Broadcasting.—Representatives of the British Broadcasting Co. and Post Office officials met at Magnet House, Kingsway, on September 12th, following the receipt by the Broadcasting Co. of the Postmaster-General's criticisms of the company's articles of association, submitted to the Post Office on August 28th.

The "big six" of the company are the British Thomson-Houston Co., the General Electric Co., Marconi's Wireless Telegraph Co., Metropolitan-Vickers Electrical Co., Radio Communication Co., and the Western Electric Co. These firms have guaranteed the required capital. But all *bona-fide* manufacturers of wireless apparatus in Great Britain may join upon their taking up one or more shares. Both the Marconi Co. and Metropolitan-Vickers have broadcasting stations ready to work so soon as sanction is given.—*Financial News.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—October 23rd. Municipal Council. Two thousand 240-V, d.c. and 25,000 240-V single-phase electricity meters.

October 23rd. Minister of Public Works. Two water-turbines and generators in connection with the Barren Jack hydro-electric development. (September 8th.)

Adelaide, South Australia.—December 5th. Adelaide Electric Supply Co., Ltd. 380 electric motors.

Belfast.—September 22nd. Tramways Committee. Reconstruction of 10 miles of single track. (September 8th.)

September 26th. Tramways Committee. Tramway stores, including electrical accessories, cable, lamps, &c., for five months. (September 8th.)

Belgium.—Brussels.—October 18th. Direction des Téléphones. Manual telephone exchange equipment and the provision of 1,200 subscribers' instruments.*

September 27th. Belgian Telegraph and Telephone authorities at Salle Madeleine, Brussels. Supply of telephonic central-battery commutators.

Brazil.—Cachoeira, Rio Grande do Sul.—October 24th. Municipal Council. Six centrifugal pumps, with electric motors, piping, &c.*

Brentford.—September 25th. Board of Guardians. Six months' supply electric lamps and accessories. Mr. F. E. Harmsworth, clerk, 24, Twickenham Road, Isleworth.

Birmingham.—September 16th. Board of Guardians. Radiographic, electrical, and massage apparatus for the X-ray Department at Dudley Road hospital. Mr. J. Curtis, clerk to the Guardians, Edmund Street, Birmingham.

Bournemouth.—September 21st. Tramways Committee. Reconstruction of tramway. General manager, Tramways Department.

Croydon.—September 21st. Board of Guardians. Six months' supply of electrical appliances. Mr. N. P. Walker, clerk to the Guardians, Mayday Road, Thornton Heath.

Dundee.—September 22nd. Electricity Department. 750 yd. .4 x .2 x .4 l.p. 3-core paper-insulated lead-covered armoured 660-V cable. (See this issue.)

Ebbw Vale.—September 27th. Electricity Department. Three 300-kW rotary converters, transformers, switchgear, &c.; 1,250 yd. 500-V, d.c. .5 x .2 x .5 cable. (See this issue.)

Egypt.—Cairo.—September 30th. Electric pump, accumulator plates, and a 3-phase transformer, for the Asile des Aliénés, Khanka. Engineer-Electrician-in-Chief, Electrical Service, Ministry of Public Works, Cairo.

Halifax. — September 19th. Board of Guardians. Supply of electrical fittings for six months. Mr. A. T. Longbotham, clerk to Guardians, Union Offices, Carlton Street, Halifax.

Leeds.—September 12th. Tramways Department. Reconstruction of tramway track, Woodhouse Lane and Cookridge Street. Mr. J. B. Hamilton, general and commercial manager, 1, Swinegate.

London. Islington.—September 12th. Board of Guardians. Electrical supplies for six months. Mr. Albert King, Guardians' offices, St. John's Road, Upper Holloway, N.19.

Fulham.—September 20th. Electricity Department. 11,000-V switchgear, 2-phase and 3-phase. (September 8th.)

Kensington. — September 21st. Board of Guardians. Supply of electric lamps and electric fittings. Mr. W. R. Stephens, clerk to the Board, Marloes Road, South Kensington, S.W.

Loughborough.—September 29th. Electricity Department. Rotary converter plant; sub-station switchgear. (See this issue.)

Morocco.—Rabat.—September 16th. Supply of bronze wire, copper wire, and twisted copper wire for the telegraph and telephone service. Office National du Commerce Extérieur, 22-24, Avenue Victor-Emmanuel III, Paris.

New Zealand.—Auckland.—February 1st, 1923. Harbour Board. One 1-ton fixed electric crane.*

Wellington.—October 24th. Public Works Department. 400 miles 19/13 S.W.G. bare h.d. copper wire for Mangahao electric power scheme.*

November 28th. Outdoor and indoor sub-station switchgear in connection with the Mangahao power scheme.*

November 21st. Mangahao scheme. Electrical storage battery and accessories, including a motor-booster and one single-phase testing transformer.*

Portsmouth. September 20th. Board of Guardians. Electrical fittings for three months. Mr. H. C. Morrell, clerk, St. Mary's Road.

Reigate.—September 26th. Town Council. 11.p. switchgear. (See this issue.)

South Africa.—Pretoria.—September 28th. Municipal Council. Electric capstans, coal elevator, ash elevator, and coal-stacking elevator.*

Johannesburg. — September 27th. Municipal Council. House service meters and time switches.*

Southport.—September 25th. Relaying about 1,800 yards of tramway track with new rails, in single track. A. E. Jackson, M.I.C.E., borough engineer and surveyor, Town Hall.

Torquay. — September 22nd. Electricity Department. Two water-tube boilers, with superheaters, economisers, chain-grate stokers, induced-draught plant, and other accessories. (See this issue.)

Uruguay.—Monte Video.—November 11th. State Electricity Department. One 10,000-kW turbo-generator. State Electricity Department, Calle Julio Herrera, 1458, Monte Video.—*Reuter's State Service* (Monte Video).

Warrington.—September 26th. Board of Guardians. Electrical supplies for three months for Whitecross Institution and Cottage Homes, Padgate. Mr. A. Bottomley, clerk to Guardians, Bewsey Chambers, Warrington.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Argentina. — Catamarca.—Plant for the hydro-electric generating station and transformer sub-station:—Three 165-h.p. Pelton wheels and alternators, switchboard, transformers, and two sets 130-kW a.c. motors, switchboard, &c. The following tenders have been received:—

	Ars. gold
Siemens Schuckert, Ltd.	$33,480
Ditto (alternative)	34,730
Ditto ditto	34,891
Ditto ditto	35,860
Bergmann Electricitats Werke	40,380
Ditto (alternative)	36,025
Ditto ditto	40,850
Ditto ditto	37,240
H. & G. Keller	34,640
Sun Union Traction Company	43,036
Ditto ditto (alternative)	42,606
Metropolitan Vickers Electrical Export Co., Ltd.	46,645
A.E.G. Gte Sudamericana	41,740
Ventrella Lavagna	41,767
Anglo-Argentine General Electric Co., Ltd.	Nominal
J. G. H. Shaw (for W. G. Armstrong, Whitworth & Co.)	41,450
English Electric Co., Ltd.	37,000
Cie. Westinghouse Electric	40,000
Cie. Industrielle de Electricidad	40,400
Bertuletti Velicogna y Cia.	40,000

Revised [illegible]

Barrow.—Town Council. Accepted:—
150-kW rotary converter and switchgear for Abbey substation (£1,920).—Metropolitan-Vickers Electrical Co., Ltd.
Cable for the emergency circuit on the promenade at Rampside (£375).—Johnson & Phillips, Ltd.

Doncaster.—Town Council. Accepted:—
[illegible] £2,847.—British Insulated Cables, Ltd.
[illegible] £1,896.—Callender's Cable & Construction Co., Ltd.

Dover.—Hospital Committee. Accepted:—
Intercommunication telephone system at Dover hospital.—J. Martin, Dover.

Erith.
[illegible] ing cables (approximately £12,000).—Callender's Cable & Construction Co., Ltd.

Glasgow.—Corporation. Recommended:—
Installation of electric lighting at Belvidere Hospital (£3,365).—Mr. A. W. Mickel, Partick, Glasgow.
Lighting Committee. Accepted:—
Lamp pillars and extension pieces.—British Mannesman Co., Ltd.
Sewage Disposal Committee. Accepted:—
Metallic packing for generator engines at Shieldhall works.—The Universal Metallic Packing Co., Ltd.

Leeds.
Power and lighting installation at the new spinning mill erected by Messrs. W. Rennie & Co., Farsley.—Clarke's Extension, Ltd.

London. Metropolitan Asylums Board.—The following tenders have been received for the installation of telephones at Colindale hospital:—

	£
Myall Bros. recommended	188
Riddle & Goddard, Ltd.	201
G. H. Thomas	220
Reliance Telephone Co., Ltd.	238
Lund Bros. & Co.	240
Electrical Contracts & Maintenance Co., Ltd.	262
W. H. Yates	275
Commercial Telephone & Electrical Co., Ltd.	300
Victor Engineering & Supply Co.	400

Mile End.—Messrs. R. Langston-Jones & Co., of Teddington, have received the contract for generating plant and motors for the Institution of the Mile End Old Town Board of Guardians.

Macclesfield.—Town Council. Accepted:—
Installing the electric light at Byron Street schools and providing 108 lamps (£185).—J. W. Brees, Macclesfield.
Connecting the school with the mains (£47).—Electricity Co.

Paris.—The Compagnie Parisienne de Distribution d'Electricité has placed a repeat order with the Compagnie Electro-Mécanique for turbo-generating sets. The order comprises sets varying between 2,500 and 35,000 kW, and representing a total of 100,000 kW.

Preston.—The Town Council has accepted the tender of the English Electric Co., Ltd., for the erection of the new generating station at Penwortham for £94,900. The Guild Mayor said it was the lowest tender out of 38. The time allowed by the tender for completing the work was 43 weeks. Except for a few experts, the labour will be local.

Swansea.—Electricity Committee. Accepted:—
Supply of main colliery coal, at 21s. 6d., for three months.—J. R. Davies and Co.

Torquay.—Town Council. Accepted:—
3,000-kW generating set for the power station at Newton Abbot (£17,330).—British Thomson-Houston Co., Ltd.

Trowbridge.—
Installing electric lighting in Tabernacle church.—Edwards & Armstrong.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, September 16th. At the Grand Hotel, Birmingham. At 7 p.m. Lecture on "Coal Getting by [illegible]" by Mr. C. Jones.

Salford Technical and Engineering Association.—Saturday, September 16th. At the Royal Technical College. At 7 p.m. Lecture on "Textile Printing and Allied Machinery," by Mr. J. Higginbottom.

Institute of Metals.—September 19th to September 22nd. At Swansea.

Association of Mining Electrical Engineers.—Friday, September 22nd, and Saturday, September 23rd. At the University College, Nottingham.

NOTES.

London Street Accidents.—The statistics of street accidents, recorded by the Metropolitan Police Authorities during the months of April, May, and June, are worthy of close perusal, for they enable the responsibility for such occurrences to be correctly apportioned amongst the various classes of traffic using the London highways. The total number of accidents caused by [illegible] of all kinds was 15,555 (159 fatal); of which 899 (19 fatal) were due to omnibuses; 982 (2 fatal) to tramcars; 3,526 (37 fatal) to private motor cars; and 2,800 (61 fatal) to [illegible] and commercial vehicles.—*Commercial Motor.*

A Ramsay Memorial.—On November 3rd a memorial tablet to the late Sir William Ramsay in Westminster Abbey will be unveiled by the Prince of Wales.

Fire.—The *Daily Mail* records that a fire occurred in the nine-storey warehouse occupied by Messrs. Falk, Stadelmann and Co., lamp manufacturers, at Great Clyde Street, Glasgow, on September 11th.

New Swedish Electric Welding Invention.—*Svenska Dagbladet* learns that a new Swedish invention has been put on the market, viz., a system of electric welding by alternating current, invented by the engineer M. Toernblom, and called the Wex system. The firm of Messrs. Carlson, Hedberg & Beyerdier is working the system, and is also negotiating with American, British, French and Finnish interests regarding the formation of affiliated companies. An affiliated company has already been formed in Norway.—*Reuter's Trade Service* (Stockholm).

Educational. Municipal College of Technology, University of Manchester.—We have received the prospectus of University courses for the coming session. The Michaelmas term will commence on Thursday, October 5th, and students will be enrolled on Monday, Tuesday and Wednesday, October 2nd, 3rd and 4th. New students can also be received at the college between 10 a.m. and 1 p.m. from September 25th onwards (except on Saturdays) when they can be advised with regard to their courses and can complete their enrolment.

Battersea Polytechnic.—*Electrical Engineering Department.*—Day and evening courses for the 1922-23 session commence on Monday, September 25th.

Abridged calendar of evening classes can be obtained gratis on application to the Principal. Calendar of Technical College for Day Students, 3d. post free. Further particulars are given in our advertisement pages to-day.

Huddersfield.—The new session for the winter at Huddersfield Technical College, beginning this week, includes classes in wireless telegraphy and telephony.

Summer Time.—In consequence of numerous inquiries which have been addressed to him, the Home Secretary desires to give notice that in accordance with the Order in Council of March 15th, 1922, summer time will not cease until 3 a.m. (summer time) on the morning of Sunday, October 8th, when the clocks will be put back to 2 a.m. The shorter period of summer time prescribed by the Summer Time Act, 1922, does not operate this year.

Electric Transatlantic Liners.—Electrically-driven liners, 1,000 ft. long, and of 70,000 tons, are to be built for the Atlantic trade by a new American shipping company, according to an announcement made by Mr. Lasker, chairman of the United States Shipping Board. Mr. Lasker adds that the financiers organising the company are men whose names are "household words" in the United States, and that the capital will amount to £6,000,000, of which £1,000,000 is already available for preliminary work. The new ships will be driven by electric motors, the energy for which will be furnished by Diesel oil-engines, after the system adopted in the newest American battleships. The project is tentative, the announcement adds, to the extent that the building of the ships depends on the assurance of the Government that the company will receive a grant for ship construction from the loan fund created under the Merchant Marine Act, 1920, and that it benefits from the Ship Subsidy Bill now before Congress. Mr. Lasker said that such aid would probably be given provided the plans for the ships were approved by the Shipping Board. It is proposed that the ships should be built in the United States, and should cost approximately £3,000,000 each.—*The Times.*

United States Electric Vehicle Market.—Manufacturers of electric trucks report that business during August was better than usual at this season of the year. The Newark (New Jersey) baking concern which had arranged to increase its fleet of electric trucks to a total of fifty changed its plans and placed an order for 177 trucks, which is said to be the largest single contract of its kind ever placed in the United States. Another important order for 25 trucks was recently placed by a New York laundry, and several individual sales were booked during the month.

The demand for industrial trucks has also been fairly brisk during the month, with prospects of increased activity in the late autumn.

The Electrocar Co., of New York City, manufacturers of new types of taxis and 'buses, expects to start production on a commercial scale early in October. The company is also planning to produce a half-ton truck, which may be placed on the market early next year.

In connection with the annual Electrical and Industrial Exposition to be held at New York from October 7th to 14th, one of the features of the event will be an electric motor truck parade.

Forty-nine electric trucks and passenger cars valued at 59,044 dollars were exported from the United States during June.—*Reuter's Trade Service* (New York).

Legal.—Stealing Magnetos.—On a charge of having stolen two magnetos, value £25, the property of the Western Anglo-Swedish Electric Welding Co., Ltd., Charles Edward White (21) was at Cardiff police court, on Wednesday last week, committed for trial at the Quarter Sessions.

New X-ray Equipment.—A donation of £5,000 has been made by Mr. Robert McDougall, chairman of the firm of Messrs. Arthur McDougall, Ltd., flour manufacturers, Manchester, to the Manchester Royal Infirmary towards the equipment of the new extension of the X-ray department. —*Daily Mail.*

A Welfare Conference.—A lecture conference for welfare supervisors is being held at Balliol College, Oxford, from September 15th to 20th. A very full programme has been arranged by the organisers, the Industrial Welfare Society.

Metric Equivalent Scales.—A very handy device has been produced by Mr. A. E. Bawtree, 7, Manor Park Road, Sutton, Surrey, for ascertaining the metric equivalents of quantities, &c., in English standards. It consists of a series of scales with the English measure on one side and the metric equivalents on the other, forming a very direct method of converting from one system to the other. The scales provide, *inter alia*, for length, area, and weight, pressure, and thermometer readings. The price of the device is 1s. post free.

Electric Cement.—A new cement now known as "electric cement," is produced by fusion of the raw materials in an electric furnace. The main reason which led to the adoption of electricity was the high price of coal, and after painstaking research and numerous failures, the experimenters had the pleasant surprise of finding that the product obtained possessed important advantages over ordinary Portland cement. The most noteworthy claims made for it are: (1) although slow-setting it hardens rapidly, its strength after 24 hours equalling that of ordinary Portland cement after 28 days; (2) its ultimate strength being much greater than that of Portland cement, the safe working stresses can be increased to three times those now generally adopted; and (3) it resists absolutely the action of sea water. These advantages are of sufficient importance to outweigh the higher cost of the material. It must be noted that electric cement cannot be used together with or mixed with other varieties of cement or lime, and that great care must be taken when mixing it to see that all utensils have been thoroughly cleaned, so that no trace of lime or cement other than electric cement remains on or in them.—*Eastern Engineering.*

Appointments Vacant.—Plumber-Jointer, for the Loughborough Corporation Electricity Department; Assistant Electrical Engineer (£700) for the Municipality of Singapore; Test-Room Assistant for the Bury Corporation Electricity Works; Demonstrator in Electrical Engineering and Teacher of Practical Mathematics, for the Wimbledon Education Committee evening classes; plumber-jointer for the Stepney Borough Council Electricity Department. (See "Official Notices" to-day.)

The Trade Union Congress.—The 54th annual Trade Union Congress, which was held at Southport during the week September 4th to 9th, exhibited a large, but not unnatural, falling off in the number of workers represented. The recorded membership was 5,127,308, a decrease of 1,290,602 compared with last year. The influx of all sorts of people into industry during the war increased the membership of trade unions from two and a quarter millions in 1913 to six and a half millions in 1920, but the gradual return to normal conditions and the slump in trade has now reduced this figure, and the delegates, who numbered more than 800 at Cardiff last year, this year number nearly a hundred less.

French X-ray Martyr.—Prof. Bergonié, of the Bordeaux Faculty of Medicine, who is a correspondent member of the Academies of Science and Medicine, is the latest martyr to research work on X-rays. He has already suffered the removal of several fingers, and now his right arm has had to be amputated. After Tripier, Dr. Bergonié stands first among French pioneers of radiography, and his name is associated with the principal rules for the application of X-rays to therapeutics.—*The Times.*

Small Circuit-breakers v. Fuses.—Writing to the *Electrical World* of August 12th, Mr. J. M. Van Nieukerken draws attention to the extensive adoption in Holland of miniature circuit breakers on domestic and industrial circuits, feeding lamps, small motors, &c. They are adjustable for loads from 6 to 25 amperes at pressures up to 250 volts, and are reset by turning a handle like that of a rotary snap switch. An indicator shows when a breaker has opened. Such circuit breakers are used in place of main fuses where the cables enter a house; they are sealed to prevent alteration of the setting, but can be reset by the consumer. They are also used for the separate circuits instead of fuses. The mechanism is very simple and not liable to get out of order.

Therms—and the Gas Bill.—The following effusion has come to hand unsigned, but dated from The Avenue, Erewhon, September 9th, 1922:—

Said the Kelvin to the Therm
You elusive little worm
Your ways, I must confess, are most distracting.
In a cubic foot you lurk
With the power to do work
But your union's rules are terribly exacting.
Your must get just so much air
Or you simply do not dare
To work at anything like full efficiency,
Then the pressure, too, must be
Neither more nor less than be
Enough to suit your precious self-sufficiency.
But I feel constrained to say
You have one quite useful trait
Which in all trade unionists we do not meet,
In strike, "ca' canny," lock-out,
If it even came to "knock-out"
You'd pursue your argument *with little heat.*
Yours thermocubically,
"GASSED."

Scout Ball.—The Hyde Park Dance Club is organising a second Scout Ball at the Hyde Park Hotel on October 12th, in aid of H.R.H. the Prince of Wales's Boy Scouts' Fund. Tickets (one guinea each, or ten for seven guineas) may be obtained from the hon secretary of the Club, 222, Strand, W.C.2, or from the manager of the hotel.

INSTITUTION NOTES.

Association of Mining Electrical Engineers.—The annual meeting is to be held at Nottingham on September 22nd and 23rd. The programme includes the annual dinner and general meeting, and a number of visits to engineering works in the neighbourhood of the city.

The report of the General Council for the year ended June 30th, 1922, shows a total membership of 1,761. The annual accounts disclose a sound financial position.

Birmingham and District Electric Club.—The second half of the 1922 session opens to-morrow night, at 7 o'clock, at the Grand Hotel, Colmore Row, Birmingham, with a lecture by Mr. C. Jones on "Coal-getting by Electricity." Later events for this year are:—

October 14th.—Paper by Mr. F. R. Unwin.
November 10th.—Visit to G.E.C. Witton Works.
November 11th.—Discussion on Mr. Unwin's paper.
December 9th.—General meeting.

Institute of Cost and Works Accountants.—The Institute is holding a public meeting at the Connaught Hall, Newcastle, on October 6th, for the purpose of inaugurating a branch in the Newcastle district, at which a paper will be read on "The Necessity for Scientific Costing," and the chair will be occupied by Mr. Summers Hunter, C.B.E. Tickets may be obtained from the Secretary at 38, Grosvenor Gardens, S.W.1.

Junior Institution of Engineers.—This Institution, which has for many years carried on its activities for the benefit mainly of the younger members of the profession, with headquarters at 39, Victoria Street, S.W.1, has, on account of increasing membership, been compelled to seek more accommodation. This has been found in the same building, and a suite of rooms on the first floor overlooking Victoria Street has been acquired. The suite includes adequate accommodation for the Institution staff and a reading and lecture room, with double the seating capacity of the present one. All future ordinary and Friday evening informal meetings will be held in the new home.

The first meeting of the Winter Session will be held on Friday, October 6th, when Mr. W. A. Tookey, M.I.Mech.E. (past chairman) will read a paper on "Engineering in Bacon Factories."

Society of Engineers.—The Council of the Society has arranged for a conference of the members of certain engineering societies to take place at the Engineers' Club, London, on Friday, September 29th, at 3 p.m., for the purpose of considering and, if thought advisable, inaugurating the formation of "The Association of British Engineering Societies" in accordance with a constitution which has been drafted. The Council feels that a number of local engineering societies at present working on more or less parallel lines, but quite independently, would derive mutual advantage from being brought into co-operation. The association would not have the same field of action as the Joint Council, which is believed to be in course of formation among four of the leading institutions.

There is no charge for attending the Conference, but engineers who are members of recognised societies and wish to attend must apply to the secretary (Mr. A. S. E. Ackermann, B.Sc., 17, Victoria Street, S.W.1) for a Conference badge.

OUR PERSONAL COLUMN

The Editor invites electrical engineers, whether connected with the technical or the commercial side of the profession and manufacturers, electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

CORRECTION.—We much regret that the note in our last issue upon Mr. E. P. Bennett's tour on behalf of the Sangster & Credenda joint sales organisation was so worded as to give a wrong impression of the significance of the tour. It might be supposed that existing overseas agencies were to be reorganised or replaced; this is not so, the intention is to establish *new* representations where necessitated by post-war conditions in all oversea centres of importance. Mr. Bennett will incidentally visit the existing agencies.

Mr. C. ORMI BASTIAN, M.I.E.E., has entered into partnership with Mr. F. J. CAMPBELL ALLEN, who has purchased the business of the Bastian Electric Co., Ltd. The business in electrically heated appliances of every description will be carried on by Messrs. Bastian and Allen at 58, Haymarket, London, S.W.1.

Mr. ERNEST BROOK, electrical engineer, of Rossefield Avenue, Birkby, has been elected to fill a casual vacancy of the Huddersfield Town Council.

The wedding was solemnised at Blackpool Parish Church, on September 6th, of Miss MURIEL FURNESS, daughter of Mr. Charles Furness, electrical engineer and tramway manager of Blackpool, and Col. J. P. LITT, R.A.M.C., of Bolton. The gifts included a silver candlestick from the Blackpool electricity and tramways department, a salad bowl from the office staff (of which the bride was formerly a member) and a silver cigarette case from R.A.M.C. officers.

Capt. G. P. THOMSON, Lecturer in Mathematics at Corpus Christi, has been appointed to the chair of Natural Philosophy in Aberdeen University, in succession to Prof. Niven, who has retired. He is the only son of Prof. Sir J. J. Thomson, F.R.S.

On Thursday, September 7th, the staff and employés of the Aberdeen Corporation Electricity Department presented Mr. H. G. NOBLE with a handsome dressing case, for himself, and a hand-bag, for his wife, as a token of their appreciation and to mark the occasion of his recent marriage. Mr. Noble has obtained a position on the electrical staff of the Shanghai Municipal Council and leaves for China in a week's time.

At a meeting of the Dundee Town Council on Thursday last week, Mr. DOUGLAS H. BISHOP, B.Sc., M.I.E.E., was appointed Corporation electrical engineer, at a salary of £800, rising to £1,000 per annum.

Mr. R. ILLINGWORTH, A.M.I.E.E., A.M.I.Mech.E., has resigned his position as engineer in charge at Messrs. Palmers Shipbuilding & Iron Co., Ltd., Jarrow-on-Tyne, and has been appointed superintendent of the power supply department of Messrs. Cory Bros & Co., Ltd., Ogmore Vale, Glam.

Capt. GEORGE B. WHITAKER, O.B.E., A.M.I.Mech.E., A.M.I.E.E. (ex-Major, R.E.), chief electrical engineer to the Burma Corporation Ltd., Namtu, N.S.S., Burma (India), is now in England on sick leave from Burma. His address is 3, Cardigan Road, Headingley, Leeds.

On Tuesday evening Mr. W. H. ALABASTER, A.M.I.E.E., city electrical engineer, Melbourne, was entertained at dinner at the Engineers' Club by a number of friends on the eve of his departure for the United States. Mr. Albert Gay, chief electrical engineer, Islington Borough Council, presided, and Mr. J. Y. Fletcher was vice-chairman. Mr. Gay, proposing the health of the guest, who had joined his staff at Islington in 1896 and was with him three years before proceeding to Plymouth electricity works and subsequently to Melbourne, expressed his pleasure at meeting Mr. Alabaster on several occasions during his stay in England, and wished him a safe journey to Australia. Mr. Alabaster responding, expressed his keen appreciation of the reunion, which was typical of the kindness which he had experienced wherever he went. Mr. Gay might be regarded as the "father" of electricity supply undertakings in this country, so many engineers now holding responsible positions had passed through his hands. He [illegible] had initiated in some of the British power stations which he had visited a great variety of plant, some of which [illegible] the erection of super-stations would enable such plant to be scrapped, and the cost of production to be reduced. Wherever possible, he thought, d.c. supply should be curtailed and replaced by three-phase. The cooking and heating load in residential areas was dealt with in Australia by overhead mains; to lay underground mains for the heavy load of this class that would arise would involve an appalling cost. The development of the domestic load would benefit not only supply undertakings but also all manufacturers of electrical apparatus. Electricity should use electrical methods themselves.

Mr. Fletcher, in proposing the health of the chairman, alluded to Mr. W. H. Alabaster as an old G.E.C. comrade, and eulogised the policy of Australia, which not only gave a preference to British manufacturers, but made a point of placing orders in this country for all kinds of electrical goods. That policy had done much to alleviate unemployment, the fear of which was at the root of most of our labour troubles. Acknowledging the toast, Mr. Gay remarked that 25 of his "old boys" were now holding responsible positions, which they had gained by their own unaided efforts. He considered that excessive taxation was the main cause of unemployment, and that there was no good reason why it should not be reduced.

Obituary.—MR. J. W. EDMUNDSON.—The death took place at Sowerby (Yorks.), on September 1st, of Mr. John Wigham Edmundson, who was formerly manager of the Sunbeam Lamp Co., at Gateshead. He was 74 years of age.

NEW COMPANIES REGISTERED.

Champion Sparking Plug Co., Ltd. (184,200).—Private company. Registered September 6th. Capital, £5,000 in £1 shares. To carry on the business formerly carried on by the Champion Sparking Plug Co., Ltd., at Cowley, in the county of or through the agency of F. B. Caswell in the United Kingdom, and to carry on the business of engineers, electricians, manufacturers, importers and exporters of, and dealers in, automobiles, locomotives, cycles, air and marine craft, and vehicles of all kinds, sparking plugs, ignition devices, &c. The first directors are: R. A. Lady (managing director), Waldorf Hotel, Aldwych, W.C.; Alec W. Godfrey, 8, Eatonville Road, Balham, S.W. Remuneration as fixed by the company. Registered office: 84, Pall Mall, S.W.

Gayton Park Electricity Co., Ltd. (184,208).—Private company. Registered September 6th. Capital, £3,000 in £1 shares. To carry on at Gayton Park and elsewhere in Cheshire the business of an electric light company in all its branches, and to adopt an agreement with S. Moore. The subscribers (each with one share) are: Mrs. A. Moore, 37, Cable Road, Hoylake; S. Moore, 37, Cable Road, Hoylake, chemical manufacturer. S. Moore is primage governing director, subject to holding 500 shares. Registered office: The Power Station, Reading Green Farm, Gayton, Neston, Cheshire.

Electric Depôt, Ltd. (184,100).—Private company. Registered August 4th. Capital, £2,000 in £1 shares. To carry on the business of electrical, mechanical, and automobile engineers, manufacturers and suppliers of and dealers in engineering apparatus and plant, motor accessories, &c. The subscribers (each with one share) are: W. H. Bill, "The Ling," Bishops Road, Sutton Coldfield; J. H. Norton, 260, Boldmere Road, Erdington, mechanical engineer; A. Kennedy, 43, Cannon Street, Birmingham, certified accountant. The permanent directors are: W. H. Bill and J. J. Norton. Qualification: £1.

Willesden Electric, Ltd. (184,246).—Private company. Registered September 7th. Capital, £10,000 in £1 shares. To take over the business of electric lamp manufacturers carried on at 843-5-7, Harrow Road, Willesden, as the "Willesden Electric Co." The subscribers (each with one share) are: H. E. Childs, 72, Lancaster Road, North Kensington, W.11, electrical engineer; W. C. Hendy, 13, Pultney Road, South Woodford, Essex, shipping agent. H. E. Childs signs as director. Qualification: £100. Remuneration as fixed by the company. Registered office: 843-5-7, Harrow Road, Willesden, N.W.

G. Haslam & Co., Ltd. (184,265).—Private company. Registered September 8th. Capital, £2,000 in £1 shares. To take over the business of electrical engineers carried on by G. S. Haslam and W. G. Haslam at Leigh-on-Sea as "Haslam & Co." The permanent directors are: G. S. Haslam (managing director), 7, Woodfield Road, Leigh-on-Sea; W. G. Haslam (secretary), 7, Woodfield Road, Leigh-on-Sea, with £312 and £208 per annum respectively as remuneration. Qualification: £600. Secretary: W. G. Haslam. Registered office: 51, Broadway, Leigh-on-Sea.

British Generator Co. (1922), Ltd. (184,113).—Private company. Registered September 1st. Capital, £3,000 in £1 shares. To carry on the business of electrical, mechanical and general automobile engineers, overhaulers, &c. The life directors are:—J. H. Baker, 481, Oxford Road, Reading; J. Thrussell, 55, High Street, Hoddesdon, Herts; W. T. Edmunds, Lutton, Ware Road, Hoddesdon, Herts; F. G. Webb, 478, High Road, Tottenham. Remuneration as fixed by the company. Registered office: 481, Oxford Road, Reading.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Ilford Dry Battery Co., Ltd.—G. W. Roberts, of 2 Guildhall Chambers, 31-34, Basinghall Street, E.C.2, ceased to act as receiver on August 22nd, 1922.

Blackpool, St. Annes, and Lytham Tramways Co., Ltd. G. Nicholson, of "Parkside," Princes Park, Liverpool, ceased to act as receiver on August 1st, 1922.

British Electric Vehicles, Ltd.—A. S. Sinclair, of 7 and 8, Poultry, E.C., was appointed receiver and manager on September 5th, 1922, under powers contained in trust deed dated October 1st, 1920.

Park Electrical and Engineering Co., Ltd.—Mortgage and debenture, both dated August 22nd, 1922, to secure £4,500, charged on land at Stretford, near Manchester, forming part of Trafford Park estate, and the company's undertaking and property, present and future, including uncalled capital. Holder: Miss S. Ainley, "Winmarith," Lytham Road, South Shore, Blackpool.

British Thomson-Houston Co., Ltd. (47,982).—Return dated June 13th, 1922. Capital, £4,000,000 in 2,000,000 7 per cent. cum. pref. shares, 2,000,000 deferred shares of £1 each, 2,000,000 ord. and 1,560,000 pref. shares taken up, £425,310 paid, £74,000 considered as paid. Mortgages and charges, £1,639,495.

Bridgwater and District Electric Supply and Traction Co., Ltd.—Particulars of £5,000 debentures authorised May 27th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Wardle Engineering Co., Ltd. (102,714).—Return dated August 15th, 1922. Capital, £7,000 in 5,000 ord. and 2,000 pref. shares of £1 each. All shares taken up. £6,800 paid; £200 considered as paid. Mortgages and charges, £4,000.

Christy Brothers & Co., Ltd. (90,039).—Return dated June 30th, 1922. Capital, £28,000 in 20,000 ord., 3,000 deferred, and 5,000 pref. shares of £1 each. 15,229 ord., 3,000 deferred, and 250 pref. shares taken up; £9,379 paid; £9,100 considered as paid. Mortgages and charges, £4,000.

Union Cable Co., Ltd. (67,054).—Return dated June 8th, 1922. Capital, £100,000 in £1 shares. All shares taken up. £1 per share called up on 50,000 and 10s. per share on 50,000 shares; £75,000 paid. Mortgages and charges, nil.

Lisbon Electric Tramways, Ltd. (62,983).—Return dated July 12th, 1922. Capital, £1,250,000 in 750,000 ord. and 500,000 pref. shares of £1 each. 634,026 ord. and 425,553 pref. shares taken up. £1 per share called up on 134,026 ord. £134,026 paid; £325,553 considered as paid on 500,000 ord. and 425,553 pref. Mortgages and charges, £466,300.

Sheffield Electric Power Co., Ltd. (106,880).—Return dated December 17th, 1921 (filed April 26th, 1922). Capital, £2,000 in £1 shares. Two shares taken up. £2 paid. Mortgages and charges, nil.

CITY NOTES.

French Companies.

Est-Electrique.—The report for 1921 of this Parisian company recorded the completion of the works contemplated at its central station and the carrying out of those, begun in 1921, for the bettering of the network, which would be finished towards the end of the current year. At the end of December, 1921, the company served a total of 67 communes; nine new concessions had been acquired during the year, and application for 23 others had been made. The year 1921 closed with a profit of 1,022,545 fr., increased by the carry-over of profit and loss by 63,217 fr., which was devoted to covering the losses on the working of previous years.

Le Triphasé (*Nord Lumière*).—The recent meeting of this company approved the accounts for the year ended in December last, showing a gross profit of 3,860,286 fr., including the carry-over from 1920 of 39,937 fr. After provision for depreciation and renewals, and placing 1,200,000 fr. to the sinking fund, the balance of 2,260,286 fr. allowed for distribution of 7 per cent., or 35 fr. per share, less tax. The year 1920 was marked by an enormous increase in the expenditure, but the past year was characterised by a steady return to normal prices, and also by a serious industrial crisis. Expenses had fallen considerably chiefly owing to the lower price of coal, which had decreased from 300 fr. in 1920 to about 150 fr. From this had resulted a reduction in the receipts, a great number of the important contracts having a clause making the price of current dependent on the price of coal. The negotiations conducted since 1920 to place the contracts on a more economic footing had resulted satisfactorily. The company had been approached by an important group in the suburbs of Paris, with a view to fixing general charges for high-pressure energy, and a satisfactory conclusion had been reached. In the Seine-et-Oise department the agreements arranged with certain communes had secured the Prefectorate sanction. The Union d'Electricité during 1921 had carried out the plans associated with the big station at Gennevilliers, which was to gradually feed with current all the *secteurs* located in the region of Paris. This station had started working, and was supplying the Ouest-Lumière company. Some delay, the Council expected, must occur before the Asnières station could be dispensed with and the total supply drawn from the Gennevilliers station alone.

Escher Wyss and Co.

The *Financial Times* reports that the profit and loss account for the year ended March 31st, 1922, shows a gross manufacturing profit of 7,420,000 fr., as against 6,888,000 fr. in the preceding year. General expenses amounted to 4,350,000 fr. (3,860,000 fr. last year) and an amount of 1,530,000 fr. (1,850,000 fr. last year) has been written off for depreciation. The resulting net profit is 913,781 fr. (744,886 fr. last year), and the directors are able to propose the distribution of a dividend of 6 per cent. on the ordinary shares as last year, while the new preference shares will receive their 8 per cent. dividend, which is due for the first time. The directors consider the results of the year to be satisfactory. This is principally due to the circumstance that the company started the year well provided with orders which had been placed at the higher prices ruling in the preceding year. Work has been carried out not only in Switzerland, where particular mention may be made of the Barberine power station in the Canton of Valais installed for the Swiss Federal Railways, but also in Spain and France. Orders are also on hand for the supply of turbines to England, Holland and the Argentine. The company's Italian subsidiary has again been able to pay a dividend of 6 per cent. and the work of the other branches has been satisfactory.

Italian Companies.

The Forze Idrauliche di Tresso sull' Adda (Milan) has increased its capital from 10 to 20 million lire, chiefly its financial year in March with a dividend of 10 per cent.

The Società Esercizi di Elettricità (Venice), whose capital is 10,000,000 lire, has experienced a difficult first year of existence owing to the exceptional drought. Nevertheless, the accounts, after the normal apportionments, show a net surplus of 7,642 lire.

The Società Elettrica Romagnola (Bologna), with a capital of 10,000,000 lire, has closed the year 1921, after a costly resort to heat generation owing to the drought, with a balance of 1,014,021 lire, allowing of a dividend of 35 lire per share.

The Società Elettrica Padana (Ferrara), with a capital of 6,000,000 lire, has completed its second year, although burdened with the costs of first establishment, with a balance of 10,379 lire.

The Società Marchigiana di Elettricità (Recanati), capital 8,000,000 lire, has realised a balance of 360,585 lire, from which a dividend of 6 per cent. was distributed.

The Società Emiliana di Esercizi Elettrici (Parma) has made a loss on its year's working equal to half its capital. In consequence its capital has been written down to 14,000,000 lire.

The Società per Applicazioni di Energia Elettrica (Torre Annunziata), with a capital of 3,000,000 lire, has approved a dividend of 8 per cent. on the strength of a balance of 322,438 lire.

The Unione Tarantina Elettrogas C. Cacace e Cia. (Taranto), capital 2,000,000 lire, has stated its inability to declare a dividend, owing to the general crisis.

The Società Elettrica Mesagnese (Mesagne), capital 500,000 lire, has closed its year's working with a balance of 19,924 lire, distributing a dividend of 7 per cent.

The Società Idro Elettrica Vasi (Bagnara Calabro), with a capital of 3,000,000 lire, has made a net profit of 4,988 lire.

The Unione Esercizi Elettrici has increased its capital from 44 to 66 million lire, devoting its new shares in part to exchange with shares of the *Società Industriale Italiana*, and offering the remainder in option to the shareholders.

The Società Edison per Fabbricazione delle Lampade, già Ingenieri Clerici e Ca (Milano) has carried out the increase of its capital from 2,000,000 to 5,000,000 lire by the issue of 15,000 new 200-lire shares.

The Società Anonima Imprese Elettriche di Riccione (Milan) has decided to reduce its capital from 450,000 lire to 225,000 lire by writing down the value of its shares to 50 lires.

The Società Iesina di Elettricità (Iesi) has increased its capital from 1,200,000 lire to 1,750,000 lire, and authorised its board to make a later increase to 2,000,000 lire.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Committee under Rule 159:—

London Electric Wire Co. and Smiths, Ltd. 644,070 ordinary shares of £1 each fully paid, Nos. 1 to 644,070.

Applications have been made to the Committee to allow the following to be officially quoted:—

Fairbairn Lawson Combe Barbour, Ltd. £350,000 7½ per cent. 15-year notes.

Stewarts & Lloyds, Ltd.—Interim dividends for half-year to June 30th at the rate of 6 per cent. per annum on preference shares and 10 per cent. on preferred ordinary shares.

Davis & Timmins, Ltd.—Interest on 6 per cent. preference shares and interim dividend on ordinary shares at the rate of 6 per cent. per annum, free of tax, for the half-year to June 30th last.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less tax, on the preference stock for the quarter ending September, and a second quarterly dividend of 2½ per cent. on the ordinary stock, free of tax.

South Metropolitan Electric Light & Power Co., Ltd.—The transfer register and register of 4½ per cent. first debenture stockholders will be closed from September 19th to October 2nd, 1922 (both days inclusive), for the preparation of warrants for interest payable the 2nd proximo, for the half-year to October 1st, 1922.

British Aluminium Co., Ltd.—Dividend at the rate of 5 per cent. per annum, less tax, on ordinary shares for six months ended June 30th, and dividend at the rate of 6 per cent. per annum, less tax, on preference shares for the same period.

Manila Electric Railroad and Lighting Corporation.—A dividend of 2 per cent. (2 dols. per share) for September quarter on the common capital stock is announced.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—An interim dividend of 5s. per share payable, free of tax, for the June quarter is announced.

Globe Telegraph and Trust, Ltd.—Interim quarterly dividend of 5s. net on ordinary and 3s., less tax, on preference.

STOCKS AND SHARES.

Tuesday Evening.

It may be on account of the holiday season having ended, or it may be due to other causes, but the fact remains that business in the Stock Exchange is more active. Notwithstanding a certain dulness that continues to dog the gilt-edged stocks, owing to the possibility of money becoming tighter, there is a definite disposition on the part of the public to take a hand in various industrial and other speculative investments. In some places, there may be traces of a bull account which, in the ordinary way, is not a strengthening influence, but the financial position of the Stock Exchange has never been more solid than it is to-day, for which the war-time legislation is responsible. Apprehensions of possible trouble in connection with the clearing-up the pre-war account have passed away with the settlement that took place at the beginning of this month. The autumn output of new issues has scarcely started. It is known that there are many borrowers anxious to try their fortune as soon as the City resumes its normal after-the-holidays aspect, and within the course of the next month or so, a fresh batch of newcomers is likely to put in an appearance.

The strength of Metropolitans and Districts is still the outstanding feature of the Home Railway market. District stock has been bought in substantial amounts. One suggestion advanced to explain the support is, that as the District second preference stock no longer looks to the pooled receipts for its 12 per cent. share of profits, this should have a favourable effect upon the dividend on District ordinary. Last year, it may be recalled, the company paid 1 per cent. after an absence of 40 years from the dividend list. The optimists are now talking about three per cent. in respect of 1922, and a progressive rate of dividend thereafter. Side by side with Districts, Metropolitans have been showing decided strength. In their case, the hope of alliance with the Great Western continues to be the main ground upon which purchasers build their expectations. Underground Electric 6 per cent. income bonds have gained a couple of points.

Reasons are being sought to account for the remarkable strength of electricity supply shares. It is well known, of course, that the industry as a whole is doing remarkably well. The present twelve months may prove to be a banner year. Nevertheless, the Westminster Company, as already noted here, cautioned its shareholders against pinning too much faith to a bumper dividend, simply because the interim distribution was raised. The County of London Company also emphasises the fact that the increase in interim dividend is part of a policy for equalisation of the amounts distributed each half-year. It is both fair and frank on the part of the companies to indicate this to their shareholders, for the latter, in the event of final dividends being below optimistic anticipation, can certainly not blame the directors for not having clearly stated the reason for the interim payments having been increased.

Metropolitan ordinary 6⅛ are 7s. 6d. higher. Brompton ordinarys are 5s. up at 8. Gains of ½ are secured by Kensingtons, Londons, Westminsters and St. James's. City Lights, which have been rising sharply of late, are a trifle easier at two guineas. The new County ordinary remain at 3s. 9d. premium, the preference being a little better at 2s. 4½d. premium. The question arises as to whether it is worth while exchanging County of London old ordinary for the new shares. There is not much in it. The new can be bought at 26s. 9d. fully-paid, and the old are saleable at 28s. 3d., leaving a difference of 1s. 9d. per share, from which must be deducted the broker's commission, 4½d. per share, and an allowance of roughly 6d. to 1s. should be made for the difference in dividends until the new ordinary rank with the old. Urban debenture has risen to 66½. Edmundsons at 35s. are half-a-crown higher on the week. Of the Australian shares, Kalgoorlie preference strengthened to 12s. 6d., and in the Indian group, Calcutta Tramways second debenture stock is a little better at 2½ premium.

Of the manufacturing shares, English Electrics dropped to 16s., and the preference to 19s. 6d. India Rubber shares are 1/16 up at 13s. 9d. The cable shares continue to improve, rises being recorded in Henleys and Callenders, though Telegraph Constructions at 25¾ are 5s. down.

Anglo-American preferred at 104 shows a 10s. fall, but the deferred at 23⅛ is ⅛ higher. Indo-European weakened to 35½, while Great Northerns at 29½ are 5s. better. Apart from these changes, the cable market is very quiet, there being no alterations worth mentioning in the Eastern group. West India and Panama first preference have improved to 30s. The ordinary continue in the neighbourhood of 5s. Marconis are steady at their improved price of 2⅜. Canadian Marconis, after being up to 11s. 6d., gave way to 10s. 9d., and Radio Corporation common sagged off to 21s. 6d., the preference being a trifle easier at 13s. 9d. A timid demand for Automatic Telephone shares caused a trifling recovery to 12s. 9d. The effect of "broadcasting," upon the market for wireless shares, has so far been meagre in the extreme.

Amongst foreign traction issues, British Columbia preferred and deferred show substantial falls, for which it is difficult to find any other reason than the moderate sales that have been attempted in a market none too willing to take stock. Anglo-Argentine Tramways 5 per cent. debenture at 80 is down 2 points, and once more looks a good purchase for the investor looking for a reasonable yield with very fair security. The company's first preference are 1/16 lower. In Mexicans, there are no material changes to quote. Congress assembles next month to confirm (or not) the provisional scheme outlined by the Mexican Government for the meeting of its obligations. Optimism looks for this to be the stepping stone to re-establishment of financial order in the country, but there have been too many false starts in the past for the cautious to feel altogether satisfied with a prospect that still awaits ratification, by Congress, before the proposals become law.

The rubber market is better, in consequence of the action of the Rubber Growers' Association in pressing upon the Colonial Office the advisability of restriction of rubber production in Malaya, irrespective of what the Dutch may do. It will be remembered that, quite lately, the Dutch Government declined to interfere with the freedom of rubber production in the Netherlands East Indies. Engineering shares are steady, though Babcock & Wilcox can be obtained at the middle price of 60s. In the armament group, a drop to 11 in Armstrongs was followed by 1s. recovery, other shares in this market being uninteresting by reason of the lack of business, which is the only feature of the group.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Sept. 11. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	8	+ ½	£7 10 0
Charing Cross Ordinary	8	9	7⅜	—	5 17 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6¼	—	4 16 0
City of London	14	14	13/-	—6d.	6 13 4
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1⅞	—	5 11 4
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
Kensington Ordinary	9	10	7⅛	+ ⅛	6 13 4
London Electric	2½	4	2⅝	+ ⅛	6 1 0
do. do. 6 per cent. Pref.	6	6	5	—	5 17 1
Metropolitan	7	7	6¼	+ ⅛	5 14 3
do. do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	8⅝	+ ⅛	6 15 2
South London	7	7	8⅛	—	7 4 4
South Metropolitan Pref.	7	7	1⅜	—	5 18 0
Westminster Ordinary	10	10	7⅛	+ ⅛	6 7 0 *
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104	— ½	5 15 5
do. Def.	1½	34/6	23⅜	+ ⅛	7 8 6
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8⅛	—	8 9 8
Eastern Extension	10	10	18⅝	—	5 6 8
Eastern Tel. Ord.	10	10	186⅛	—	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 3 5
do. do. Pref.	6	6	11⅜	—	5 2 2
Great Northern Tel.	24	22	29⅛	+ ½	7 9 2
Indo-European	10	10	35⅝	— ⅛	7 0 10
Marconi	25	15	2⅜	—	6 6 4
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 3
Home Rails.					
Central London Ord. Assented	4	4	87	—	5 19 5
Metropolitan	1½	2½	57½	+2½	3 18 3
do District	Nil	1	43	+1½	2 6 6
Underground Electric Ordinary	Nil	Nil	2⅛	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	84½xd	+2	*4 14 8
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	6½	12½	8⅞	— ⅛	8 0 0
do. do. 2nd Pref.	Nil	5½	8⅛	—	7 0 9
do. do. 5 per cent. Deb.	5	5	80	—2	6 6 0
Brazil Tractions	Nil	Nil	53	+1	7 18 10
British Columbia Elec. Ry. Pcs.	5	5	76½	—	6 9 9
do. do. Preferred	5	98/-	66	—3½	*7 1 8
do. do. Deferred	8	124/-	72⅜	—4	*8 11 6
do. do. Deb.	4½	4½	76	—	5 11 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	70¼xd	—	7 1 10
do. 6 per cent. Bonds	Nil	Nil	41½	—	Nil
Mexican Light Common	Nil	Nil	20⅛	—	Nil
do. Pref.	Nil	Nil	48½	—	Nil
do. 1st Bonds	Nil	5	64½	+1	7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	15	3	—	5 6 8
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	42/-	—	7 2 10
Callenders	5	5	2⅛	+ ⅛	6 17 0
do. Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 18 4
Edison-Swan	10	Nil	8/3	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1⅜	—	8 0 0
English Electric	8	5	16/-	—1 6	6 5 0
do. do. Pref.	6	6	19/6	—6d.	6 3 1
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/9	—	5 6 8
Henley	15	15	2⅛	+ ⅛	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	13/9	+ 1/16	—
Met.-Vickers Pref.	8	8	2½	—	6 8 0
Siemens Ord.	10	10	27/6	—	*7 5 6
Telegraph Con.	20	20	26⅛	— ⅛	*4 13 6

* Dividends paid free of Income Tax.

AN UNUSUAL WIRELESS EXPERIENCE.

By "CINQUANS."

This wireless is really wonderful. Of course I don't know much about it really, but after what happened the other evening I think that even the experts have yet a lot to learn. I had had a very busy day, and after dinner was comfortably ensconced in an armchair with the receivers over my ears, listening to music which was being played, according to the papers, somewhere on the other side of the North Sea.

As is my custom, I was reading at the same time, and my book, the ever-fascinating "Time Machine," by Wells, seemed somehow to be in harmony with "listening-in." I idly wondered why the performers should specialise in German music, when, in the middle of something by Strauss, the music ceased, and a deep voice, with remarkable clearness, said: "Sie haben für mich gesunden, Herr Direktor?"

Perhaps I thought this was something to do with the performance, but I was not so surprised as might be imagined, and listened to another voice replying curtly: "Yes, I sent for you, and I tell you again to remember that I will have nothing but English in this office spoken. In two months I go to England, and it is necessary that I the language speak perfectly; do not let me have again to tell you this."

"Ich werde—I will remember, Herr—Sir."

"We have yet another order from England received, yes? Those main cables for Dundeath, and it is of that I wish to speak. You will remember how, when we were defending our country against these same English we left mines which after weeks, and perhaps months, exploded, destroying their men?"

"Ja, mein—yes, Sir, I well remember myself. I was of the Engineers, and with my own hands I arranged the great mine at Bapaume, which most successful was; almost forty were at once killed."

"Is it difficult this arranging, yes?"

"No, es ist sehr—very easy; but a little acid which cuts through metal, and we have the experiments made that to a day it can be arranged."

"That is good. Now, could you arrange so a cable that it would in one month—kurz—it is in English difficult—down-break-fail?"

"It would more difficult be and not for gummikabel, but for the paper kabel it would be done."

"Suppose it should be that the cable should not downbreak until a year—until five years? You could also that arrange?"

"Jawohl, wir mussen—I can not it in English say—so arrange the leaves of the paper—so many leaves, so many years."

"Gut—very good. Now listen carefully. You will at once make experiments and will so arrange these cables for the English—all main cables, you understand—that in the mittel of the year 1927 they will downbreak. Not at only one point—that may be not used, but in all the length, you understand?"

"Ja, Herr Direktor—it shall be."

"Remember, not more late than the mittel of the year, for we shall not this time wait for their corn to ripe. These experiments must recorded be, and I will meinself them take to our friends in England, who also good business for us make, and they also shall so arrange their cables. Then, mein freund, when comes The Day and we strike, the accursed English shall not quickly make their shells and their airships to butcher our men. Their trains shall stop, so, and their towns into darkness shall go, while our music from the air strikes death and terror, and these fools of the English who think now to make the good business with us shall know what it is to conquered be; do we not work here each night to bring that? Ach—listen, Herr—Mr. Hartstein, I do only make the joke, but it will be good business for us if these cables downbreak, for by then we shall have forced the English makers to stop, and so the orders must again to us come. You must what I have said forget, but so arrange the cables, for 1927 will be a heavy year for business, and so we shall many orders from the English obtain."

"Ja, Herr Direktor—it shall be. Gott mit——."

The voice ceased abruptly, and in my receivers I seemed to hear the roar of the London streets. Above the hoot of the motor horns I heard the strident voices of the newsboys: "Two thousand airyoplanes over the North Sea! Mobilisation ordered! Warships reported sunk!" I seized the receivers to remove them, when a new voice fell on my ears, a clear-cut voice, although the tone was despondent. "It seems hopeless, General. The Ministry has just telephoned that the anti-aircraft guns on order cannot be delivered, as the power supply to the works has failed."

Then another voice, authoritative and distinctly angry: "Why is it that all this power is failing? Within the last two weeks there has been an epidemic of failure—is it deliberate interference, do you think?"

"I don't think so, General. I investigated the last two cases myself, and it seems that the trouble is due to the cable things which they put in the ground. I don't quite understand it, but the engineer told me that he had never known anything quite like it, for the whole length of the main supply cables to Vickstrong's works had gone wrong at once. He said he would have left them in the ground and put others along the surface of the road if only he could get the cables, but they don't make that kind in this country now: it didn't pay, and they dropped it."

"Well, something has got to be done. What with these infernal trains breaking down—more power failure, I suppose—and no guns, it looks as if we shall be bombed to pieces before we can hit back. Ring up Whitmore's, at Newcastle, yourself, and tell them we must have their guns here in three days or we will come and fetch them."

"Very good, Sir."

"Confound it, what's the matter with the light?

A pause, only broken by the furious tapping, apparently of a typewriter.

Again the clear voice: "I'm very sorry, Sir, but we can't get through to Newcastle; they think a bomb must have made a direct hit on the cable route, for it was all right half-an-hour ago, and now they can't get the North at all."

"Well, send it by wireless or turn out a car—anything, and send someone to see to this light—it's up and down—*right* out now! Why——."

The voice stopped, and the strains of Strauss, crashing to a finale, resounded in my ears. Then silence save for some feeble Morse tapping out "Dot, dot, dot; dash, dash, dash; dot, dot, dot."*

Now, that's all. I tried in vain to pick up anything further of either of the two conversations I had overheard, and then, recovering my book, which had slid to the floor, I racked my brains for a solution of the phenomenon.

I can't offer any explanation, and it seems absurd to believe that everything, from the early ages to the distant future, is really happening at the same time. Besides, that wouldn't explain how I heard—no, that's out of the question.

There is nothing unusual about my receiving set, which cost me very little, for I picked it up abroad whilst assisting the Army of Occupation, and have added a few gadgets which were Government surplus, so that it can hardly be expected to develop prophetic qualities. However, there it is, and I must hope that the experts will one day furnish an explanation. Perhaps I somehow "listened in" to other performances than the concert, or possibly they were merely rehearsals.

* Morse for "SOS."—Eds.

HOW NOT TO BUY.

By WALTER SHANDY.

I see that a provincial contractor is complaining of the service of the London factors—and well he might. No doubt the fault is partly the contractor's own, he shouldn't be so credulous; but it lies to a much greater extent with the factor's traveller, who is, as a rule, only too willing to promise anything when there is a chance of punching up his commission a bit.

The contractor who is lucky enough to have a contract finds himself the centre of a horde of hungry factors' travellers the moment his tender finds acceptance, and long before any announcement of his success can have been made. How it happens I cannot pretend to explain, unless there is some subtle scent attached to an electrical job too faint for the non-travelling proboscis to distinguish. Needless to say (especially to manufacturers) the contractor hasn't got the materials for his job in stock, and consequently he asks some of the horde if their firms have—and they all say "yes," of course. With sweet words and bitter beers each man does his best to persuade the unfortunate contractor to place his order with him, stretching the long bow to an incredible extent in the endeavour to demonstrate the vastness of his firm's stocks and the lightning-like velocity with which goods are dispatched.

Whoever tells the best tale in the most convincing manner gets the order, but the result to the contractor is much the same in any case. It may be briefly summarised as follows:—

Traveller's Tale.	*Result to Contractor.*
Goods actually in our own stock.	Goods arrive in one week.
Consignment just arriving at our own stores.	Goods arrive in two weeks.
Goods actually in stock.	Goods arrive in three weeks.
(Note the subtle distinction between this and No. 1.)	(Contractor thinks "whose stock?" at the beginning of third week.)
Delivery in a few days.	Goods arrive in a few weeks.

There is no need to labour the point, every contractor could go on filling up these two columns *ad infinitum*, and never by any chance would he find any correspondence between columns 1 and 2.

In spite of such experiences, however, it seems that the contractor still has the impression—and the horde doesn't attempt to dispel it—that the factor is a man who buys in large quantities from the manufacturer to sell in small quantities to the contractor, and that he gets his living out of the extra discount allowed him for buying in quantities. This is nearly right (it was quite at one time), but the fact that it is only nearly so, should be evident to the contractor from his own experience. He knows that he has only just been able to keep his own head above water for the last two years by discarding everything in the shape of stock, and yet he continues to manifest a touching faith in the existence of factors' "stocks."

What actually happens to his order is this:

The factor's traveller who calls on him, having promised delivery next day in order to get his order, posts it off that night to his firm, and that finishes his connection with it until the time comes to draw his commission. Meanwhile, the order having reached the firm, has first to undergo a cynical scrutiny by the factor's cashier—all Scotsmen and misanthropes—and if the contractor happens to have an account and not too much of it is overdue, it will be passed on to the "inside" man to be dealt with. (If he hasn't got an account a week or so will be spent in taking up references and getting unreliable information as to his financial status from the usual agencies.)

This factor's "inside" man—I don't know what else to call him, although I have been him for years—is the man whose job it is to carry out the traveller's promises, and a fine job he's got these times. In passing I might mention for no particular reason that the traveller strenuously resents his being paid any salary at all, on the ground that all he has to do is sit on his seat and take the orders the traveller has obtained by the sweat of his brow and the empurplement of his visage, a privilege worth paying for, in fact. Of course, there is a faint possibility that the goods *are* in stock, for the reason that practically every factor runs some speciality on some unlucky manufacturer's consignment stock, and in this case the "inside's" job is appreciably lightened; but bearing in mind the fact that the electrical traveller will take ("seize" would be a better word) an order for absolutely anything at absolutely anything rather than let it go to a rival, the possibility is only faint. The goods, we will say then, are not in stock, so the "inside" man, following the clan instinct, will ring up a dozen or so other factors and have the following conversation with each:—

"Hallo! Is that the Evangelical Electrical"?

"Yes."

"We're Smith's. Have you got half a gross of so-and-so in stock"?

"No."

"Truthful, if terse," you will observe, but these are not travellers.

Next he will try one or two manufacturers of the article he wants, but the fact that he has to work to a price limit owing to the traveller's habit of "cutting," adds considerably to the difficulty of negotiating. He usually haggles the price down a bit by representing the order to be a sample one from a large user, who will take considerable quantities if he approves the first lot.

"*Not* so truthful," you remark; but the manufacturing worm is fair game, and hasn't turned yet.

All this happens, you will note, on the day the order is supposed to be dispatched. However, the contractor's luck may be in, and the factor may have been able to place his order on that day, and *if* he doesn't mind giving his customer's name away, the goods may go forward the following day under plain label. It isn't usually as straightforward as that, however, as, quite apart from the acrid discussion (interlarded with terrific promises of cheques awaiting directors' signatures) between the factor's and manufacturer's cashiers—all homicidal Scotsmen, the latter—on the question of overdue account before the goods are released, factors *don't* care to give names away, and another day or two will elapse while the goods come into the factor's stores to be re-packed and re-forwarded.

There will be further delay, of course, if the manufacturer doesn't happen to have a London office, as all this performance has to be gone through by post, the margin on contractors' orders not being sufficient to cover trunk calls in most cases.

If their orders are really treated like this, one naturally wonders why the contractors don't go direct to the manufacturers. There are no good reasons, but one or two of the bad ones are given below.

In the first place the manufacturer has in the past neglected his selling organisation, having been brought up (by the factor) to believe that it pays him to sell in large quantities at large discounts to factors and let them do the selling to the contractors. Consequently the sweet promises and liquors of the afore-mentioned factor's traveller, "the personal touch" I believe these salesmanship fellows call it, usually carry the day. For another thing, factors' discounts are usually 15 per cent., with an implied promise that they stick to all of it, but in these hard times the factors are willing to forgo some of it, and consequently manage to cut out the manufacturer, who is an honourable man, in direct competition, on the question of price.

It is extremely difficult to see why, now that the factor has given up keeping stocks, the manufacturer gives

him preferential terms; it must be either conservatism or optimism, and heaven help him if it is the latter. The fact remains, however, that he does, and consequently users' or contractors' prices are up unnecessarily.

I think I have shown the contractor pretty fully what happens to his order for materials if a factor gets hold of it, and why he gets bad delivery and pays higher prices for the privilege of being served by a factor, and I suppose it is up to me to point out how he can avoid this. The remedy is simple. It is to become a factor himself.

A "Manufacturer and Contractor" pointed out in the correspondence columns of the Review a week or so ago, that to become a contractor one needed a capital of £15, which had to be borrowed from an aunt, if I remember rightly. I think it is pretty generally known that this would start rather a "posh" contracting business, but it may not be so well known that one can become a factor for £15 less than this—if one knows a printer—which may be good news for aunts.

All that is needed is some nice letter-heading with the words "Suppliers to the Trade" under the name, and the thing is done. Inquiries will bring in factors' discounts automatically, and no questions asked. Let any contractor try it on over the telephone by way of experiment and he will probably be surprised to find how easy it is.

"Re-sale to the Trade" are magic words in the electrical game.

The time to strike the iron, however, is now, while it is still hot. I said a little way back that the manufacturing worm hadn't turned yet, but it *is* beginning to show faint signs of life. One or two in reply to inquiries with requests for factors' discounts quote with this sting in the tail: "Factor's terms will be quoted on receipt of your orders for factor's quantities," but very few of them dare protest even as mildly as that.

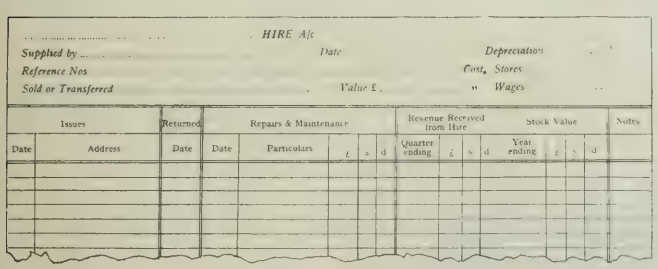
A friend to whom I showed these notes remarked that I seemed to have ignored the existence of an Electrical Wholesalers' Federation. Quite true. So I have, now I come to think of it.

And so have the wholesalers, I have heard.

WORKS RECORDS OF APPARATUS ON HIRE.

By "INTERESTED."

There are many different methods in use for keeping records of electrical apparatus lent out on hire, or hire-purchase, and one of them that has been brought to my notice, which claims practical usefulness, is described herewith. The card A reproduced in fig. 1 is ruled and printed, and bears at the top spaces in which may be entered details of the apparatus on hire, by whom supplied, the date received and price paid, reference number, and cost of installation—wages and material; also space is provided for recording the facts should the apparatus at any time be purchased by the consumer. In the columns there are spaces for recording the issues and returns, cost of repairs and maintenance, revenue received for the hire of the goods, and depreciated value year by year. No mention is made of the revenue received for energy consumed, as in this instance such particulars are available at any time from another department. This card actually records the life of each piece of apparatus, whether electric fire, cooker, stove, iron, fan, &c., upkeep and depreciation. Thus, taking as a useful life the period of, say, four years, one quarter the cost of installation, plus the amount spent in keeping it in good repair, should not in any one year exceed the sum received for its hire. Naturally, to pick out one item, any particular year might show a poor result, but, collectively, should provide a balance on the right side if the whole hire scheme is successful.


HIRE A/c

Supplied by ... Date Depreciation

Reference Nos Cost, Stores

Sold or Transferred Value £ ,, Wages

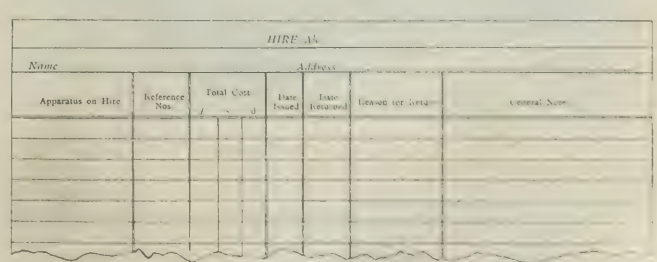
Issues		Returned	Repairs & Maintenance				Revenue Received from Hire				Stock Value				Notes
Date	Address	Date	Date	Particulars	£	s	d	Quarter ending	£	s	d	Year ending	£	s	d	

Fig. 1.—Card A.

These cards are kept in a cabinet with three large dividers: "On Circuit," "In Stock," and "Obsolete." Under each of these large dividers are smaller ones for: cookers, kettles, irons, fans, fires, and sundries. The cards under each sub-heading run in order of the reference numbers which are taken from the apparatus itself, so that a certain numbered cooker on hire can be found in a moment.

Across the obsolete cards is written how the article has been dealt with, *i.e.*, "Depreciated and scrapped," or "Scrapped and quarter cost written off," or whatever the facts may be.

Card B, fig. 2, is of a different nature, being for the purpose of showing what apparatus is at any particular address, the reference numbers on it, cost, date of issue, &c., and are indexed alphabetically under names of streets or roads. In this manner one only needs to turn up the card for a certain address and thereon will be found a list of any goods on hire at that address; from the reference numbers thereon recorded the "life cards" may be looked up in the next drawer, and the whole business is before one. That "other department" will furnish information as to sums received for sale of energy (over the telephone in the case described) if required.


HIRE A/c

Name Address

Apparatus on Hire	Reference Nos	Total Cost £ s d	Date Issued	Date Returned	Reason for Return	General Notes

Fig. 2.—Card B.

In this manner a fair idea can be obtained, and comparison made, of which goods afford most business, and whether the charges are proportionate to the average life

of the articles. Also, the costs of repairs and maintenance on similar goods by different manufacturers can be compared, together with their first cost and useful, practical life. Likewise, much detail is obtained of the length of time various goods are on hire, which will enable a closer figure to be quoted for hire.

Altogether the two cards appeal to one as providing just that information desired from time to time, and that without referring to many cards, as in some methods I have seen, which kills the whole idea of cards being convenient yet quick means for reference.

THE DIELECTRIMETER.

A New Oil-Testing Device.

In modern electricity generating stations a considerable quantity of oil is used one way and another, and its maintenance in good condition, so that it can be relied upon to function satisfactorily in the manner it is intended to do, becomes quite an undertaking, especially if suitable apparatus is not available.

There are several ways of reclaiming and reconditioning oil, amongst which is the De Laval centrifugal method that we described a year ago*, but any system of purification naturally involves means of testing the oil.

The available methods of doing so are, however, not as convenient as could be desired, inasmuch as the necessary equipment is expensive, is apt to become bulky, and is not portable. The latter consideration often involves the carrying of samples to the testing equipment over considerable distances instead of testing the oil *in situ* and, if the sample be not taken with due precautions, it may easily become contaminated, so that misleading results are obtained.

Disadvantages such as those that have been referred to should, however, be easily avoided by the use of new apparatus that has just been placed on the market by its sole patentee and manufacturer, Mr. A. W. Empson, A.M.I.E.E., &c. It is known as the Dielectrimeter, and has been specially designed as a portable and convenient instrument by means of which the dielectric strength of transformer and switch oils is rapidly and readily ascertainable. Very little larger than, and as easily carried about as, an ordinary typewriter, it will be seen from the accompanying illustration (fig. 1) to consist essentially of an induction coil mounted on a polished mahogany base, and capable of producing a

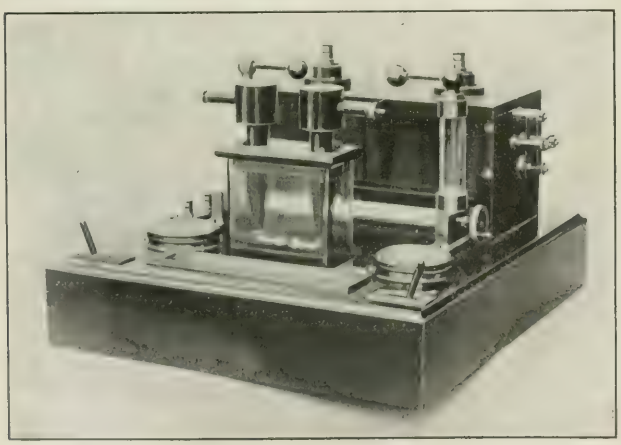


Fig. 1.—The Dielectrimeter.

1-in. spark in air between needle points; that is, the equivalent of about 77,000 r.m.s. or 54,000 r.m.s. volts.

The testing voltage is regulated by means of a variable spark gap between sphere electrodes, one of which is mechanically connected to a scale on the base of the instrument immediately in front of the cell that contains the sample of the oil to be tested; the scale is calibrated to read in r.m.s. values. The oil-test cell is provided with ½-in. sphere electrodes, one of which is adjustable, the stems of the electrodes being mica insulated and capped with ebonite. The complete cell rests on a seat in the base of the instrument, and a special feature is the facility with which the electrodes and cell can be adequately cleaned—an important consideration that is not always possible with apparatus of a similar nature.

On the low-pressure side of the outfit are fitted a fuse, voltmeter, ammeter, and reversing switches. The method of using the device is simplicity itself, and the power required to operate the coil is from 4.5 to 5 amperes at a pressure of 12 volts, obtained from a small battery of accumulators. The base of the instrument measures 16 in. by 14 in., its overall height is 9½ in., and its weight 28 lb. Carrying cases can be supplied finished in various styles to suit individual tastes.

The Dielectrimeter is an inexpensive testing outfit that should prove of great value to all users of oil in any quantity, not only in connection with electricity generating stations, but in many other spheres as well.

* Elec. Rev., September 16th, 1921; p. 388.

"EXIDE" BATTERY SERVICE.

Chloride Electrical Storage Co.'s Organisation.

As is well known to every motorist, the success of the modern motor-car electrical equipment depends upon the proper functioning of the battery. Unfortunately the battery cannot be mechanically and automatically looked after—it requires periodical testing and attention in order to maintain it in proper condition.

One supposes that as long as human nature remains what it is, it is going to be difficult to persuade motorists, or even chauffeurs, to give their battery that slight periodical inspection and attention that wards off troubles, and at the same time considerably extends its life. There is an appalling number of these useful little power boxes ruined every year, purely by neglect.

This is where the Exide Battery Service is able really to help the motorist. It looks after his battery for him and, if he so desires, shows him how to look after it himself. It does this in any decent-sized town in the British Isles—or, for the matter of that, in any part of the world.

This service has been organised by the allied manufacturers of the Exide starting battery. These are—in England, the Chloride Electrical Storage Co., Ltd., of Manchester; and in America, the Electric Storage Battery Co., of Philadelphia. Each of these companies has a long and extensive experience of the manufacture of batteries of every kind and for every purpose.

We outlined the organisation some six months ago on the occasion of the formal opening of a new depôt and showrooms in London.* At that time there existed approximately 200 such service stations in this country, and the fact that since then the number of Exide service depôts in Great Britain alone has increased to 300 is a convincing indication of the success of the venture. In addition to these, there are similar depôts in practically every country where it is safe to take a motor car, the total number throughout the world being about 4,000. Moreover, the London premises, which were intended to serve the Southern and Midland districts, have during those few months become too small to cope with the demands of the public. To relieve the situation another station was recently inaugurated in Dale Street, Birmingham, which we had the pleasure of visiting last week another step in the development of the service organisation. The work thrown upon the London depôt has been so great that it had to be relieved by narrowing the district for which it caters. This depôt in Birmingham is established to meet the requirements of the trade in the Midlands, which will no longer have to look to London for supplies, and it is confidently expected to be a mother of further offshoots. This depôt has been established in the heart of the motor-car manufacturing centre, and it is hoped that the motor-car manufacturers will make good use of it. Many motor-car builders buy the lowest-priced battery, and in many instances where batteries are bought from the maker of a starting and lighting outfit, the price of the battery to be taken into account by the motor-car maker is the difference (usually a nominal one) between the price of the outfit complete with battery and the price of the outfit without battery. This provides an explanation why Exide batteries are not supplied on new cars of some well-known makes.

In America a different condition of affairs exists: There are no longer any makers of starting equipments who make, or

* Elec. Rev., Feb. 24th, 1922, p. 256.

indeed who supply, batteries with their equipment; the motor-car maker buys his starting machine from the maker of the machine, and his battery from the maker of the battery -he relies upon the specialist for his own line. The same condition will obtain in England in the course of time, and it is a portion of the Chloride Co.'s mission to establish it.

The capital employed in the businesses of the makers of the Exide battery is over £8,000,000. This will give some idea of the resources behind the organisation and of the value of the guarantee and backing which accompany its sales. Here is a service organisation which it would be hard to rival in this or any other country. The service is open to users of all types of batteries, the charges are moderate, and every effort is made by proper supervision, by conferences, and by the utmost co-operation with agents to be of the greatest possible use to battery users, and to relieve the motor-car maker, the dealer, and the user of any trouble which may arise with batteries.

THE ELECTRIFICATION OF RAILWAYS WITH HIGH-FREQUENCY CURRENTS.

On July 17th, 1922, M. Maurice Leblanc presented a note to the Academy of Sciences on the subject of supplying power to railway trains with alternating currents of high frequency, without sliding contacts, and without affecting telegraph and telephone lines in the vicinity. The following translation of his communication is derived from *La Revue Générale de l'Electricité*, in which the note is reproduced in full:—

It is difficult to deliver strong currents to high-speed vehicles by sliding contacts; hence high pressure is necessary to reduce the strength of current, whilst also economising copper. It would be convenient to use alternating current at the ordinary frequency, transforming it on the loco-

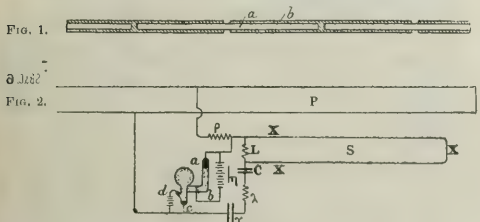


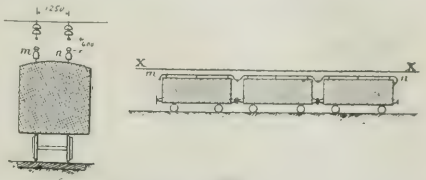
Fig. 1.—Section of Line Conductor.
Fig. 2.—Primary and Secondary Lines and Transforming Apparatus.

motive to suit the motors, but such current interferes with neighbouring telegraph and telephone lines. However, if a high frequency were employed, say 20,000 cycles per second, and the current were carried by conductors suspended over the track, it would be possible to transmit energy to a circuit carried on the train, without the use of a sliding contact. Moreover, the currents induced in adjoining telephone and telegraph lines would have no effect on the receiving instruments owing to their high frequency; to prevent the induction of high pressures in single-wire telegraph lines, it would suffice to connect the latter to earth at intervals through condensers, which would allow the high-frequency currents to pass freely, but would block the telegraph currents.

Transmission Line.—Suppose the transmission line consisted of two parallel horizontal conductors 1.25 m. apart, 4 m. above the rails, and disposed symmetrically with regard to a vertical plane through the centre of the track. Each conductor would consist of two concentric tubes, 1 mm. thick, the external diameter of the inner tube being 20 mm. and that of the outer tube 26 mm. They would be separated by a dielectric 2 mm. thick, having a specific inductive capacity equal to, say, 2, and a dielectric strength of 400,000 V/cm. These tubes are interrupted at intervals (see fig. 1), and each is divided into sections of equal length, insulated from one another, each outer section overlapping two inner sections equally. Thus the line consists of identically similar condensers connected in series. Its coefficient of self-induction is 3.751×10^{-3} henry per kilometre. The capacity of an elementary condenser 1 km. long would be 0.6094×10^{-6} farad. In order that the line should resonate, when traversed by currents of 20,000 cycles per second, each section should be 47.3 m. in length. A current of a maximum value of 100 A is assumed; the potential difference on the dielectric is then 5,542 V, whilst it would require 80,000 V to pierce it. Finally, the shunt capacity of the line, allowing for the presence of the earth, is 0.0125×10^{-6} farad per kilometre; to compensate for this an inductance coil of 0.00507 henry must be connected between the go and return conductors at each kilometre.

Feeding the Line.—A primary line P traversed by direct current at high pressure feeds transforming apparatus of the type previously described (Elec. Rev., September 8th, p. 353, fig. 2), but the transformer feeding the network is replaced by a second resonator Lc tuned for the frequency of 20,000 cycles/sec., like the resonator λγ. The secondary line XX, in which the alternating current is to flow, is formed into a loop S, and connected to the terminals of the coil L.

Then, as has been shown by M. Boucherot, if constant effective potential difference is maintained between the terminals of the resonator Lc, the line XX is traversed by a current of constant effective strength *no matter what its*



Figs. 3 and 4.—Relative Positions of Overhead Conductors and Train Conductors.

impedance may be. Lastly, if its self-induction is compensated by capacity, as in the case considered, the current which traverses the resonator Lc is entirely wattful.

Receiving Circuits.—On the roofs of the coaches (figs. 3 and 4) are arranged, 1.25 m. apart, two tubes *m* and *n*, 10 cm. in diameter and 2 mm. thick. Each extends under one of the line conductors, at a distance of 40 cm. from it, centre to centre.

These tubes are carried on insulators and connected to those on the adjoining coaches by flexible conductors fitted with couplings. At the tail of the train, these couplings are joined together, closing the circuit, whilst at the head of the train the circuit is completed by the transforming apparatus.

This circuit has, per metre of length, with the line, a coefficient of mutual inductance of 458.7×10^{-9} henry; its inductance is $2,575\times10^{-9}$ henry. Allowing a current of 1,735 A to circulate in it, a fall of pressure is caused in the line of 100 V per metre, taking 10 kW. But for this purpose it is necessary that the secondary circuit shall be in resonance. For this reason each coach carries a condenser interposed in the circuit. If the coach is 13 m. long between buffers, its condenser must have a capacity of 1.892 micro-

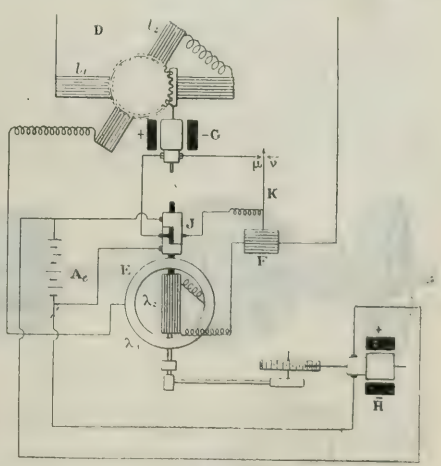


Fig. 5.—Apparatus for Automatically Maintaining Resonance.

farads; it is subject then to a pressure of 7,300 V (effective), and stores 101 joules. The power made available on the coach is 130 kW.

Maintenance of Resonance.—In order that the induction circuit may resonate, it is necessary that it be perfectly tuned, and the tuning must be maintained automatically. For this purpose, the motor-car is provided with a variable inductance D, fig. 5, interposed in the induction circuit of the train and consisting of two coils l_1 and l_2, the former fixed and the latter movable; it passes from minimum to

maximum when the coil λ_2 is turned through 180 deg. A motor G performs the rotation in the direction required, its movements being controlled by an apparatus comprising a variable inductance E, consisting of a small fixed coil λ_1 and a small coil λ_2 which is kept continually oscillating about a plane at right angles to the coil λ_1 by a motor H. The coils λ_1 and λ_2 are mounted in series in the induction circuit, as well as the coils l and l_1 and a galvanometer I, of which the pointer is connected to the pivot by light friction.

When oscillating, the coil λ_2 increases or diminishes by a small amount the inductance of the induction circuit and consequently makes the current strength i vary by, for instance, 1 per cent. The pointer of the galvanometer can move over a very small range between two stops μ and ν. If it rests on the stop μ, it closes, by means of a relay not shown, the circuit of the motor G; on the other hand, it opens the circuit if it rests on the stop ν. The former action takes place if the current i increases, and the latter if it diminishes.

A commutator mounted on the axle of the coil λ_2 sends into the armature of the motor (whose field is always excited with the same polarity) a current in one sense or the other according to the inclination of the coil λ_2 to the left or the right. The connections are so made that the motor makes the inductance D increase if the inductance E has increased, and *vice versa*, but it only starts if the displacement of the coil λ_2 has brought about an increase of the strength of current i, and it stops when the latter ceases to increase. Under these conditions, the inductance D is varied automatically so as to make the current i in the induction circuit a maximum.

Control of the Train Motors.—If the train is m metres in length, the power available for traction is $10\ m$ kilowatts, supplied by currents of a frequency of 20,000, at a pressure of $3.76\ m$ volts. But this power can be varied at will by detuning the induction circuit and consequently reducing the strength of the current. For this purpose a variable inductance controlled by the driver is provided.

The current will be transformed, as previously explained, into three-phase current of any desired frequency, which can be varied with the speed of the train. This will enable squirrel-cage motors to be used, the simplest type of all, which can be fixed under the coaches without difficulty, making them all motor-coaches. They will be connected in series, the e.m.f. available being proportional to the number of coaches, and therefore to the number of motors.

This system not only dispenses with the use of sliding contacts, but also allows of the use in the transmission line of currents at very high pressure, and of collecting currents at low pressure on the train, say at 75 V per coach. The line constitutes the primary circuit of a transformer, of which the secondary circuit is carried by the coaches. All the transforming apparatus is of the static type, except a commutator, which only carries microamperes, and the controlling apparatus are reduced to a variable inductance coil and a very small rheostat intended to regulate the speed of the commutator. Finally, it enables squirrel-cage motors to be used. This system, then, appears to be much more simple and economical than the existing methods, from all points of view.

There certainly will be many difficulties to surmount before the three-electrode bulbs of large output required to produce or transform the high-frequency currents are realised in practice; but the author has thought it well at once to draw attention to this very important application, in order to show how great interest attaches to the study of these bulbs.

THE NATIONS' FOOD EXHIBITION.

Organised by the International Trade Exhibitions, Ltd., in conjunction with the Trades' Markets and Exhibitions, Ltd., the above-named show was opened at Olympia on September 6th by Sir Thomas J. Lipton, Bart., K.C.V.O., for a period of three weeks. It is designed on an ambitious scale to bring before the public, and in the most attractive manner, the world's greatest industry. The foodstuffs exhibits are supplemented by displays of machinery, refrigerating processes, plant utilised in hotels, catering establishments, and so forth, and many items of a labour-saving character, which can be used with advantage in the preparation and cooking of food. A series of lectures appertaining to health, cooking, and food, has been arranged, and a sum of £1,050 is to be distributed in connection with competitions, while several oversea British Governments and a number of foreign countries are represented. The number of exhibitors totals nearly 300.

Whilst the suitability of electricity for driving refrigerating machinery in cold-storage warehouses and large installations of a similar character is as obvious as the desirability of this class of load to a public electricity supply undertaking, it may not be so generally known that the same principles can be applied in shops, hotels, catering establishments, &c.

Several refrigerating equipments are to be seen at the show, but probably the most interesting is that of A-S Refrigerating Machines, Ltd., which is being adopted extensively throughout the world for small and medium-size installations, over 11,000 A-S machines being in actual operation at the present time.

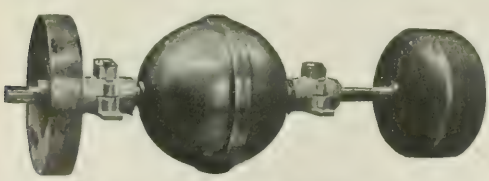


Fig. 1.—A-S Condenser and Evaporator.

Features of this novel machine are its simplicity and the fact that it requires no skilled attention. The accompanying illustrations will show the marked difference between this machine and those to which we are accustomed to seeing, there are no gauges, valves, or similar contrivances to be attended to, and positively all one has to do is to start the driving motor (indeed, this operation may be done automatically if need be by means of thermostats) and let the plant run until the desired cooling effect has been obtained, when the motor is stopped. From the users' point of view one of the great assets of the machine is the fact that it gives its maximum output continuously and automatically without having to be regulated in any way; while, furthermore, the temperature can be reduced to any desired extent; it never requires to be re-charged with lubricating oil for the compressor, chemicals, or refrigerant.

The first of the accompanying illustrations shows the essential parts of the A-S machine, while the second is a view of the complete ice-making plant. In this case the rotor is "ghosted" into the tanks to show its relative position with regard to the latter. In the brine tank portion a series of cans is placed, the cans being filled with ordinary water which in the usual way is formed into ice. To enable its mode of operation to be clearly understood reference should be made to the sectional sketch (fig. 3) which has been drawn with a view to illustrating as simply as possible the internal construction. Essentially the machine consists of a spherical condenser on the left and a cylindrical evaporator on the right, joined by a hollow shaft, to the free end of which is fitted a driving pulley F. The illustration represents the condenser partly immersed in its cooling water, while the evaporator is partly immersed in the liquid to be cooled, the two being connected by a hollow shaft, through which passes a small pipe H. The usual compression cycle is adopted, a compressor of special construction being suspended from the shaft in the condenser, and weighted, B, so that, as the condenser and evaporator rotate, the compressor remains in a vertical position. The oscillating motion is obtained by an eccentric on the shaft to which the piston is connected. The upper portion of the compressor housing is arranged in the form of a large oil container O, into which the lubricating oil (a chemically pure mineral oil) is collected by the scroop A as the machine rotates. The oil then passes over the whole of the working surfaces (including the interior of the compressor) in a definite and pre-determined stream, thus ensuring perfect lubrication. One of the chief factors responsible for the success of the A-S machine has been the system of lubrication employed, which is so perfect that after years of working the wear in the compressor and other parts is quite inappreciable. Some of these machines have been opened up after they have been running over five years, and it has been

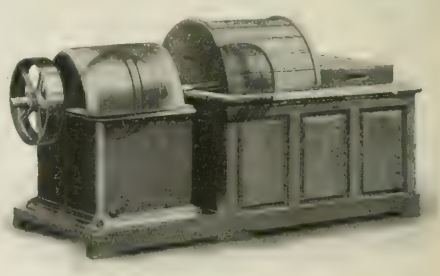


Fig. 2.—Complete A-S Refrigerator.

found that both the refrigerant and lubricating oil were in exactly the same condition as when the machines were originally sealed up, while the wear was so fine that it was impossible to measure it accurately. It was also found that the efficiency in each case was practically the same as when the machines were new.

By following out a cycle or two the operation of the machine can be more clearly understood. In the first instance the gas is sucked from the evaporator through the opening G in the end of the shaft that projects through the evaporator on the right by the compressor, by which it is compressed and then discharged into the condenser, which is rotating in the cooling water, by which its heat is extracted, and in consequence it liquefies. It then passes through the pipe H in the shaft to the evaporator, where it again evaporates and absorbs heat from its surroundings, which may be brine or other liquid depending upon the form of cooling employed. This cycle continues indefinitely so long as the machine is rotated.

Before dispatch the machines are charged under a vacuum with the requisite amount of lubricating oil and refrigerant, after which they are hermetically sealed. It is quite impossible for the gas to escape because the whole of the working parts are completely enclosed, while at the same time there are no valves, glands, of pipe connections, through which

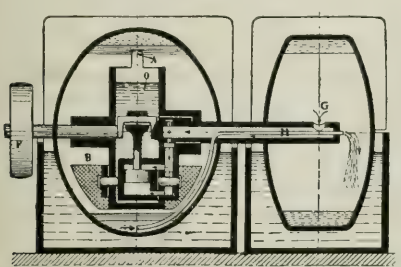


Fig. 3.—Condenser and Evaporator in Section.

leakage of gas could take place. This enables the machines to run for many years without re-charging, an important factor which should be borne in mind, particularly in districts where it is difficult to obtain the necessary chemicals. Further, there is no deterioration of the lubricating oil, because, before sealing, the air is entirely exhausted from the machines, thus ensuring that carbonisation cannot take place. For use in tropical and other situations, where water is scarce or expensive, an economiser can be supplied (as a standard fitting) to the condensing water tank, and with this in use only a comparatively small quantity of water is used for cooling purposes. The motor main switch can be coupled with the water-cock, so that when the switch is turned on, the condensing water is allowed to circulate. These small machines provide an admirable day load for supply undertakings, as they run at a steady load for many hours a day.

On Messrs. Oliver Brothers' stand are to be seen several Strite automatic toasters (fig. 4) that have been placed on the market by the Waters-Genter Co. (U.S.A.), in the belief that they fill a long-felt want in restaurants and hotels that have found the making of good toast in quantities a difficult

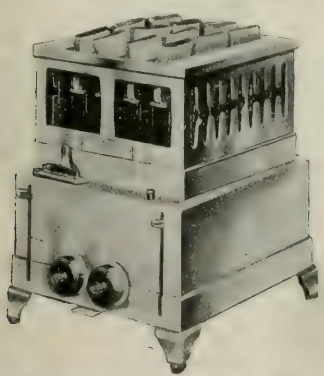


Fig. 4.—Strite Automatic Electric Toaster.

and trying problem. The device is substantially constructed of polished cast aluminium, and all one has to do is to place the slices of bread to be toasted in the slots above the oven, press down two small levers (as is done with a cash register) and leave it. Through the operation of a timer, which can be set for any degree of toasting desired, the toasting stops, the electricity is cut off, and the finished toast is raised out of the oven automatically when done. When the machine is once set for the quality of bread used it will continue to toast uniformly without further adjustment. It makes toast in a minute and a quarter, and the largest machine makes 575 slices an hour. The four-slice toaster measures about 12 in. square at the base and stands 14 in. high; the eight-slice machine is 12½ in. by 15 in. at the base and is 17 in. in height, there being four bread slots 11¼ in. long, each of which will admit two large slices or three small ones if the latter are not over 3¾ in. wide. This gives the machine a capacity of twelve small slices or eight large ones at a time or an hourly capacity of 350 large or over 500 small slices. The toasters consume electricity only when the bread is actually toasting, and only for the amount of bread in the machine; the electricity is switched on automatically when the toasting starts, and is switched off in the same way when done, so that the energy cost per slice is small.

Messrs. Herbert Smethurst & Sons, Ltd., exhibit electrically-driven ventilating, air purifying, and disinfecting machines.

The "Vigoratair" system of air purification is obtained by a centrifugally-produced upward current of water converted into spray, by collecting the air over a given area by the fan, and the cleansing effect by slowly passing the vitiated air through the water spray; the pure air escapes at the base of the apparatus. These movements create a natural current of air from the lower strata to the higher, thus removing the foul air and replacing it by pure clean air. The effect of this apparatus is to dissipate the carbon di-oxide, the ammonia, the nitrous oxide in excess, together with other noxious fumes by absorption in the water, or counteraction by necessary chemical reagents, disinfectants, de-odorisers, &c. The solid particles are washed out of the air and are deposited in the water pan, to be periodically removed by the drains.

The circulation of the air and water within the casing is performed through a hollow cone-shaped tube (inverted) revolving in suitable bearings. At the top of the tube there is a shaft on which is fitted a volume fan, and an extension of the shaft is coupled to the motor shaft, so that the fan wheel, which induces the air current, and the cone-shaped tube, which elevates the liquid, are all driven together. At the base of the cone-tube the tube rapidly tapers to a point, which is sealed by a short spindle for the bottom bearing. The rapid revolution of the cone-tube, which has a small hole at the lower end dipping in the water in the pan, elevates the water up the tube by centrifugal force to the wide portion of the tube in the form of a film, which is converted into a spray on leaving the top, when it falls back by gravity to the pan reservoir. The fan fixed on the upper part of the shaft induces the vitiated air through the perforated cover and forces it down against and through the water spray, and it is eventually ejected through the vanes at the base purified and cleansed. The object of the vanes at the base of the apparatus is to prevent the water, under the influence of the rapidly revolving inner cone-tube, from being sprayed on the surroundings outside, and this it does effectually.

The Avonmore Engineering Co., Ltd., has on view the "Acme" electrically-driven knife cleaning machine and other labour-saving appliances for the caterer.

Messrs. Joseph Baker, Sons & Perkins, Ltd. (in conjunction with Messrs. Fullers, Ltd.), exhibit working chocolate and confectionery machinery, amongst which is a "universal enrober" for covering sweets with chocolate. The machine is electrically driven and the chocolate is maintained in a liquid state by means of an electric heater.

Messrs. Benham & Sons, Ltd., show coal, gas, steam, and electric cooking apparatus and "electro-vapour" radiators.

The Falkirk Iron Co., Ltd., has on view "Falco" and "Hotpoint" electric heating and cooking ranges suitable for small flats, houses, &c., in addition to a special display of devices for an all-electric kitchen.

Messrs. Electrical Utilities, Ltd., exhibit their current limiter and cooker-radiator appliances.

Messrs. L. G. Hawkins & Co., Ltd.—On this firm's stand such labour-saving devices as electrically-driven coffee mills, meat choppers, egg and cake mixers, &c., may be seen, as well as lighting fittings.

The Hobart Manufacturing Co., Ltd., has a large selection of electrically-operated coffee roasters, potato peelers, a dish washer, loaf moulder, dough mixers, mills and choppers, &c.

The National Gas Engine Co., Ltd.—Amongst several vertical and horizontal gas engines on this stand a vertical water-cooled gas engine direct driving a 3-kW generator is to be seen.

On the gallery the Thor Co.'s washing and ironing machines, vacuum cleaners, and drying cabinets (all electrically operated) attract attention, as does also a penny in the-slot electrically-driven piano that is exhibited by the Harper Piano Co., Ltd.

Several sets of refrigerating plant that are on view are driven electrically, in addition to many of the machines that are to be seen on the stands of other exhibitors, while it is of interest to notice that several of the firms that are demonstrating cooking processes are doing so with the aid of electric cookers.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

23,251. "Mounting electric fittings on instrument boards of motor vehicles." J. Hodgson. August 29th.

23,284. "Detectors for wireless telegraphy, &c." H. R. Rivers Moore and R. M. Rivers, Ltd. August 28th.

23,286. "Telephone receivers." C. Brandes Inc. August 28th. (United States, June 13th.)

23,294. "Telephone instruments." C. M. Farquhar and W. S. Stephenson. August 28th.

23,306. "Control mechanism for electric ship propulsion, &c., systems." Metropolitan-Vickers Electrical Co., Ltd. August 28th. (United States, September 1st, 1921.)

23,307. "Device for releasing billiard balls, &c., and for automatically controlling lighting, &c., circuits." J. R. Bell and Burroughes & Watts, Ltd. August 28th.

23,308. "Electro magnets." British Thomson-Houston Co., Ltd. (General Electric Co.) August 28th.

23,311. "Sparking plugs." G. F. Sleath and M. S. Stephenson. August 28th.

23,316. "Electric junction boxes." A. W. Claremont (legal representative of E. A. Claremont), E. A. Claremont, L. B. Claremont (legal representative of E. A. Claremont), and G. H. Scholes. August 28th.

23,321. "Electric cooking apparatus." R. Ullrich. August 28th.

23,332. "Electric couplings." D. S. Ince and G. W. Pearson. August 28th.

23,335. "Electric incandescent lamp bulbs." J. Dyke and C. Hering. August 28th.

23,337. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 28th. (Holland, August 30th, 1921.)

23,338. "Glow discharge tubes with gas filling." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 28th. (Holland, September 1st, 1921.)

23,339. "Electric lamps with enclosed arc discharge." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 28th. (Holland, September 1st, 1921.)

23,340. "Head lamps for motor vehicles." F. E. Musgrave. August 28th.

23,369. "Electric lamp lock." W. V. Slynn. August 29th

23,374. "Controller fingers for electric switches." E. N. Bray and E. N. Bray, Ltd. August 29th.

23,375. "Electric resistances." E. N. Bray and E. N. Bray, Ltd. August 29th.

23,380. "Controlling and operating sliding contacts on inductance tuning coils." H. Ogden. August 29th.

23,388. "Control of electric lifting magnets, magnetic chucks, &c." H. E. Bowen, W. Brooke, E. Holme & Co., Ltd., and Steel, Peech & Tozer, Ltd. August 29th.

23,399. "Electric igniting devices." O. Bartschi. August 29th.

23,401. "Discharge tubes with enclosed arc discharge for alternating current." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 29th. (Holland, August 30th, 1921.)

23,402. "Electric lamps with enclosed arc discharge." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 29th. (Holland, September 1st, 1921.)

23,409. "Electric fusible cut-outs." G. C. Garrard, A. H. Railing, and A. F. Searle. August 29th.

23,410. "Telegraphic devices." A. R. Angus. August 29th.

23,425. "Electric condensers." N. W. McLachlan. August 29th.

23,437. "Self-exciting electric machines." J. Sousédik and R. Suczek. August 29th. (Czecho-Slovakia, August 30th, 1921.)

23,447. "Manufacture of electric storage battery plates." W. J. Plews. August 29th.

23,458. "Electromagnetic safe lock." M. Deakin. August 29th.

23,464. "Electric incandescent lamp and process for manufacture of same." Dr. Just Fele Izzolampa es Villamossagi Gyar Resvenytarsasag. August 29th. (Hungary, September 6th, 1921.)

23,472. "Terminal plugs for electric flat irons." S. Ginsburg. August 30th.

23,479. "Variable condensers for radio instruments, &c." F. Addie and Victoria Electrical (Manchester), Ltd. August 30th.

23,490. "Primary electric batteries." B. F. S. Baden Powell. August 30th.

23,492. "Wireless telephony." B. N. B. Wireless, Ltd., and B. Bryan. August 30th

23,493. "Telegraphy." D. Murray. August 30th.

23,494. "Wireless aerials." N. Crowther and S. Wainwright. August 30th.

23,509. "Crystal detectors for radio instruments." F. Addie and Victoria Electrical (Manchester), Ltd. August 30th.

23,516. "Magnetic motor." J. Hurych. August 30th.

23,528. "Devices for controlling ignition circuits of motor vehicles." W. Chipperfield. August 30th.

23,530. "Electric cooking utensils." M. Endres & Magnum Ges. August 30th.

23,531. "Electric smoothing irons." H. Endres & Magnum Ges. August 31st.

23,534. "Amplifying arrangements for telephonic currents." S. Strauss. August 30th.

23,544. "Tuning apparatus for wireless telegraphy and telephony." F. A. Stinchcomb. August 30th.

23,547. "Battery case for motor-cycle electric head lamps, &c." W. Long. August 30th.

23,568. "Installation of electric horns on motor cars, &c." W. H. Glaser and C. A. Vandervell & Co., Ltd. August 30th.

23,575. "Coils for electrical apparatus, and methods of manufacturing same." British Thomson-Houston Co., Ltd. (General Electric Co.). August 31st.

23,587. "Thermionic rectifier." H. R. S. McWhirter. August 31st.

23,596. "Electrically-operated direction indicator for motor vehicles." W. [illegible] August 31st.

23,607. "Lamp holder." B. J. van der Stigchel. August 31st.

23,633. "Devices for testing sparking plugs, &c." F. M. Denton. August 31st.

23,646. "Electric storage batteries." H. M. Genese, G. R. N. Minchin, Pyrene Co., and D. P. S. Co., Ltd. August 31st.

23,654. "Appliance for use with telephone receivers." C. C. M. Kennedy. August 31st.

23,665. "[illegible]." A. R. Angus. August 31st. Australia, [illegible] 1921.

23,666. "[illegible] systems." H. Baron & Aldenhoffs. August 31st.

23,720. "[illegible] Lamp holders in Lanterns." F. H. Morgan, [illegible] August 31st.

23,747. "Sparking plugs." J. R. Davis. August 31st.

23,764. "[illegible] apparatus for wireless telephony." T. A. Graham. August 31st.

23,779. "[illegible]." F. C. R. Marks (Whiteland Manufacturing Co.). [illegible] August 31st.

23,683. "Electromagnetic sound producing devices." H. Wade (F. J. Kaiser). [illegible] August 31st.

23,684. "[illegible] preventing corrosion and corrosion of metals." J. S. D. Hooker. [illegible] August 31st.

23,688. "Device for varying illuminating power of electric lamps." J. C. Roberts and H. C. Roberts. [illegible] August 31st.

23,692. "Collapsible electric heater." E. J. McCormack. September 1st.

23,701. "Method of commutation and control of electric dynamos." T. Cooper. September 1st.

23,702. "Case for spare sparking plugs." H. R. Skinner. September 1st.

23,711. "Trolleys of electric tramcars, &c." H. R. Garth. September 1st.

23,730. "Maintenance and cleansing of secondary batteries." G. A. Penrose. September 1st.

23,722. "Electric switches." J. W. Clark. September 1st.

23,726. "Tramway tracks." T. H. Rushton. September 1st.

23,745. "Electrical heating apparatus." J. R. Quain. September 1st.

23,746. "Electrical heating apparatus." J. R. Quain. September 1st.

23,747. "Electric switchboards and circuit selecting apparatus." C. F. Atkinson. September 1st.

23,755. "Starting device for magneto-electric ignition machines." A. G. L. Neighbour. September 1st. (Australia, September 3rd, 1921.)

23,766. "Terminal setting tools." C. Brandes Inc. September 1st. (United States, July 11th.)

23,767. "Telephone head sets." C. Brandes Inc. September 1st. (United States, May 12th.)

23,771. "Method of distinguishing between opposite directions of energy flow." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 1st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

4,513. "Systems for signalling by means of high-frequency currents." British Thomson-Houston Co., Ltd. (General Electric Co.). February 8th, 1921. (184,498.)

4,904. "Electron discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). February 11th, 1921. (184,506.)

5,170. "Anti-vibration devices for the suspension or support of electric lamps." Wardle Engineering Co., Ltd., and E. L. Hopwood. February 14th, 1921. (184,508.)

5,621. "Electric discharge tubes." Naamlooze Vennootschap Philips Gloeilampenfabrieken. April 20th, 1920. (162,268.)

6,288. "Winding devices for paying out and automatically winding in electric conductors." R. D. Stowell, N. D. G. Robertson, and Wayne Engineering and Equipment Co., Ltd. February 24th, 1921. (184,518.)

6,902. "Sensitive film supports for X-ray photography." N. I. Lubashev. March 2nd, 1921. (184,519.)

7,973. "Electrolytic cells." Elektrizitäts Akt. Ges. vorm. Schuckert & Co. June 14th, 1920. (165,071.)

8,462. "Electromagnetic relays." W. E. Barber. March 10th, 1921 (184,524.)

10,509. "Transformation of alternating electric pressures and currents to direct pressures and currents and to different frequency and number of phases." Johnson & Phillips, Ltd., S. A. Stigant, and A. L. Tracy. April 11th, 1921. (184,532.)

12,638. "Systems of electric current distribution." C. A. Turner. May 3rd, 1921. (184,547.)

12,896. "Selective switches particularly for use in automatic telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 5th, 1921. (184,551.)

13,400. "Perforated tape controlled apparatus suitable for use in connection with printing apparatus." Creed & Co., Ltd., and F. G. Creed. May 11th, 1921. (184,558.)

13,429. "Electron discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). May 11th, 1921. (184,560.)

13,441. "Commutators or distributors for use in connection with electric ignition systems." F. W. Baker. May 12th, 1921. (184,562.)

13,622. "Process for obtaining metallic electrolytic deposits easily detachable from the cathode." Soc. d'Electro-Chimie et d'Electro Métallurgie. June 18th, 1920. (165,082.)

13,731. "Electric rivet heaters." E. Schroder. May 17th, 1921. (184,570.)

13,809. "Stranded cables." Sir C. A. Parsons, J. Rosen, A. W. Grey, and R. W. Midgley. May 17th, 1921. (184,574.)

13,819. "Means applicable for lubricating the armature and axle bearings of tramcars and the axle bearings of railway and road vehicles." H. Murgatroyd. May 17th, 1921. (184,576.)

13,909. "Intermittent vibratory contact devices for electric circuits." J. R. Quain and G. P. Ferreira. May 18th, 1921. (184,580.)

14,040. "Telephone transmitter mouthpieces." Western Electric Co., Ltd., and L. van Rutten. May 19th, 1921. (184,588.)

14,290. "Combined switches and plugs for electrical purposes." J. B. Tucker. May 23rd, 1921. (184,594.)

14,335. "Centrifugally-operated switches." British Thomson-Houston Co., Ltd., and A. P. Young. May 23rd, 1921. (184,595.)

14,445. "Battery indicator systems." G. Cooper and J. H. McIlroy. May 24th, 1921. (184,599.)

14,615. "Sound wave concentrators." A. Marr. May 26th, 1921. (184,600.)

15,940. "Suspension device for overhead conductor wires for electric railways and the like." Sir P. Dawson and F. W. Fawdry. June 9th, 1921. (184,629.)

16,230. "Electric igniting devices." H. J. Cohen (J. Nies). June 13th, 1921. (184,631.)

17,129. "Reflectors." British Thomson-Houston Co., Ltd. (General Electric Co.). June 22nd, 1921. (184,645.)

17,255. "Control of electrically-propelled vehicles." M. J. Pattison and Electro-Mechanical Brake Co., Ltd. June 23rd, 1921. (184,646.)

17,615. "Electrical protective systems." Metropolitan-Vickers Electrical Co., Ltd. October 9th, 1920. (170,268.)

17,722. "Electromagnetic switches." British Thomson-Houston Co., Ltd. (General Electric Co.). June 29th, 1921. (184,648.)

17,765. "Secondary cells or batteries for electricity storage." C. G. Smith. June 30th, 1921. (184,649.)

18,589. "Electric accumulators." A. Dinin. July 8th, 1921. (Addition to 14,119/14.) (184,658.)

18,811. "Binder for securing telegraph and telephone wires to insulators." O. R. Williams and D. D. Williams. July 12th, 1921. (184,663.)

18,973. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). July 13th, 1921. (184,666.)

19,991. "Electric selective switches for automatic telephone exchanges and the like." C. W. Wilman. July 26th, 1921. (184,677.)

21,561. "Casings for electric cut-outs and similar apparatus." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. August 13th, 1921. (184,694.)

25,600. "Worm gearing for electric vehicles." G. Muller. October 11th, 1920. (169,973.)

26,383. "Switch or contact device for use in a battery or electric circuit." H. H. Bywater. January 20th, 1922. (184,721.)

26,797. "Manufacture of pottery particularly adapted to electric insulators." F. F. Schild and Schomburg & Sohne Akt. Ges. October 10th, 1921. (184,725.)

29,429. "Means for indicating the presence of noxious gases such as firedamp." Ges. fur Drahtlose Telegraphie. November 24th, 1920. (171,386.)

34,744. "Sheet metal sleepers for railways and tramways." A. H. Hill and F. Roberts. December 28th, 1921. (184,743.)

1922.

2,123. "Electric control systems and apparatus." Compagnie Electro Mécanique. January 26th, 1921. (174,692.)

2,401. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). January 26th, 1922. (184,748.)

THE

ELECTRICAL REVIEW.

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SPEED-REDUCTION GEARING IN SHIP PROPULSION.

THE marine engineering world is considerably perturbed by the many unsatisfactory reports which have been received regarding the working of the mechanical speed-reduction gearing installed on turbine-propelled vessels. In order to obtain a high propulsive efficiency in a screw steamer, it is necessary that the speed of rotation of the screw should be low; at the same time, a turbine having a high speed of rotation must be employed in order to obtain the maximum economy in steam consumption. Further, a high-speed turbine is considerably smaller as regards both weight and space occupied than is a turbine having a low speed of rotation, and this, obviously, is of great importance on board ship. Hence, it has become almost universal practice on turbine-propelled vessels to fit helical gearing, so that a high-speed turbine can drive the propeller at its most economical speed. A pinion is mounted on an extension of the turbine shaft, and this pinion drives a gear wheel mounted on the propeller shaft, thus giving a "single-reduction" gear. This type of gearing has been found to answer very satisfactorily, and speed-reduction ratios exceeding 20 to 1 have been successfully obtained by this method.

The desire for even greater speed-reduction ratios enabling turbines running at a speed of 4,000 revolutions per minute or more to be employed to drive propellers running at 75 revolutions per minute led to the introduction of "double-reduction" gears, in which the first gear wheel shaft carries a second pinion, this in turn driving a gear wheel mounted on the propeller shaft. Many such gears have been fitted, particularly on cargo steamers, and it is this type of gear which is proving so unreliable in practice.

Many cases are on record of vessels fitted with double-reduction gearing in which, even during their trial trips, an undue amount of vibration and noise has developed in the gearing. If no further trouble has developed, the vessels have been accepted by the owners and put into regular service, because it has become almost an accepted fact that a certain amount of noise is inseparable from the use of gears of this type. Often enough the noise has been excessive, and the vessel has earned the unenviable distinction of being "a roarer." Frequently the noise has tended to diminish after a while as the wheel teeth become worn together, the hard steel of the pinion grinding away some of the inequalities of the teeth on the softer material of the gear wheel. In many cases, however, the trouble has tended to increase until finally the gears have failed altogether, due to excessive wear, or the chief engineer has been compelled to run the machinery at reduced speed until a port was reached where examination and repairs could be effected in order to avoid a risk of immediate breakdown.

So serious has the position become that the *Liverpool Journal of Commerce*, a journal which expresses the opinions of a large number of influential shipowners, in referring to this question, states that "the recurring troubles with marine turbine gearing, especially with double gears, have reached that critical stage when something must be done, and done quickly." We understand that the Institution of Mechanical Engineers has invited manufacturers and users of these gears to meet and discuss the question, but so far, except for individual efforts, little appears to have been done to get to the root of the trouble.

Notable contributions to the literature of the subject were two papers which were read at the annual meeting

of the Institution of Naval Architects in London last spring. Mr. J. W. Wilkie, in his paper entitled "Double-reduction Gears in the s.s. *Melmore Head*," gave a very full account of the defects which, right from the first trial, developed in the gears fitted on that vessel and of the subsequent steps which were taken to surmount the trouble; while Dr. J. H. Smith, in his paper entitled "Nodal Arrangements of Geared Drives," gave a complete mathematical investigation of the periodic vibrations of the various parts of the original gearing, and showed how by certain modifications he was able to eliminate to a large extent the vibration and the excessive noise and wear which vibration entailed. The subsequent discussion of these papers, however, showed that many designers were far from accepting the conclusions arrived at by Dr. Smith; while it was generally admitted that the accepted theories of the transmission of power by means of helical gearing appeared to fail when applied to double gears, it was felt that by sturdier construction and the use of materials of a higher quality, satisfactory and reliable gearing could be produced. But so long as the causes which produce failure are not removed, complete reliability cannot be obtained, and the advantages of the turbine drive due to the reduction of weight and space are to a large extent neutralised.

The failure of mechanical gearing undoubtedly presents a most favourable opportunity for manufacturers of electrical machinery to demonstrate that the electrical system of speed reduction—or electrical propulsion, to give it another name—is capable of proving a reliable and efficient method of operating cargo ships. Broadly speaking, what is required is an alternating-current generator driven by an efficient high-speed turbine, and a low-speed motor direct coupled to the propeller shaft and driven directly by the current produced from the turbo-generator. The machinery must be simple and fool-proof, and it must compare favourably as regards initial cost, weight, and space occupied with the present arrangements of turbines and double-reduction gears. If this machinery is forthcoming, we do not doubt but that the other advantages which would follow the adoption of electrical propulsion, which were recently set forth in our columns by Mr. A. Regnauld,* would lead shipowners to consider favourably the electrical gear as an alternative to the unreliable mechanical gear.

THE WELL-BEING OF EMPLOYÉS.

The third annual Industrial Welfare Conference has just been held at Balliol College, Oxford. It was organised by the Industrial Welfare Society, and extended from Saturday last until Tuesday. The proceedings are of considerable interest to all who believe in industry being made as humane an affair as is practicable. It is generally recognised to-day that there are obligations resting upon the employer to make the conditions of factory life as healthy and congenial as possible, as well as obligations resting upon the employé to co-operate with the employer in the conduct of measures designed to that end. A recognition of a duty, however, is not always and everywhere followed by a conscientious fulfilment thereof, but it is satisfactory to note that the industrial welfare movement has made great progress during the past few years, and it is to be hoped that further headway will be made with the application of various methods of rendering the hours of toil less monotonous, nerve-wracking, irksome, and dangercus, and with the provision of reasonable social facilities for brightening the after-work hours. The use of the word "welfare" has sometimes been objected to as savouring of coddling, which British workers, with their natural spirit of self-confidence, rightly resent, and we can imagine that the promotion of efficiency by the encouragement of the "Suggestion Box" system would be regarded as hardly a matter of "welfare" as it has come to be understood. One of the Oxford lecturers directed attention to this subject which, of course, has been with us for scores of years. He mentioned that there are large numbers of firms who offer prizes to their employés for suggestions conducing to the efficiency of the business, but he emphasised the need for doing everything in reason to encourage larger numbers of employés to take a sustained interest in such schemes. He advocated the widening of the range of subjects and the ample rewarding of those who advanced even what appeared to be trifling ideas; also prompt consideration of suggestions and full publicity. We have long favoured such schemes in the Electrical Review, but we are not prepared to say whether the author is altogether correct in blaming the management where the box intended for suggestions contains nothing but cigarette ends. It was felt that more satisfactory results would attend such efforts if an outline were circulated of subjects suitable for suggestions—perhaps for the manufacturing class or alternatively for the general—as well as a list of the minimum awards paid for different classes of improvements. The question or suggestion box idea should be welcomed by managers and by directors as a means of stimulating the interest of the worker in the success of the business or industry of which he forms a unit, and when seriously treated by all parties it should tend to the increased efficiency and prosperity of that business and the well-being of all. The Suggestion Box is assuredly a good business proposition.

Another of the Oxford lecturers added one more powerful appeal to the many thousands that have gone forth in recent years for co-operation and goodwill in industry. Whitley councils and works committees; the need for statesmanship amongst those concerned with industrial relationships (both in their wider national aspects and in individual firms) were discussed, and many other matters were reviewed which are supposed to be aiding the spread of a "new spirit" in industry.

The importance of keeping records and statistics was dealt with in an address by Dr. H. M. Vernon, of the Industrial Fatigue Research Board. He stated that a system of efficient records and statistics is an integral part of the new ideas of industrial management which are steadily gaining ground. The elimination of waste in industrial establishments was mentioned as a means of betterment which must prove eventually of benefit to all concerned, and it is only possible if the requisite records are kept. Records should be kept of lost time due to ill-health as distinct from other and avoidable causes; also of lost time due to accidents and injuries incurred, and of the type of machine or operation on which such mishaps occurred; the effect of fatigue due to overtime; the loss effect where new workers are being trained, and so on. The need for accident prevention campaigns amongst workers, and such matters as temperature and ventilation of workshops also came within the scope of Dr. Vernon's address. Much information on these and allied subjects has been given in the reports of H.M. Inspectors of Factories and Workshops. There are fairly reasonable standards recognised in the best factories and works in regard to many of the matters affecting the health and well-being (or welfare) of employés, and it has to be recognised, too, that we were all so over-done with forms for records and statistics during the weary years of war that all our eagerness for increasing the humane element in factory operation leaves practically untouched the prejudice that exists against any additional record and statistical burdens.

We have great respect for the views advanced by Mrs. Carney, lecturer on Industrial Welfare at the Manchester College of Technology, on "Health, First Aid, and Safety," and we agree with her when she says that employers have a great responsibility with regard to the health of their workers, but anybody who has studied the reports of the Government Inspectors of Factories and has observed in practice the carelessness, callous-

* Elec. Rev., August 4th, p. 171.

ness, and apathy of some workers in taking care of their own health and guarding themselves against accident and disease by availing themselves of the means placed at their command, will know that responsibility is not limited to employers. Mrs. Carney apparently recognises this when she refers to the educational aim that should characterise industrial health service.

There is little need to refer here to the value of the industrial canteen to works employés. Hundreds of electrical and engineering works, large and small, have proved it in recent years. There are now over 2,000 firms having organised canteens, and we gather that the canteen is now included as a matter of course in new works' schemes, and that in practically every trade, employers are carefully considering the advisability of the introduction of such accommodation. That it plays an important part in any works organisation scheme is unquestionable. According to Mr. A. F. Agar, formerly chief organising inspector of munitions canteens, these departments result in better time-keeping, less sickness, more time for recreation, and have an influence on the workers' homes. One speaker at Oxford referred to the canteen's usefulness in dissipating grievances quickly when men discussed them together over a decent meal. We should prefer to tread cautiously on this ground.

One other matter that was brought forward was the superannuation of the worker. It seems from the inquiries received by the Industrial Welfare Society from all parts of the world that no question connected with industrial welfare is receiving greater attention. The feeling of insecurity with regard to the future haunts large numbers of workers who out of their wages cannot possibly make adequate provision for old age, and to find means for relieving that anxiety is a purpose worthy of the efforts of all legislators and social reformers, associations and unions, and all who have the welfare of our industrial race at heart.

Scientific and Industrial Research.

The report of the Research Department for the past year, which was recently issued, places the necessity for economy in the forefront; pointing out that "in happier circumstances, the Department would by now have been able to take full advantage of the increasing opportunities for useful research," it declares that this is for the moment impossible. Apart from grants to research associations from the "million fund," the expenditure last year was £338,552. The policy of retrenchment has involved a slowing-down of the research programme, but has not interrupted good work already in hand, and while we recognise—and deplore—the imperative need for economy, we are glad to note that the Committee on National Expenditure was unable to find any evidence of extravagance or waste and made no recommendation for further reductions.

The balance of the million fund on March 31st, 1922, was £816,850; that the interest (£65,359) on the balance was greater than in the previous year, in spite of the reduction in the capital, was due to the re-investment of the fund in other Government securities, a fact which does credit to the management of the fund. The total expenditure for the year was £525,585, of which £273,194 was contributed by the Exchequer, and £100,678 was derived from fees for tests and special investigations; headquarters administration cost £37,561, or 7.15 per cent. of the expenditure.

In the report a number of instances are quoted in which the value of researches effected with the aid of the department has been demonstrated on a commercial basis. A Portland cement manufacturer, whilst acknowledging the merits of the mechanical appliances designed by the Research Association, remarks that "compared with the work the Association has done in furthering what may be termed 'scientific management' in the cement trade, they are a small matter. The value of the spirit of accuracy and the spread of the knowledge of how science can be applied is of tremendous value to the trade, and leads firms to further investigations and improvements. We are now saving fuel to the value of over £25,000 per annum. No better testimony to the fruitfulness of research could be desired; it is as though the works' organism had been inoculated with a serum the beneficial effects of which spread throughout it, infusing health and vigour into all its members. Remarkable results have been gained by the British Scientific Instrument Research Association in connection with improved abrasives and polishing powders, and other instances of successful investigations are recorded.

Whether scientific research is receiving a fair share of the department's attention seems open to question. The expenditure on grants for this purpose during the academic year 1921-22 was estimated at £47,005, or less than 9 per cent. of the total outlay. The great bulk of the report—and of the expenditure—is devoted to industrial research, and whilst we recognise the importance of this work, we regret that the department shows no enthusiasm for the promotion of the more fundamental investigations which are essential to the future prosperity of our industries.

The Tramway Problem.

In his presidential address before the Municipal Tramways Association last week, Alderman Mayne ably stated the case for the tramways in the increasingly strenuous struggle between them and other modes of transit, which is likely to engage the attention of Parliament in the near future. The inequity of the burdens which are laid upon electric tramway undertakings, in contrast with the demands upon the automobile vehicles which compete with them, has long cried out for rectification. As the president remarked, "On equal terms they can outstrip with ease all their rivals and competitors"—but they have never enjoyed equal terms, and the advocates of rival systems, in basing their comparisons on the existing conditions, close their eyes to the handicap which the tramways carry.

Alderman Mayne, spurred on by the proposal of the Underground Railways that they should be granted ten years' immunity from omnibus competition, did not hesitate to claim that the municipal tramways had a still better right to a monopoly. We would not go so far as that; equitable conditions would suffice to enable the tramways to prove that they could give an efficient all-weather and all-day service at the lowest cost. But his contention that the proposal of the Underground Railways implicitly involved subsidised omnibus competition with the municipal tramways was well founded, for the London omnibuses are almost wholly controlled by the Railway group, and any deficit on the former is made good by the latter.

Mr. Mattinson's paper on the same subject was a moderate summary of the position; he recognised that the tramways must bear their due share of the cost of road construction and maintenance. But he made it clear that under present conditions they were charged with heavy liabilities for which they should not be held responsible, while the president set forth in full the other statutory burdens from which competing systems are wholly free, and there is no doubt that the tramway undertakers have a very strong case for the reform of the law on this subject.

The Gennevilliers Visit.

On Friday, September 15th, we forwarded application forms and full details as to routes and expenses to all who have indicated to us their desire to participate in the visit to Gennevilliers and the Northern stations.

No time should be lost in filling up and returning the forms, particularly in those cases where passports for France and Belgium are required.

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FRANCE REVISITED.—II.

Impressions and Comparisons.

By THEODORE RICH.

Seasonal Water Power.

France is, and has been, mainly an agricultural country, although during the war it very distinctly found itself as a manufacturing nation. The Frenchman is very adaptable, and in many districts the water-power supply fits in to the seasons when there is the least agricultural demand. Many men who work in electrochemical works during certain months of the year can be found in the harvest field at other times. It can be quite well understood that the more adaptable people are, the less distress there is in hard times; although even in France the trade unions are trying to pen the workers up in watertight compartments, it seems that workers there prefer work to the "spongers' dole." There is one difficulty—the greater the "demands" of the worker the greater the demand for machinery, and therefore the greater the capital outlay per employé; this tends to make seasonal water supply a difficult problem. With interconnection the matter becomes easier, the very high overload capacity of modern steam plant distinctly easing the situation.

Electrical Power Lines.

As previously stated, a large number of power lines have been erected or are under construction. As a rule, especially in the north, the new main trunk lines, 45,000 volts and upwards, are cross country, while those of lower voltage are more often alongside the roads—by-roads, provided they are reasonably straight, being preferred. In the devastated areas, in order to get over wayleave difficulties, use has been made of the special facilities and regulations made by the Government. Although there has been a large increase in the use of reinforced concrete poles, it has been found that, owing to transport difficulties, they are more convenient for roadside than for cross-country lines. The fall in the cost of structural steel has recently rendered reinforced concrete posts less attractive, although a number of attractive bridges were seen under construction made of this material.

There seems to be a tendency to increase the spans; a number of 45,000-volt lines with 100-metre spans were seen, some of the newer lines being 6-conductor, two-circuit. As in America, there still seems to be a controversy regarding the use of an earth wire or earthed insulator stalks with wood poles, though, of course, in the United Kingdom, where we have the least experience, the matter has been settled. There is still in some parts, especially in the north, a controversy regarding the merits of glass or porcelain insulators for high-pressure work.

The advocates of porcelain say that the use of glass involves a continuous loss, while advocates of glass say that the latter stands up better in wet, windy areas like those of Flanders and Picardy. Up to 45,000 volts there seems to be no material increase in the use of chain insulators; in fact, in the Béthune area, in order to be in a position to utilise an existing 45,000-volt line and not get the conductors too close to the ground, experiments are being made with a view to using stalk insulators, made of glass, at 100,000 volts. The use of 15,000 volts for general distribution is distinctly spreading in the north, it is not too expensive where cable has to be used, and in areas where the climate is similar to that in England it has proved in every way suitable for rural and outer-suburban overhead distribution to outdoor or cabin transformer stations.

As, according to law, the local authorities can charge a small rent per square metre for space taken up on the pathway or roadway, great ingenuity is sometimes shown in compressing the apparatus into a small area, the use of two storeys at the transformer post making the connection to overhead lines, without the danger and nuisance of a short length of cable, a matter of no difficulty.

Rural Lines.

Although village and rural distribution has not perhaps reached the degree found in some parts of the United States, yet light and power are to be found in an astonishing number of small places; such distribution is usually made with simple apparatus and a wooden pole line (fig. 1). It is quite usual when going along a village street to hear the hum of a motor and the click of a belt joint. In an area between Béthune, St. Omer, and Abbeville, in order to encourage rural development, some single-phase 15,000-volt branches are



Fig. 1. H.P. Line Passing over Roofs of Houses in a Small Town in French Savoy. The L.P. Distribution Line can be Seen Below the H.P. (on the Right), with Connections to Houses across the Street

being tapped on to three-phase mains with single-phase, 3-wire, 120-volt distribution. In order to obviate a change of system, in cases where motive power is wanted, a three-phase motor with slip rings is used across the 220-volt outers; the third phase is connected on starting to a point with a resistance on one side and a reactance on the other. Some of these branches are made with iron wire. When the load grows, a three-phase copper line will be run, and the three-phase motors already installed will then be used for full power and not merely for 0.6 of the output as with a single-phase connection. It might be remembered that at a number of base camps and depôts at Le Havre during the war, single-phase three-wire outdoor transformers were installed by the R.E., and a start was also made in the Béthune area

with transformers on 15,000 volts. At the present price of copper, unless the voltage is about 15,000, there seems to be little advantage in the use of iron wire, although galvanised iron wire should be cheap enough in the north of France. In many of the lines in France local timber is used, and in Spain, in the Pyrenees, all sorts of crooked poles seem to be usable to enable the conductors to be kept off the ground. It is amusing to note that a few months ago an English railway journal made quite a "song and dance" about the fact that the Great Western Railway, with a technical temerity almost worthy of a Stephenson or Brunel, in Cornwall, for a light railway, had actually used some local timber to support the telegraph lines for the railway working; it is to be hoped, however, that the railway experts at Whitehall will not get the wind of such a departure from virtue.

According to French law, a power company can obtain a wayleave along a road either for cables or overhead lines for a small sum per post or per kilometre, the price depending on the density of the population, so that where there is an alternative route it is naturally easier to treat with land owners. There is also the point that probably 60 per cent. of the roads in France are without hedges; this makes the running of roadside lines much easier.

Before the war, as in England, in those parts where the finance of power companies was to a great degree in the hands of cable-making interests, the use of overhead lines was to a material extent restricted, although in France financial necessities, especially in the devastated areas, have made even cable enthusiasts pause.

After the war the French Government put up a number of interconnecting trunk lines, and in order to encourage home industry and minimise exchange difficulties stranded conductors of aluminium were largely used. Owing, it is said, to impurities in the composition, and perhaps also to lack of experience in its use, there seems to be in some quarters a distinct bias against its use, especially in the North. In France, although up-to-date methods are usual with regard to the design of overhead lines, the apparatus and methods employed for erection and repair, as, for instance, the repair of live circuits, do not seem to be as up-to-date as in the United States, although there seems to be an absence of the "bulletin" inspiration, which is often a feature across the Atlantic.

Lightning Arresting Apparatus.

It is remarkable, especially in the north of France, how much of the lightning-protection apparatus is out of use. Electrical discharges are perhaps not so frequent in rolling country as in mountainous districts like the Pyrenees or the Alps. Choking coils, a solidly-constructed line, and as far as possible a transformer between the overhead line and the generators, seem to be looked upon as good safeguards.

Before the war, horn arresters with water resistances were very common, glycerine being used to prevent freezing. Glycerine became unobtainable, so people began to empty the resistances in winter, and forgot to fill them or left them disconnected during the following summer and, strange to say, little harm resulted. What is suitable in some areas is of little use in others. In some parts an earth wire has been found to be necessary; in other parts it has been said that the earth wire breaks more often than the copper line it is supposed to protect.

Central-station Plant.

Before the war, two systems were somewhat fashionable with regard to condensing, the Le Blanc rotary air pump and the German system with a horizontal low-speed dry-air pump; nowadays the ejector air pump, especially the Breguet system, seems to be extending. To obviate the objection of putting too many eggs into one basket, steam turbine-driven auxiliaries seem to be more popular than electrical auxiliaries, especially for circulating and condenser hot-well pumps, the exhaust being put usually into a low stage of the turbine. In France, as on the Continent generally, engine-rooms and boiler-houses seem to be more spacious than in England, and perhaps, if anything, the pipe systems are less complicated.

French boiler makers appear to have grasped, what it took the Anglo-American boiler combine so long to learn, that for efficient combustion one must leave ample space before the gases are cooled by contact with the water tubes. The disposal of ash and clinker seems to be still a matter of difficulty, some engineers saying, after somewhat excessive repairs have been paid for, that a tipping truck worked by hand filled from a shoot takes a lot of beating.

All over the north of France the system of chimneys made up of sectional concrete with a vertical rib and internal reinforcement seems to be beating the brick chimney, one reason, perhaps, being its reduced weight on the foundations. The German system of building an elevated water tank round the chimney in industrial works is apparently going out of use, although in the north numerous elevated ferro-concrete tanks are to be seen with the bottom an inverted cone resting on a pillar.

One advantage of the fluted concrete chimney over those of concrete of the cylindrical shape is that the optical illusion of "swelled headedness" due to the deposit of black at the top end in contrast with the yellowy-grey of the concrete is avoided, and certainly few chimneys are more elegant than those of the new shape.

As a contrast to the concrete chimney, a cooling tower with brick outer walls was seen at Noeux-les-Mines, near Béthune; it looked very neat. Model houses for power-station operatives are a distinctive feature at several



Fig. 2.—Houses for Operatives at the Soulom Power Station of the Midi Railway in the Pyrenees.



Fig. 3.—Catenary Construction on Railway.

modern stations in France (see fig. 2). It is not unusual, even in model factories, to find the house of a partner or of the managing director alongside the works; this system has the advantage that the worker feels that the boss is more approachable than when he lives perhaps miles away; and, further, the system must lead to more care being taken in the design of the works. The incidence of our inhabited house duty has at home done much to separate master and man.

It is interesting to hear of the way in which 6,000-kW sets are being moved about like pawns. At the Drocourt power station the turbine makers supplied a 6,000-kW set to take the load for a start, agreeing to take it back and replace it by a much larger set as soon as a material part of the station plant had been installed.

France is a country with large watersheds and therefore big rivers, but all the same in parts the problem of condensing water is a matter of some difficulty, especially in the mining districts. One of the largest power stations in the north of France before the war was at Wasquehal, between Lille and Roubaix-Tourcoing, which supplied power to many textile factories, and owing largely to condensing difficulties and lack of space, a new power station is now being erected at Comines on the Belgian border, a few miles away to the north. This station is being put up somewhat on the lines of Gennevilliers, but with 25,000-kW sets. The power station at Lomme, on the River Deule, near Lille, which was almost completely dismantled and smashed up by the Germans, has now been practically rebuilt, and a fine new power station erected in a remarkably short space of time on the "ashes" of the old station smashed up by gun fire and explosives, has now arisen on the River Oise at Beautor. Some of the French machinery is very well made, and some of the structural steelwork is ingenious and pretty.

Catenary Construction.

Owing to the smooth running, which facilitates high speed and the reduction in the number of supports, catenary construction is spreading even for d.c. normal pressure traction work. The illustration (fig. 3) shows a passing station on the Bayonne-Biarritz electric railway. This is run on a private right-of-way. It was originally standard gauge, run by steam; it has now been converted to metre gauge, so that eventually it can be extended along the coast to the Spanish border at Hendaye, about 18 miles away. The voltage is 650 V, d.c., power being supplied from the Pyrenees to a substation through overhead lines.

Lessons of the War.

The Frenchman, who even before the war was not nearly so anxious to turn his power stations and substations into showrooms for instruments and gadgets, as we were on this side of the Channel, has to a material extent learned during the war what can be done without. At that time, while the Service Electrique was buying simple switches and other gear and fixing them on quartering or anything handy, with us, on the contrary, marble or polished slate slabs with a multiplicity of instruments and circuit breakers, even when connected to petrol sets with no overload capacity, were hardly good enough for the then ignorant taxpayer to pay for. Of course the weaker a man is technically the more anxious he is to protect himself with gadgets.

One notes almost wherever one goes in France that there is a movement towards simplicity; people have found, for instance, that a hole through a large pane of glass, with or without a roof projection, is quite good enough for an inlet for a 45,000-volt line, although it should be noted—thanks perhaps to the efforts of the democratic sportsman and the comparative absence of game preservation—that there are fewer birds in France than in England. Difficulties through birds are not unknown in America.

The engineer of an important power company put the situation in this way: that many protective gadgets add more points of weakness than the extra security is worth. The French people apparently do not find it necessary to use highly complicated expensive relay schemes. It can be quite understood that the more unnecessary instruments there are to look at, the larger is the operating staff necessary to run the station; the smallness of the operating staff and labour is a not unusual feature of French power-station operation. It must not be forgotten, however, that the French Electrical Trade Union agreed some time ago to standards of technical knowledge and operative skill that would make many of our wiremen jump.

THE STATUS OF ELECTRICAL CONTRACTORS.

By H. R. TAUNTON.

The title rather begs the question. It assumes that electrical contractors have a status. Individual contractors, as individuals, may have one, but not as contractors. Their designation, with its variants, "electrician," "electrical engineer," conveys to the layman no more of qualification or responsibility than that of a jobbing plumber; and, to the initiated, something less than that.

Electrical Engineer! Electrician! Majestic titles which—if one could dissociate them from their all-too-common application—should conjure up a mental picture of combinations of Faraday and Watt, with a dash of Newton; Jovian beings, with subtle hands controlling the lightning, with dome-like brows sine-waving splendidly through a tangle of differential calculus and vector diagrams to the domination of Nature! All-embracing titles: shared alike by Edison and the purveyor of electric torches, by Sir Oliver Lodge and the youth who doses the bell battery! Empty titles—meaningless and worthless!

Anybody can go round to a cheap printer and order a few billheads, blazoning to the world the advent of yet another electrical contractor, electrical engineer, or electrician. The three designations are used impartially. There is no reason why they should not be, for they are certainly all of equal value—zero.

A wireman gets the sack for inefficiency. He sells his old motor-bike or his wife's sewing machine for working capital, and becomes an electrical contractor. A shift engineer who wants a change does the same. So does the enterprising cycle mechanic, the bright schoolboy with a taste for Meccano, the handy-man who has learnt to wire a bell push. They all become electrical contractors.

They stock some dark little shop in a by-street with goods "on appro." or "sale or return"; put a few cheap electrical "novelties" in the window, leavened with an odd Leclanché jar or spider fitting; wafer up a gaudy poster or two; and behold, they are "Lighting and Power Engineers—Complete Installations in Town or Country—Electric Bells a Speciality—Estimates Free." A wonderful fabric to be built up on the foundation of a pair of pliers and a yard of black tape!

Presently some misguided person gives them an order. They flourish. They buy the cheapest Continental wire and accessories and rubbish; or, if they are lucky, somebody's surplus stock. They pay their men—if the job is one they cannot tackle single-handed—with a share of

the "business," certainly not at T.U. rates. They keep their accounts in their head, and their correspondence in a manifold book.

Reckless, ignorant, and greedy, they undercut responsible firms, who are handicapped by conscience and a costs system, taking good work from them to spoil it. They flit from job to job, blazing a trail of liabilities for the fire insurance companies, till presently they vanish obscurely, until such time as they can get credit from another printer for new bill-heads in a fresh district; or their sister-in-law starts them in that last resource of the incompetent, the "fancy stationery," or a sweet shop.

But the memory of their misdeeds survives them. In black and white in the ledgers of too-confiding wholesale houses; in the thoughts and speech of the victims of their "jobs," and of all their friends and relations. "Electricity" gets a bad name. The supply company's load-factor suffers; so does the credit and turnover of the legitimate contractor; so, indirectly, does the electrical industry as a whole. The effect in one particular instance is small, perhaps; multiplied by the thousands of similar cases it is as large as it is deplorable.

But the will-o'-the-wisp jerry wireman is not the only offender against the good name of electrical contracting —nor indeed is he the worst. He has at least the merit of being evanescent. There are others whose offence is permanent—the thousand and one firms, big and little, to whom electrical contracting is a subsidiary issue.

Every plumber nowadays is also an electrical engineer; every ironmonger and toy-dealer gets trade terms as an electrician; every builder, decorator, furnisher, draper, and candlestick-maker has an electrical contracting department. In some obscure corner of a back shop lurks a dusty wholesale catalogue, and a wiring table as technical equipment; and there are repeated all the sins of the jerry wireman: shoddy work with unskilled labour and cheap material, bad costing, and reckless undercutting; with the same results to the detriment of legitimate contractors, supply companies, and the trade at large. Not also, unfortunately, in this case, to the detriment of the offenders. The electrical department, negligible in its turnover, can have little effect on the financial results of the main business; and so its iniquity continues, year after year, encouraged by the ignorance of the public, the trade terms of the wholesale houses, and the supineness of the real electrical contracting industry.

(We have to thank such firms, however, for the interesting estimate of the status of electrical contracting with which they present us; a contemptible "side-line," to be handed over to a junior assistant, or a foreman, "to see what he can make of it"; a rule-of-thumb affair, needing neither training nor experience.)

The genuine electrical contractor—and the others are not likely to be reading this article—will agree that this is no exaggerated picture of his local competitors. He will agree, too, that, as a general nuisance, they ought to be suppressed, for the good of the industry. The only difficulty is, how?

The answer to that question is the solution of the pressing problem of how to raise the whole tone of the electrical contracting industry, by standardising the quality of installation work, and regulating prices.

The obvious body to deal with the problem is the E.C.A. Probably the majority of the genuine contractors are members; certainly the majority of the others are not. Unfortunately there are a number of firms of standing who have hitherto not considered it worth while joining the Association. More unfortunately still, there are a number of members of the Association who are not firms of good standing (at least, as electrical contractors), whose only qualification is the ability to pay their subscriptions—mostly firms of the "side-line" class.

If the industry were properly organised *all* the reputable firms would be members, and *none* of the others would be. If that were the case membership of the Association would be equivalent to a guarantee of a definite standard of workmanship, on which the public would learn to rely. Just as at present nobody would dream of employing a solicitor not on the rolls, or an unqualified doctor, or even an unregistered plumber, so in time, by an intensive advertising campaign, people could be taught to employ only a contractor who was a member of the Association.

In other words, the solution of the problem is registration. Not the "voluntary" registration with which the E.C.A. is now amusing itself and the trade. That means nothing, and will effect nothing. Some 700 members of the Association will receive in due course a circular letter and a form which they will sign as a matter of routine. Several thousand other contractors will not receive it, and will therefore not be registered. The general public will be no whit the wiser, and we shall all be exactly as we were.

Registration, to be effective, must be compulsory. That does not necessarily mean by Act of Parliament. The E.C.A., if it be strong enough, can make it compulsory by the force of public opinion, educated by organised advertising. But to compel it must be strong.

There are many firms of repute who, at present, refuse to become members. They make out a case for their refusal. They say that the activities of the Association are neither very marked nor very helpful. But if every contractor of repute raised the same objection there would be no Association at all. Only by joining can the objectors point their objection to its present policy, or lack of policy, and assist in shaping a stronger and a better one. If the recalcitrants would but join there would be some hope of inducing the committee, with new blood in it, to get down seriously to the one thing that really matters: the strengthening of its organisation, and the elimination of the shoddy firms who hamper its efforts and discredit its very name.

The converse is equally true, and easier of realisation. If the E.C.A. would but eliminate these shoddy firms, membership of the Association would have a higher value, and the reputable firms who now object to associating with their jerry competitors would more readily be persuaded that their interests lay in adding theirs to the good names that would be left.

Elimination would be a comparatively simple matter, and one that, in itself, if judiciously advertised, would go a long way towards educating the public. It would only be a question of raising the standard of qualification for membership of the E.C.A.

In the first place, eliminate all those firms whose original, or chief business is not electrical contracting; all the plumbers, ironmongers, decorators, and jacks-of-all-trades. Cut them out entirely. Their activities are unfair and noxious to the genuine contractor. Apart from that, their interest in their electrical departments must always be subsidiary to their interest in their main businesses, and for that reason they cannot be expected to have at heart the interests of the electrical contracting industry. For the same reason they cannot be effectively controlled by an electrical organisation. From both aspects they are an obvious source of weakness.

All other candidates for membership would have to comply with certain conditions. The framing of these conditions would, of course, be the crux of the problem. It may not, perhaps, be easy, but there is no reason why it should prove impossible so to frame them that they would not unduly restrict the individual, or discourage the legitimate contractor in a small way of business.

Every wireman who, with little capital, starts in business as an electrical contractor, is not necessarily incompetent or a rogue. Many a big contracting business has been built up from the smallest foundations, and it would be manifestly unjust and impolitic to handicap by impossible conditions men ambitious and able to do the same. Whatever the conditions of membership they must be such as will allow fair scope to legitimate enterprise, however humble. At the same time, they must make impossible the unfair competition of the jerry wireman, while guaranteeing to the public,

employing members of the Association, work not below a definite standard.

The simplest and most obvious condition would be that all members should employ labour on the terms agreed with the E.T.U. This, not from any love for the E.T.U., but because the accepted scale of wages and conditions forms a basis for fair labour pricing.

The fair pricing of material is more difficult to regulate. Even if it were possible, it would not be in the interests of either contractors or manufacturers to insist that members should buy only from those groups with whom the N.E.C.T.A. has made agreements; nor indeed from any list of selected firms, however comprehensive. Any conditions regulating the prices paid for materials employed by contractors would have to be negative rather than positive. For instance, members might be barred from buying certain items of Continental accessories, not because they are Continental, or because they are cheap, but because they fall below the desirable standard of quality.

Alternatively, it would be quite practicable, without playing into the hands of manufacturers' rings, for the E.C.A. to draw up a complete series of specifications for all the materials commonly used by contractors, regulating broadly the minimum quality and the essentials of efficient design. Members would then have to agree to purchase only such goods as complied with "E.C.A. Specification." This would neither stifle competition among manufacturers, nor prevent judicious buying on the part of contractors. The Association would soon be strong enough to enforce its specifications on manufacturers, who would come, in time, to deposit samples with it, and then stamp their wares as approved by the E.C.A.

Another simple condition would be that all installations carried out by members should conform to a definite minimum standard, *e.g.*, the proposed modification of the I.E.E. rules. It would not be difficult to enforce such a standard, assuming the E.C.A. becomes a recognised power, which could count upon the co-operation of supply authorities and insurance companies, to report infractions.

Another condition might be that a certain proportion of the principals and managers of contracting firms should have certain defined qualifications, such as membership of the I.E.E., or apprenticeship with an approved firm, or so many years' experience in a position of responsibility.

A financial qualification would be undesirable, in the interests of the struggling beginner; but it would, perhaps, not be unreasonable to stipulate that he should have a registered office of a minimum rental. This would check the irresponsible individual who keeps his "store" in his bedroom, and conducts his business correspondence in the bar parlour, competing unfairly with firms who have to add standing charges to their labour and material costs.

All these conditions are calculated to check unfair competition, and, at the same time, they safeguard the interests of the public, guaranteeing them a certain standard of material and labour, combined in a workmanlike job by contractors of experience and responsibility. It would be the business of the E.C.A. to impress upon the public the advantages of such a guarantee; and it would not be long before they were realised. The time would surely come when no sane man would employ a contractor who was not a member of the Association; in other words, who was not registered as a qualified man whose work could be relied upon to pass a certain definite standard.

No contractor could then afford not to be a member of the E.C.A.; and with the power that would then be gained it would soon be in a position to secure the co-operation of the supply companies in the direction of refusing to connect up an installation carried out by an unregistered firm, so adding the final weapon of coercion to its armoury. Registration would have become in effect compulsory, to the benefit of the contractors, the electrical industry, and the public at large.

The present suggestion of voluntary registration is but marking time; a feeble shuffle which cannot possibly effect any improvement in the status of contractors. The alternative of preparing the ground for "compulsory" registration by first weeding out undesirable firms, and so enticing, and finally compelling, the others to join, is, to be sure, at first sight, a drastic policy. The first and obvious result would be a certain reduction of the volume of subscriptions, due to a temporarily lessened membership. But for every "dud" firm struck off the list, three or four firms of repute would hasten to join. Nobody values membership of an organisation which admits any Tom, Dick, or Harry who will pay his fee. Make membership of the E.C.A. a privilege; give it the cachet of exclusiveness; and every contractor with a reputation to keep, or to make, will clamour for admission.

In short, the first step in raising the status of the electrical contractor is to raise the status of the Electrical Contractors' Association.

FUEL ECONOMY PROBLEMS.

The Small Generating Station's Aspect.

By CHAS. F. WADE, A.M.I.E.E.

A survey of the fuel costs of the smaller steam-driven generating stations, of from 500 kW capacity downwards, discloses an astonishing variation in the figures obtained from sets of plant approximating closely in general character. There appears to be no relation between load factor and the fuel cost to account for the variations, neither do local peculiarities, such as proximity or otherwise to coal fields, seem to have any definite influence upon the cost of coal per kWh sold.

The chief engineers of the smaller stations must feel very envious of their larger brethren whose undertakings are of such a size as to permit of the subdivision of the work among specialists in each particular branch of work included in the business of electricity supply. After all is said and done, the problems involved in the direction, management, operation, and maintenance of an electricity supply undertaking require as much versatility of knowledge for a small concern as in the case of a large one.

Bearing the above facts in mind, it is quite probable that it is the all-important human factor which is the principal cause of the otherwise inexplicable variations in costs already referred to. The chief engineer of a small undertaking is expected to have a full and complete knowledge of everything connected with the concern for which he is responsible, from the initial selection and purchase of the fuel right through to the legal points involved in enforcing payment of the accounts of defaulting consumers. The scope of the knowledge required for the successful carrying out of each individual department of any undertaking calls for almost undivided study to make a real success of the business, and it is not reasonable to expect the chief engineer of a small station to be a "superman" in

respect of all-round knowledge of several distinct branches of business any more than the manager of a 150,000-kW undertaking is expected to be.

The engineer, like everyone else, has a particular aptitude for one or another branch of the work in which he is engaged, and consequently tends to specialise in that particular section which appeals to him most. Thus, we find chiefs who are predominantly electrical men, others who are good business managers, some who are good mechanics, and so on. The same applies to the boiler house, where an engineer with a fairly good knowledge of chemistry and physics will secure the minimum possible consumption of fuel. Unfortunately, however, the layman, as represented by electricity committees, knowing little or nothing about the business for which he is supposed to be responsible to the ratepayers, is unable to realise the importance of these subdivisions of engineering work, and therefore expects the engineer to have abilities beyond the scope of any one man, though this expectation is not usually reflected in the salary paid.

Dealing more particularly with the fuel economy question, it is now admitted that to obtain uniformly good results with any boiler plant, it is essential that continuous attention be given to the working of the plant, intermittent visits being quite unsatisfactory; also the firemen must be properly qualified men with some sort of elementary knowledge, at least, of the principles of their work. These two essentials are unfortunately the most difficult to attain in the small station, where the duties of the chief and his small staff are spread over a large variety of work, and the local labour market affords but a poor selection of men for the important position of boiler fireman. The all-important matter of low fuel consumption is, therefore, largely left in the hands of firemen with but little experience of economical steam raising, as the little stations are mostly situated in non-industrial residential neighbourhoods.

Nevertheless, the difficulties are not insurmountable, even in those small stations whose margin for economy in coal consumption is insufficient to make the appointment of a full-time specialist in the boiler house a paying proposition. An examination of the returns of a large number of small undertakings gives the following results:—

	Capacity, kW.	Load factor, per cent.	Ann. output, kWh	Coal cost per kWh, d.
Maximum	500	18.35	602,948	3.03
Minimum	132	9.26	82,630	1.10
Average	329	14.00	269,394	2.12

It does not seem unreasonable to assume that the coal cost should not exceed 1.62d. per kWh, or ½d. per kWh below the average. On an output of 270,000 kWh per annum this would represent a saving of £564 on the coal bill, a very important economy in a station of the size under consideration.

The writer has given a very great deal of thought to the problem of the small plant for some years, and from personal experience of both small and large undertakings is convinced that the question of fuel cost is mainly one of how much scientific knowledge of steam raising is brought to bear upon the work of the boiler house. Most of the little stations are equipped with plant of a type that should give a continuous efficiency of over 70 per cent., whereas the actual results, where definitely ascertained, are much below this figure.

The solution of the problem seems to lie in the provision of continuous recording instruments for CO_2, gas, and water temperatures, draught, steam pressure, and temperature, &c., with a water meter, the readings of which are tabulated hourly on a properly drawn-out log sheet. The records thus obtained, together with samples of the coal used and from the ash heap, would furnish any qualified expert with all the necessary information to enable him to submit a reasoned report on the working of the plant for the period covered and any particular part thereof. That it is worth while adopting this scheme will be evident from the following, the figures being based on the average station mentioned above, together with the results actually being obtained in a plant working to-day where the scheme is in operation.

The initial cost would be somewhere in the neighbourhood of £200 for the purchase and installation of the instruments, and the annual cost would approximate as follows:—

Maintenance and depreciation of instruments, at 15 per cent.	£30
Charts, pens, inks, posting, &c.	12
Services of specialist in analysing records, periodical visits, reports and advice	80
Total	£122

Setting the above figure against the estimated fuel saving of £564, there remains a balance of £442 to the good, the satisfactory nature of which needs no comment, which allows a very large margin for variation without risk.

Many chief engineers, no doubt, have a sort of feeling that to appeal to outside help in connection with the operation of their plant is to admit incompetence, but a little reflection will show that the adoption of some sort of system of expert supervision such as that outlined above, is only reproducing on a small scale what is done in the larger undertakings, where the plant is of sufficient size to justify the appointment of a full-time specialist for steam raising alone. Nevertheless, the small steam-driven station will never have a square deal, or show what it is capable of in the way of low fuel costs, until it has the same trained attention as the large plant.

In the plant referred to above as having adopted a similar scheme as that suggested, a saving of 25 per cent. on the fuel consumption has been effected, which should be a convincing argument in favour of the proposals.

The writer has mentioned the ideas outlined above to various well-known experts, who are unanimous that the solution of the small plant's fuel problem lies entirely on the lines indicated.

A Wire-Annealing Electric Furnace.—An interesting example of an electrically heated regenerative car-type furnace for annealing wire was recently put in operation at the works of the Fowler & Union Horse Nail Co., Buffalo. The plant consists essentially of three furnace chambers, each 12 ft. long, 7 ft. wide, and 4 ft. high. One chamber is employed for heating, one for cooling, and one for pre-heating. The first two are arranged in tandem with a common door between them, while the pre-heating chamber is placed alongside the cooling chamber with a full side opening between them to allow free interchange of heat from the hot to the cold charge. The total heating capacity is 180 kW, the windings being designed for direct connection to the 440-volt three-phase mains of the plant. Automatic temperature control is effected by means of a standard General Electric heater panel, actuated by a Leeds and Northrup two-point control instrument. The furnace cars, 12 ft. long, 6 ft. wide, and 30 in. deep, are heavily insulated, and have sand-seal troughs on all four sides, so that the furnace can be sealed when in service. The conveyor mechanism for moving the cars into and out of the furnace consists of two endless chains, parallel to each other, one being placed below the floor level in the centre of each car track. The material to be annealed is ⅜-in. wire, from which horseshoe nails are made. The wire is delivered to the furnace in coils weighing approximately 250 lb. each, the charge per car being about 7,500 lb. The cold charge is first placed in the pre-heating chamber, where it absorbs heat from the cooling charge for a period of three hours. It is then transferred to the heating chamber, where it remains for another three-hour period in a temperature of 1,360 deg. F., and finally it is taken into the cooling chamber, where it radiates heat into a new cold charge in the adjacent pre-heating chamber. The furnace thus delivers one 7,500-lb. charge of annealed wire every three hours. The labour required is remarkably small, being represented by the time of two men for a seven-minute period to operate the mechanical equipment for moving the cars and the furnace doors and also to load and unload the cars. This operation occurs once every three hours. When the furnace is working ten hours a day the power consumption is 185 kWh per ton of annealed product, but does not exceed 115 kWh if the furnace operates on a continuous 24-hour schedule.—*Eastern Engineering.*

DYNAMOS AND MOTORS OF COMPARATIVELY SMALL OUTPUTS.

By J. W. BURLEIGH, A.M.I.E.E.

The design and construction of small dynamos and motors is a matter of considerable importance in view of the great and ever-increasing demand for small power machines.

It must not be expected that this article will deal with the matter in nearly a complete manner. The subject embraces such a vast number of points that a volume would be required to deal with it comprehensively. It is hoped, however, that the observations and comments in these notes may be of some interest.

The manufacture of dynamos and motors cannot now be regarded otherwise than as an old industry, compared with the manufacture of many kinds of machines constructed at the present time.

The writer doubts, however, if in any class of machinery greater diversity of opinion exists with regard to the design of its principal members, the materials used, and the adjuncts often embodied, as in modern dynamo machinery. It can, to a certain extent, be understood why, for instance, one maker uses cast iron, and another cast steel for the yoke. For different factories, too, the design of the machine must, as far as possible, suit the particular manufacturing methods employed.

One finds that there is not that real approach towards standardisation which might be expected. Possibly this may be due partly to the fact that the kind of machinery now under consideration presents problems of a more scientific nature, and that consequently different conceptions prevail with regard to fundamental principles than in, say, a steam engine and certain other mechanical apparatus, the design of which is governed by fairly hard and fast rules which do not admit of such variations in design, as in the case of electrical motors.

It does seem a fact that, particularly in small machines, standardisation is further removed than it was some twenty-five years ago. Then one nearly always expected to find (there were notable exceptions) a smooth core drum armature with horse-shoe magnets. Even the commutator sections by different makers for a given output did not show such a wide variation in number as in present-day practice.

Even in small machines (say below 6 b.h.p.) it appears that there is no consensus of opinion as to whether two or four poles should be used. The use of four main poles and four interpoles for a 220 V, 1 b.h.p. motor certainly suggests that a limit has been reached so far as the number of poles are concerned. It is well known, too, that these small machines often have expensive laminated poles bolted to a steel frame. The use of a fan is common practice, even for the smallest output.

It is somewhat difficult to see why a four-pole machine should find favour for low output; compared with a two-pole motor the average voltage per section on load, for the same number of sections, is considerably higher, although not double, as one might at first sight expect having in mind the conditions when running light. The brush gear is much more complicated and expensive. There is a greatly increased number of parts. The frequency is doubled, a matter of serious moment, considering that very high speeds are often required in small machines. The armature is more costly to wind for a four-pole series winding than for the ordinary two-pole type of winding. The cost of production of the very small four-pole motor is considerably higher, a point which the writer believes will be conceded by nearly all, if not all concerned.

For quantity production (a most essential condition of manufacture nowadays) it is of vital importance that no part or member should be embodied in a design unless, by its use, it is most clearly established that there is a very real gain either in prime cost, efficiency, or performance. This is of the first importance alike to maker, factor, and purchaser—every non-essential member must be eliminated.

In considering the manufacture of a single machine, the incorporation of certain refinements often shows a real reduction in weight, and perhaps an apparent lessening of cost. The matter, however, assumes an entirely different aspect when quantity production is the aim.

It cannot be too fully emphasised that with the present labour charges it nearly always pays to spend a shilling more for material if sixpence can be saved in labour— a fundamental and obvious point which does not always appear to appeal as fully as it might to the scientific mind.

The relationship of material to labour is of great importance, but it is not proposed in this article to deal as fully with this matter as it deserves.

The writer proposes later in this article to describe a very simple design which he believes does, to a large extent, fulfil the design requirements for quantity production.

It may, however, be desirable to first state some of the main points which, in one way or another, affect designs generally, and to show the refinements which it is proposed to eliminate.

To enable one to properly make comparisons between different designs it is, of course, necessary to know several details underlying the constructions. It is well known to the designer that what might at first sight appear slight modifications in the design of small machines have often a marked influence on the weight and cost.

The principal points which occur to the writer, perhaps not in order of importance, are as follows:—

(*a*). Number of poles and nature of material used in them.
(*b*) Open or partly-enclosed slots.
(*c*) Thickness of slot insulation.
(*d*) Length of air gap.
(*e*) Temperature rise.
(*f*) Commutation.
(*g*) Efficiency.
(*h*) Nature of covering on the wires.
(*i*) Overload capacity.
(*j*) Fan ventilation.
(*k*) Interpoles.

In dealing with these points the writer will put forward certain data relating to the new construction, which it is hoped will enable the reader to make comparisons between this construction and other types.

(*a*) For simplicity and minimum cost, a two-pole construction is essential. It can be shown that cast iron only can be utilised for the magnets with great economy. Different designers have demonstrated this in numerous machines at present running. With the low-gap density usually found in small machines, and giving the pole tips a suitable shape, it is quite unnecessary to use laminated pole shoes. When using a solid pole face it may be desirable to use a few more slots in the armature, but the cost of this is small compared to fitting laminated poles. Hence lamination in the magnetic circuit is a refinement which does not find favour when quantity production is concerned.

(*b*) Partly-enclosed slots have certain advantages, but these advantages are outweighed by disadvantages found in the workshop. An armature having this type of slot is not so easily and quickly handled as one having slots of the open type. It might have been expected that the writer would favour the partly-enclosed slot, seeing that he advocates solid pole faces. Such, however, is not the case, as it is found in practice that, with due care in design, the open slot is quite satisfactory. Hence the partly-enclosed slot must come under the non-essential heading.

Armatures are often built with the laminations

arranged so that the axis of a tooth, or slot, is not parallel to the axis of the spindle. This refinement is out of the question where competitive quantity production is concerned.

(*c*) The question of slot insulation is an important one. It is most unwise to cut down the slot lining to very fine limits. At the same time it is quite unnecessary to provide anything like the thickness of insulation found in, say, a 500-V, 30-b.h.p. motor. Differences of opinion naturally exist as to the proper thickness of insulation for a motor of this output, but few designers would care to specify much less than .10 in. in width and .20 in. in depth for the total insulation over the double cotton covering.

In small machines it is found that, owing to the accommodating nature of a number of small wires and the general flexibility of the armature coils it is, in practice, preferable not to consider the actual definite dimension for the width or depth of the insulation, but rather to consider it as a product of the two dimensions —that is, within reasonable limits. The writer finds this a useful method of considering the matter, especially when, for a given frame, the same core plate has to suffice for all speeds and voltages. It is evident that with fixed-slot dimensions the various coils (which are, of course, composed of widely differing gauges of wire) must adapt themselves to the space provided. It is an

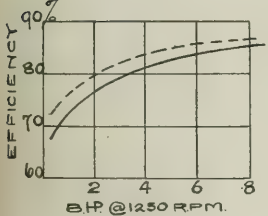


Fig. 1.

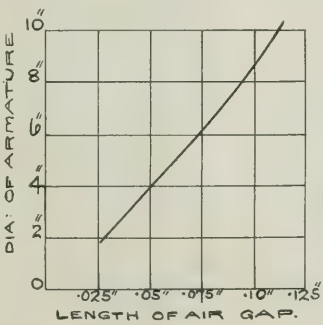


Fig. 2.

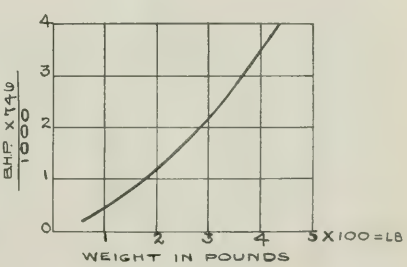


Fig. 3.

essential condition that the same core plate and the same number of commutator sections must, for a given frame, be used for all voltages up to 500. This is an easy matter in two-pole construction with a comparatively small number of sections.

In the 30-b.h.p. motor referred to, the product of the insulation thicknesses equals .02.

For 220-V motors of, say, ½ b.h.p. the product lies between .011 and .013. For 500-V motors of the same output the product lies between .014 and .016. For 220-V motors of, say, 6 b.h.p. the product will lie between .014 and .017. For 500-V motors of this output the product will be between .016 and .02.

(*d*) A suitable length of air gap (actual clearance between pole and armature laminations) for the new design in shown on curve (fig. 2).

(*e*) Final temperature rise 75° F.

(*f*) The commutating properties of small machines should be such that with the brushes in the geometrical neutral position there is no sparking. Furthermore, the machine must withstand, without injury, 50 per cent. overload for short periods with the brushes in the position defined.

(*g*) For comparative purposes the weights to be given later will be based on the commercial efficiencies given in fig. 1.

It must not be assumed that the figures given are the maximum attainable. It is not difficult to obtain the top curve by slight additional weight, or by the method referred to later. The bottom curve, however, would more properly indicate the watts which can be lost, still keeping the machine well within a low temperature

(*h*) Considerable saving in weight can be made in small machines by winding the armature with silk-covered wire, and the field coils with single-cotton-covered wire.

The writer prefers to use fine double-cotton-covered wire for both the armature and field coils, and it is on the use of this covering that the data given are based. By the use of one kind of covering, the copper carried in stock is considerably decreased. With a machine designed in the first place for double-cotton-covered wire, it must not be overlooked that by winding the armature with silk-covered wire and the field with single-cotton-covered wire a considerable gain in efficiency can be obtained. It is very useful at times to take advantage of this when a very high efficiency is called for. Alternatively, when weight is a consideration, a greater output can be obtained. The reason for this is obvious—with silk-covered wire the next larger gauge of wire can nearly always be used in the armature, and single-cotton covering admits of a considerably greater amount of copper on the field coils. It will easily be seen that the extra price of the silk covering and extra weight of copper will run up the cost, but there certainly arise in practice occasions when it is justified.

The writer has an open mind with regard to the use of enamelled wire for the interpoles, but it must be confessed that he generally specifies double-cotton-covered, being impelled to do so largely by the question of stock.

(*i*) The motors, for which the weight curve is shown in fig. 3, will easily stand the following overloads:—

Up to 1 b.h.p., 25 per cent. for ½ hour.
Above 1 b.h.p., 25 per cent. for 1 hour.

(*j*) A fan is certainly considered a non-essential member, and would not find favour in a design which aimed at simplicity.

(*k*) With motors up to 250 volts, and with two-pole construction, it is not difficult to obtain the commutation requirements as set forth under (*f*) without the use of interpoles. Above 300 volts it is wise to use interpoles. It is also necessary to use them for the lower voltages in the case of variable-speed motors above 2 :1 speed ratio and where extra heavy duty is required.

(*To be concluded.*)

A Large Californian Undertaking.—The Pit River development of the Pacific Gas & Electric Company was started a year ago and now the power house, costing upwards of $6,000,000, is nearing completion. The plant will develop 93,000 h.p. when completed and will be ready for operation about September 15th. A 220,000-volt transmission line 210 miles long will connect the plant with the Vacaville substation, and 70 miles must still be covered by another line before San José Mission is reached and the power is delivered at San Francisco.

The whole Pit River development is expected to reach completion in 1935, at a cost of more than $100,000,000, or an annual expenditure of about $8,000,000. The power developments mapped out are: Pit No. 2, 23,500 h.p.; Pit No. 3, 90,500 h.p.; Pit No. 4, 107,200 h.p.; Pit No. 5, 250,000 h.p.—*Electrical World.*

MUNICIPAL TRAMWAYS ASSOCIATION (INC.)—II.

ANNUAL CONFERENCE.

The first day's proceedings of the Conference were attended by wretched weather conditions in Newcastle. The Lord Mayor (Alderman R. H. Millican), attended by the Sheriff (Councillor James Lunn), the town clerk (Mr. A. M. Oliver) and many members of the Council, extended the city's welcome. The Lord Mayor said that on its first visit to Newcastle, the Association was celebrating its majority. It had honoured the city by electing as its president for the year Alderman Richard Mayne, chairman of the Newcastle Transport and Electricity Committee. As a municipality, Newcastle recognised what Alderman Mayne had done during the past few years in connection with the city tramways. He believed that the coming year would be a most difficult one for tramways and other municipal undertakings throughout the country, for it would bristle with anxieties arising from financial, labour, and industrial problems.

The Lord Mayor's welcome on behalf of the city was briefly responded to by the president, and on the motion of Sir John Timpson, Portsmouth, vice-president, seconded by Mr. A. L. C. Fell, London, the Lord Mayor and Sheriff were thanked for their greetings and presence.

A special programme drawn up for the ladies was then entered upon. Directly after the reception by the Lord Mayor, they proceeded in motor 'buses to a tour of the city, including a visit to the old Castle, Blackgate Museum, and the Trinity House on the quayside, and after lunch they left for the coast *via* Gosforth Park, tea being served at the Grand Hotel, Tynemouth. Their initial outings were not pleasant, owing to incessant rainfall, but nevertheless there were many expressions of appreciation.

The President (Alderman Mayne) having read his address (which is abstracted below), was cordially thanked for it, on the proposition of Mr. J. B. Hamilton, of Leeds, seconded by Alderman S. Craddock, of Wolverhampton. Mr. Hamilton observed that he never had listened to a presidential address which showed more vision or contained more lucid statements.

Afterwards the papers of Mr. Ernest Hatton and Mr. P. M. Heath were read and discussed.

Alderman Richard Mayne presided at the second day's proceedings of the Conference. The weather was again wretched, and completely spoilt the pleasure outing of the lady visitors, who were conveyed to Jesmond Dene, where they were entertained to luncheon; afterwards they were shown over the offices of the *Newcastle Chronicle and North Mail*, where they saw the complete production of an issue of the evening paper.

Meanwhile, a paper was read by Mr. E. S. Rayner, general manager of the Hull City tramways, on "Tramway Rolling Stock"; an abstract of the paper was printed on p. 368. After this had been discussed, Mr. H. Mattinson, general manager of the Manchester City Tramways, read a paper on "Highways Costs Borne by Tramways," and a discussion followed.

At the concluding session on September 15th, Sir John Timpson, K.B.E., chairman of the Portsmouth Tramways Committee and vice-president of the Association, was unanimously elected president for the ensuing year, and it was resolved that the next conference of the Association should be held at Portsmouth.

Mr. J. M. McElroy, one of the pioneers of the Association, who has lately retired from the post of general manager of the Manchester tramway system, and who has also retired from the Council of the Association, was elected an honorary member of the organisation.

Alderman W. G. Wylie, South Shields, was re-elected a member of the Council, to which Alderman S. Craddock, Wolverhampton, was also elected, both being selected to represent the Associated Tramway Committees. To represent tramway managers on the Executive Council, Mr. James Dalrymple, C.B.E., general manager, Glasgow, and Mr. T. B. Goodyer, general manager, Croydon, were re-elected; and there were also appointed Mr. P. Priestley, general manager, Liverpool, and Mr. W. Chamberlain, general manager, Oldham.

The newly-elected president, Sir John Timpson, and the general secretary, Mr. J. Beckett, were appointed to represent the Association at the International Convention of Transport Authorities to be held in Brussels in October.

Votes of thanks to the retiring president and to all those who had assisted in making the Conference a success were cordially carried. Later the members of the Association motored to Chollerford and visited the Roman camp at Cilurnum.

Presidential Address.

By Ald. Richard Mayne, J.P.,

Chairman, Newcastle-upon-Tyne Transport and Electricity Committee.

(*Abstract.*)

To-day we celebrate the 21st anniversary of the formation of this Association. Out of a total of 102 municipally operated tramways, 95 are now members of it. It has become a custom in some quarters, not suspect of altruistic motives, to declaim against tramways undertakings and assume that they have had their day. It is 57 years since public tramways were first operated in this country, and in 1921 they carried 4,863,968,000 passengers; the capital outlay was £62,293,000 (local authorities) and £23,849,000 (companies), a total of £86,142,000, the former carrying 3,949,138,000 and the latter 914,380 passengers. The Ministry of Transport has stated that "In 1920-21, tramway undertakings received £939,004 from local rates, and contributed in relief of such rates £53,594. In 1913-14, they received £62,600 and contributed £589,886. . . .In spite of the increased fares the ratio of working expenses to receipts rose to 80·49 per cent. as compared with 80.55 per cent. in 1919-20. In 1913-14 the ratio was 64.35 per cent."

It is obvious that tramways have met a great public necessity. That they continue to do so is beyond question. The vehicle has yet to be devised that can compete successfully with them in carrying our industrial population by means of a regular service at low fares on equal terms, especially in relation to the burdens of rates, taxes, and maintenance that they have to carry. On equal terms they can outstrip with ease all their rivals and competitors.

Sir Henry Maybury recently said that there would now appear in equity to be a case for the tramway undertakings against the ordinary commercial user. As Parliament has put the obligation on them they should go to Parliament for relief, and officially he would not be against them. If they obtained relief, they should be brought into a scheme of taxation, and a charge should be made on the seating capacity of the tramcar; the track, which was now the responsibility of the undertakers, being transferred to the Highway Authority. This indicates that it may be necessary to take action by means of a private Bill and fight out the issue in the House of Commons. Parliament should be pressed to remove a manifest injustice.

We have never claimed a monopoly, but we claim either freedom from exactions not placed on other passenger transport systems, or that the same exactions be levied on our competitors. The London Underground Railway group, however, had put forward a proposal involving freedom from omnibus competition for ten years, together with a Government guarantee of interest on a sum of £6,000,000. The Metropolitan Municipal Tramways Council had stated that a Government guarantee of this nature would result in placing the municipal undertakings at a still greater financial disadvantage, by permitting the Underground group to subject municipally-owned tramways to a subsidised competition by their buses. The municipal tramway undertakings had a still greater right to such support, and the Council urged that no such monopoly should be granted to any private undertaking.

Road transport competition and big schemes of road widening and adaptation to heavy modern mechanical vehicles, which are not adapted to many existing roads, the fierce progress in the wear and tear on roads, the character and the measure of taxation upon mechanical road vehicles—these are subjects with which the financial interests of all local authorities are closely bound up. They raise issues of overwhelming importance; they affect seriously the oppressive burdens of local taxation; they bear directly upon the interests of the members of this Association, but even they do not throw into true perspective the vital difference between a pirate or vagabond service of passenger transport, which is out in fine weather and at favourable times, and in when it is wet and unfavourable, and a regularised and efficient ser-

vice, operated all the time at the lowest possible cost for the public advantage.

Engaged as we are in operating a publicly-owned passenger service, concerned only with efficiency and cost price whenever we can get it; not impelled or stimulated by motives of profit, we fear no competition under fair conditions, and, if nothing short of monopoly can secure to the community a self-sustaining and efficient service, then, on broad grounds of public policy and in the public interests, we place our claim as high as that of a monopoly.

The subject of unemployment insurance is being considered by the Executive Council; the industry is contributing £150,000 per annum to other industries whose unemployment is greater, and as it was the policy of the Government to encourage industries to administer their own schemes for dealing with their unemployed workpeople, to accept this encouragement and provide a "special scheme" would be sound policy.

An Argument for the "Penny Fare" demonstrated by Actual Experience.

By Ernest Hatton, General Manager and Engineer, Newcastle-upon-Tyne Tramways. (*Abstract.*)

Owing to advancing working costs it was found necessary to raise the minimum fare; some undertakings made this 1½d., and some 2d. The present tendency is, however, to revert to the 1d. fare. However long a distance may be given for a high minimum fare it places the tramcar beyond the reach of many, especially in the case of a large household of children. Therefore, the scale of fares must be as low as is consistent with the financial safety of the undertaking. Taking the Newcastle Corporation system as an example, it is seen that up to 1917 by keeping the long-distance fare low and giving a good ride for a penny, good results had been obtained. In 1920 the percentage of costs to receipts had increased so heavily that revision of fares became necessary. There were many advocates of a 1½d. minimum fare, but it was finally decided to retain the 1d. fare and also the ½d. children's fare. The principal change was a curtailment of the 1d. fare distance from 2,800 to 2,000 yards. The revision was estimated to produce from sixty-five to seventy thousand pounds; it actually produced eighty thousand pounds at the time. Further increases in wages absorbed this extra revenue and necessitated another revision. It was decided, however, to meet the emergency by a reduction in working costs, and as the wages of employés were fixed by national agreement, the Corporation seceded from the industrial councils and agreements. Receipts are falling, due to lack of employment generally, and it would be a preposterous condition that the workers who use the cars should subsidise the workmen in the cars. During the whole of the period nothing had been done to deprive the long-distance rider of any privileges, while the 1d. and ½d. passengers (and they are still 40 per cent. of the total) are given a quick service and are carried a reasonable distance.

The author is not in favour of altering the value of the penny; conditions must shape themselves to suit the nation's coinage—not *vice versâ*. The great increase in traffic following the introduction of electric traction was not gained by increasing fares, but by fare reduction and quick services. This policy should be pursued still.

Discussion.

Mr. A. Baker (Birmingham) said he would be very much surprised if more than half-a-dozen persons agreed with the paper in its entirety. The thesis of the paper was that fares ought to be brought back to pre-war level, and that the only way to accomplish that was to reduce working expenses. Wages represented 60 to 65 per cent. of the total costs, and to reduce fares to pre-war level meant that wages must be brought down to that standard, or lower. Tramwaymen to-day were getting 130 to 140 per cent. more than they were receiving in July, 1914, and compared with other industries, they were getting something more than the market value for their labour. Doubtless reductions would have to take place. That matter was being dealt with by the National Joint Industrial Council. Did anyone imagine, however, that wages would ever come down to the 1914 level? He thought—indeed, he hoped—they would not. The worker was entitled to a higher standard of living than he had enjoyed in 1914. Tramway fares had always been too low in this country to provide sufficient margin for emergencies. The only way in which they could be made self-supporting was to make the passenger pay the cost of his ride. To suggest that fares could be brought back to pre-war level was as fallacious as it was pernicious.

Mr. W. Murray (Walthamstow) argued that it was impossible to make conditions that would be applicable to the whole of the country.

Councillor Waite (Coventry) said that ideals were impossible under present conditions, and tramways must be made to pay.

Alderman C. Higham (Blackburn) said the smaller undertakings could not afford to have a penny fare on the present rate of running costs.

Councillor W. G. Turner (Belfast) considered that each system should be a law unto itself, so far as fares and distances were concerned.

Alderman F. Smith (Liverpool) said tramways were a cash affair, and those who could not make them pay should not be allowed to own them.

Councillor B. Clarkin (Walthamstow) favoured free rides, but as the ideal was unattainable at present, he gave his support to the penny fare.

Councillor Woffenden (Huddersfield) said there was no justification for asking the ratepayers to subsidise the tramways.

The President said a man ought to be able to get on a car for a penny. If they could not carry him a long way, let him be carried a short way, but let him use his penny.

Mr. J. Barnard (Bolton) contended that Newcastle could not afford to run its cars on a penny fare. Had Newcastle set aside a sufficient sum of money for renewals and depreciation as put forward at the Court of Inquiry, instead of a deficit of £2,667 last year, the deficit would have been £63,000.

Mr. James Dalrymple (Glasgow) said that if the penny fare would not yield sufficient revenue to defray expenses, it was useless considering it.

Mr. H. P. Stokes (Plymouth) said the sooner undertakings aimed at getting back to the penny fare the sooner would there be a revival in industry.

Mr. Hatton, in reply, said he had not argued for a reversion to the penny fare; it could not be done at the present time. Last year, Newcastle tramways, after three weeks' holiday, cost the undertaking £13,000. Before that, because of the coal strike, the undertaking had switched on to oil fuel, and the two items together cost £20,000. But for these items there would not have been a deficit of less than £3,000; there would have been a handsome profit. Out of revenue they had purchased 'buses which had cost £40,000, and they had built and equipped a power station and four sub-stations.

The Legal Aspect of the Question of Electrolysis.

By P. M. Heath, Town Clerk, Manchester.

(*Abstract.*)

The question of the legal liability of tramway undertakers for damage occasioned by the leakage of electric currents has attracted attention consequent upon the decision of the Court of Appeal in the recent case of the Postmaster-General *v.* the Blackpool and Fleetwood Tramroad Co., Ltd. In the circumstances of this case, it was held by the Court of Appeal that the Postmaster-General was entitled to recover certain sums expended on the repairs to Post Office cables, which had been injured by the leakage of electric currents from the tramway system. This case was decided upon the special provisions, in favour of the Postmaster-General, contained in the company's Act of 1896, and it is not to be regarded as an authority in claims for damages for electrolysis from others, such as water and gas undertakers.

The question of nuisance and damage from escaping electric currents used in connection with a tramway undertaking first engaged the attention of the High Court in the year 1893 (National Telephone Co. *v.* Baker). By reason of the escape of electric currents from the tramway system, disturbances were occasioned to the company's telephone wires.

Kekewich, J., ruled that the act complained of was done in pursuance of a provisional order confirmed by Act of Parliament and was protected to the same extent as other nuisances under statutory authority. The defendant being expressly authorised to use electric power, the Legislature must be taken to have contemplated it and to have condoned by anticipation any mischief arising from the reasonable use of such power.

The National Telephone Co. enjoyed no special statutory protection, and was, as regarded claims for damage by electrolysis, in no better or worse position than water or gas companies.

A Joint Committee of the House of Lords and of the House of Commons reported in July, 1893, that the Board of Trade should have power to make regulations to secure the best system of working electrical tramways and railways, and a clause was agreed, requiring the undertakers to take all reasonable precautions so as not injuriously to affect, by fusion or electrolytic action, any gas or water pipes or other metallic structures, or to interfere with the working of any line or apparatus used for the purpose of transmitting electrical power, or of communication. The undertakers are deemed to take all proper precautions, if they employ means of preventing injurious interference as prescribed by the Board of Trade Regulations.

Clauses for the protection of the Postmaster-General were reduced to a common form in 1911, and such require the undertakers to use every reasonable means to prevent injurious affection to telegraphic lines or currents therein.

The case of the Postmaster-General *v.* Blackpool and Fleetwood Tramroad Co., previously referred to, is instructive as to the construction which has been placed upon language similar to that contained in the model clause.

It was contended by the defendants that they were not liable, for the telegraphic lines of the plaintiff were injuriously affected, not by the working of the defendants' undertaking, but by plaintiff's own negligent act. The Court held that neither the fact that the defendants had used every reasonable means in the working of the undertaking to pre-

vent injurious affection of the plaintiff's cable, nor that the plaintiff by laying his cable so near to the defendants' lines had courted the injury, afforded any defence.

It will therefore appear that notwithstanding that the Postmaster-General be negligent in selecting the place for his telegraphic or telephonic cables, if these are injuriously affected by the construction or working of a tramway line, the Postmaster-General is entitled to require the tramway undertakers to pay the expense of all alterations that may be necessary to remedy such injurious affection.

It is submitted that an alteration of the law is necessary—and that the proved negligence of the agents of the Postmaster-General should disentitle him to recover the cost of alterations.

Discussion.

Mr. A. L. C. Fell (London County Council) moved that the Executive Council be asked to appoint a technical committee to meet the experts of the Postmaster-General and the Ministry of Transport for the purpose of clearing up the position. Mr. J. Gordon (Liverpool) seconded.

In supporting the resolution, Mr. J. B. Hamilton (Leeds) said that after every precaution had been taken they were still liable for heavy damages. He believed the Association could at least get a modification of what promised to be a very serious charge on some undertakings. At present they were liable if the Post Office claimed injury, even without proving it.

Mr. C. J. Spencer (London) suggested that the Tramways and Light Railways Association should be asked to co-operate in the matter, and this was embodied in the foregoing resolution and adopted unanimously.

This ended the first day's proceedings.

INDIAN NOTES.

(From Our Special Correspondent.)

A very promising institution has been established in the Punjab, called the Punjab Electricity Board, whose work is to meet at intervals to discuss with experts and other officials possibilities of electrical development in that province. The first regular meeting of the Board was held in Simla in June with the Minister of Industry, who is a prominent Indian, in the chair. The principal business was a discussion of the merits of the Sutlej Valley hydro-electric scheme as a by-product of the main irrigation works. The chief engineer opposed the electrical scheme for two reasons, one being that its financial prospects were bad; the other being that the necessary regulation of the flow of water for turbine work would give rise to serious complications and interfere with the main irrigation project. Colonel Battye, the hydro-electric expert, explained the advantages and disadvantages of such a scheme. No immediate decision appears to have been arrived at.

Afghanistan.—The possibilities of business with this country are becoming more encouraging. The large hydro-electric plant installed a few years back is proving its utility, and further developments are likely to take place in the near future. The representative of a large local firm of engineers has been invited to go to Kabul to work out details of a new project and submit estimates. Among the 90 students from Afghanistan, who recently went to Europe to complete their education, there are several who are destined for the electrical engineering service.

Owing partly to the belief among people of the East in the efficiency of German educational methods and in part to the depreciation of the mark, many of these students have gone to Germany for training.

The complaint of the Indian student who goes to England for training is that he is left too much to his own resources in workshops which he joins; nobody troubles about him; he meets few among his acquaintances who are keen in their work, his shop companions being mostly interested in football, racing, kinemas, and such other, to him, uninteresting trivialities. Again, he has to remark on the colossal ignorance about India, which is so obvious in England—and so painful to an Indian. These matters, which may seem trifles, get discussed and talked about when a student returns, and hence it is that many decide to go to Germany, America, or even Japan, where more attention seems to be paid to Indian students.

Shillong.—This fascinating little hill station in Assam is formulating plans for giving its inhabitants the benefits of an electricity supply. The Shillong Hydro-Electrical Co. has been formed, and, under certain conditions, has been granted a concession for 31 years—one of the conditions being that the municipality pays one anna per unit less for its consumption than the general public. As Shillong is very close to Cherapoonjee, which has the largest rainfall in the world, *viz.*, 428 inches average, it looks as if the project should be a success; but, of course, this huge rainfall is only seasonal. If a light electric railway could be run from Gauhati to Shillong, a distance of about 64 miles, it would add much to the comfort of visitors and to the prosperity of the town.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR AUGUST, 1922.

The returns of electrical exports for August show an appreciable improvement on the July position, the month's exports having advanced from £809,915 in July to £863,637 in August. The electrical imports also showed a similar but more marked tendency, the total £318,432 for August comparing with £184,979 for July. The re-exports were valued at £12,943 as compared with £15,246 for the previous month.

Generally speaking, all sections of the exports, except batteries and accumulators and electrical machinery, were at a higher level than in the previous month, the principal increases occurring in submarine telegraph and telephone cable, and telegraph and telephone instruments and apparatus, while glow-lamp exports were also considerably in advance of the July figures; on the other hand, electrical machinery records were lower by £25,000, and battery and accumulators by £18,000 than in the preceding month.

In the electrical import section electrical machinery values advanced by more than £100,000, while telegraph, telephone, and glow-lamp imports were also on an extended scale.

Values of Electrical Exports and Imports for August, 1922.

	Exports.	Imports.	Re-Exports.
	£	£	£
Electrical goods and apparatus ...	105,386	33,958	3,871
Insulated wires and cables ...	153,591	19,937	32
Glow lamps	37,808	10,593	709
Arc lamps and parts...	219	571	7
Batteries and accumulators ...	25,209	20,210	478
Meters and instruments	33,738	5,844	1,235
Carbons	6,572	1,957	431
Electrical Machinery.—			
Railway and tramway motors ...	11,666	—	—
Other motors and generators ...	113,634	—	—
Switchboards (not telegraph or telephone)	5,293	428	—
Electrical machinery (unenumerated)	123,588	174,934	4,733
Telegraph and telephone cable and material.—			
Telegraph and telephone wire and cable (not submarine)	750,759	—	—
Submarine telegraph and telephone cable	46,782	1,053	130
Telegraph and telephone instruments and apparatus	149,392	48,947	1,317
Totals	£863,637	£318,432	£12,943

A Durability Test.—Messrs. Mawdsley's, Ltd., of Dursley, have sent us the following letter from a customer:—"With regard to one of your standard 25-h.p. motors. The above machine was placed on a pumping set which unfortunately was drowned owing to a large in-rush of water into the mine, and was submerged for five weeks under 90 ft. of water. When the machine was recovered, only the lifting eyes were visible, the rest was in a mud bank. The armature could not be extracted owing to the mud, so this thick mud was swilled out by means of a hot water hose. The machine was dried out with heater elements without dismantling, and the test of all windings to earth was 1.2 megohms. The machine was next put on a haulage, and has since given six months' service without a moment's trouble of any sort. I think this is a remarkable performance for an open-type standard machine."

ELECTRICITY SUPPLY ADMINISTRATION.

The report of the Minister of Transport respecting the applications to and proceedings of the Ministry under the Electricity (Supply) Acts, 1882 to 1919, during the year ended March 31st, 1922, has recently been published (H.M. Stationery Office, 9d. net).

The approved estimated net expenditure of the Electricity Commissioners for the year was £44,000. This is being defrayed from the Exchequer, making a total advance, including interest, of £90,796, which has to be repaid by annual instalments by March 31st, 1925. As from April 1st, this year, the Commissioners' expenses are to be provided directly by the electricity supply industry.

During the year 31 Special Orders were confirmed by the Minister, and a further five awaited confirmation on March 31st. Most of these have been mentioned in previous issues of the Electrical Review at the time of their being made by the Commissioners. Apart from the Orders included above, the Minister has also confirmed a bulk supply agreement between the Wolverhampton Corporation and the Cannock Urban District Council; and an application for a Special Order made by the Bootle Corporation, permitting it to use the water of the Leeds and Liverpool Canal is also under consideration. Under the Statutory Undertakings (Temporary Increase of Charges) Act, 19 Orders have been made modifying the charges which may be made by the undertakers concerned. Increases in the maximum price which undertakers are permitted to charge have been allowed in 24 cases; it was found necessary to hold only five inquiries in this connection.

Extensions of the time in which works are to be carried out have been granted to five authorities. An extension of the time in which it may decide to purchase the local undertaking of the Urban Electric Supply Co., Ltd., has been allowed the Newton Abbot Urban District Council.

Twelve Electricity Orders have been completely revoked; the parts of two Acts relating to electricity have been cancelled; and the area defined in the Runcorn Electric Lighting Order, 1910, has been curtailed. Consideration of the revocation of a further eight Acts (in so far as they apply to electricity), and Orders has been deferred. In five cases permission has been given to break up streets, not repairable by the local authorities, for the purpose of laying cables.

An interesting feature of the report is the section announcing that no less than 46 authorities have secured permission to erect overhead lines for the purpose of supplying electricity. Two applications for consents to wayleaves came up for consideration. One of these, made by the undertakers under the North Wales Electric Power Act, 1904, for consent to a wayleave for certain parts of the route of an overhead line from Dolgarrog to Colwyn Bay, was granted; in the other case the undertakers under the Portishead and District Electric Lighting Order, 1911, applied for, and were refused consent for, a wayleave across a field.

The latter part of the report gives an outline of what the Electricity Commissioners' report will be. It first mentions that two more electricity districts have been delimited, *viz.*, the West of Scotland and the East of Scotland. The Commissioners have given their consent to the erection of eleven new stations, representing a total initial installation of 30,660 kW. Authorised extensions of 50 existing stations represent approximately 143,700 kW of generating plant. In addition to the applications not disposed of at the date of the last report, the Commissioners received 394 applications from local authorities for sanction to borrow funds for the purposes of their electricity undertakings. Sanctions were issued in respect of 389 applications, the total amount sanctioned being £13,708,385.

At the commencement of the period covered by the present report the Commissioners had before them 27 applications for Special Orders under Section 26 of the Electricity (Supply) Act, 1919, and during the period covered by the report received another 43. Of these applications the Commissioners made Orders in 33 cases. In one case an Order was granted despite the refusal of consent by the local authority for the parish of Bedworth. Approval was given in seven instances to agreements between undertakers for mutual assistance or bulk supplies. Fifty-eight Orders were made permitting undertakers to supply electricity to specific premises situated outside their areas. Special systems of supply were sanctioned in the case of 28 undertakings. The Commissioners have dealt with a number of applications referred to them by the Unemployment Grants Committee for approval of electricity works proposed to be carried out by local authorities with the aid of grants from the Committee: they have also assisted the Trade Facilities Act Advisory Committee in a consultative capacity.

An appendix to the report shows the position, as at March 31st, with regard to the electricity districts delimited by the Commissioners. This has been followed closely in our pages as the various steps have been taken.

LEGAL.

James Keith & Blackman, Ltd., *v.* B. Barnett (Electrical Engineers), Ltd.

Before Mr. Registrar Dell, in the Mayor's & City of London Court, on September 14th, a claim was made by plaintiffs, of Farringdon Avenue, E.C., against defendants, electrical engineers, 125, Whitechapel Road, for £4 10s. 6d. for work done.

Plaintiffs' representative said the defendants ordered two ventilating fans, and after delivery found one of the fans wanted altering. They also required two fresh switches. The fan was altered and the switches were supplied, the amount sued for being the price. The goods had been supplied exactly as ordered.

Defendants' representative said that they were erecting a public building for the L.C.C., and required two ventilating fans. Plaintiffs' representative called and he was shown the plans which required two ventilating fans, one to take the air out and the other to send the air in. The plaintiffs' representative gave the price of the fans required, which was accepted, and the fans were ordered on plaintiffs' representative's selection. The account was paid before the fans were delivered on the job. Afterwards it was found that a mistake had been made in the fans supplied being both alike.

Plaintiffs' man said it was simply a matter of reversing the blades of one of the machines. The switches that were sent were considered a danger to the public and others were to be sent. The motors were guaranteed, so far as workmanship was concerned, for 12 months. Two or three days after the alterations and delivery of the fresh switches, a bill was sent to them for £4 10s., for which they considered they were not responsible.

Mr. Registrar Dell said, in order to deal with the matter properly, he would require the attendance of the plaintiffs' representative to whom the order for the fans was given. At present he had only the defendants' version of the interview. He would not deprive the plaintiffs of their right to recover, which would depend on what the plaintiffs' representative would say. He did not want to encourage the plaintiffs to bring the matter on again unless they had strong evidence that the defendants were responsible. He was fairly satisfied from what the defendants' representative said that the plaintiffs would have a difficulty in making them responsible. The case was adjourned.

A South African Trade Union Case.

The case of an electrician who sued the South African Council of the Amalgamated Engineering Union for £5,000 was recently dealt with by the Appeal Court at Cape Town. In December, 1920, the Union expelled an electrician named A. E. Young, on the ground that Young had accepted an increase of ten per cent. offered by the Johannesburg Municipality to certain employés, while the question of acceptance was still under consideration by the Society. In consequence of his expulsion, plaintiff was given twenty-four hours' notice and dismissed from his employment by the Municipal Council. The case previously came before the Witwatersrand Local Division, which court reinstated Young as a member of the Union with full rights and privileges. He was not, however, re-employed by the Municipal Council. Against the decision of the lower Court the Union appealed, and the Appeal Court upheld the appeal with costs in both Courts.

Steel Erector's Widow Awarded £300.

In the Shoreditch County Court, on September 12th, before Judge Cluer, there was an application, under the Workmen's Compensation Act, by the widow of George William Hood, of Romford, a steel girder erector, against Mr. W. J. Cearns, a builder, of Stratford, for compensation for the death of her husband. It appeared that on July 14th the deceased man was erecting a steel girder at the Shoreditch Electricity Works, when he fell and fractured his skull. He died as a result of his injuries. A claim was made of £300 for compensation for the widow, and this was admitted.

"Drawback" Allowance on Goods for Australia. The High Commissioner for Australia in London has been informed by the Commonwealth Government that exporters of goods to Australia are now at liberty to use the form of invoice declaration recommended by the Imperial Customs Conference, which will be adopted as an official requirement from January 1st, 1923. As this form provides for the insertion of a statement as to the amount of any "drawback" or remission of duty which has been or will be allowed on exportation, its use obviates the need for a supplementary certificate from the Customs authorities of the country of export hitherto required in the case of goods exported to Australia under "drawback."—F.B.I. *Bulletin.*

BUSINESS NOTES.

Bankruptcy Proceedings.—Frederick Hungate Dennis, 124, New London Road, and 21c, High Street, Chelmsford, late 20, High Street, Chelmsford, Essex, electrical engineer.—The first meeting of the creditors was held on September 15th at 29, Russell Square, London, W.C.1. The Official Receiver, who presided, stated that he had not yet been able to issue the usual report to the creditors, but, according to the statement of affairs, the ranking liabilities were £841. There were fully-secured creditors for £693 holding securities consisting of a mortgage on 124, New London Road, and a charge on a life policy. From those two securities there was a surplus of £270, but a portion of that went to the partly-secured creditors. The surplus carried to the assets amounted to £245. The total assets amounted to £615. Debtor attributed his failure to insufficient capital and general depression in trade. The matter was left with the Official Receiver as trustee of the estate.

Jervis St. Vincent Clegram Farrant, electrical engineer and merchant, 14, Queen Victoria Street, E.C.—The public examination of this debtor was held on Tuesday last week before Mr. Registrar Mellor at the London Bankruptcy Court, the accounts showing liabilities £8,692 and assets valued at £54,486, chiefly consisting of claims and book debts. Replying to Mr. W. P. Bowyer, Senior Official Receiver, the debtor stated that for many years prior to 1908 he was employed in various parts of the world as an electrical engineer, but then commenced business on his own account as an importer, and subsequently as a broker and merchant. In 1917 he ordered 15,000,000 electrical pocket batteries from a firm in New York, the purchase price being six shillings a dozen; he received about 960,000 of these batteries, but the balance was not shipped owing to import restrictions, whilst about one-half of the batteries received proved to be faulty, and he had to return the money paid by his purchasers. Witness made a claim upon the vendors for £14,000; the proceedings extended over a period of two years, and he eventually received £8,500, which was exhausted in payment of outstanding debts, he having had recourse to moneylenders during the interval. His loss in the transaction was between £4,000 and £5,000. The debtor contended that he was more than solvent, and attributed his present position to his inability to collect moneys due to him for commissions earned and advances made; to loss over the electrical pocket batteries; and to stagnation of business during the 12 months preceding the date of the receiving order. The examination was concluded.

H. Garniss, electrician, late of 107, Beverley Road, Kingston-upon-Hull.—Receiving order made September 12th on debtor's own petition.

M. O. Heckels, electrical wholesaler and agent, 643, Welbeck Road, Walker, and Star Buildings, Northumberland Street, Newcastle-on-Tyne.—First meeting October 4th at the Official Receiver's offices, Newcastle-on-Tyne. Public examination October 19th at the County Court, Newcastle-on-Tyne.

Company Liquidations.—Saitax Manufacturing Co., Ltd.—Winding up voluntarily. Liquidator: Mr. W. Adams, 81, Albany Street, N.W.1. Meeting of creditors, September 25th.

Helsby Wireless Telegraph Co., Ltd.—A meeting of members is called for October 27th, at Surrey House, Embankment, W.C.2, to hear an account of the winding-up from the liquidator, Mr. J. B. Edwards.

Dissolutions of Partnership. — Tarbuck & Gilbert, plumbers, decorators and electrical engineers, 150, Broad Street, Chesham.—Mr. W. Tarbuck and Mr. G. Gilbert, jun., have dissolved partnership. Mr. Gilbert will attend to debts and continue the business.

Renshaw & Marsden, electrical engineers, 72, Penny Street, Blackburn.—Messrs J. Marsden, J. B. Renshaw and L. Marsden have dissolved partnership. Debts will be attended to by Mr. J. Marsden, who will continue the business under the same style.

Trade Announcements.—Mr. Frederick Pratt, 23, Queen Anne's Gate, S.W.1, has been appointed sales manager for the Midlands, South of England, and overseas, for the products of the Ironclad Switchgear Co., Ltd., Eccles.

Mr. H. Orgel, wholesale electrical factor, has recently transferred his business to 3, Bishopsgate Goods Station, Commercial Street, E.C.

Holophane, Ltd., informs us that the prices of its glassware and fittings have been reduced. The firm's new address is Elverton Street, Vincent Square, S.W.1.

"B. N. B." Wireless, Ltd., has opened new premises at 65, Renshaw Street, Liverpool.

Messrs. Jones Bros., electrical engineers and contractors, have opened showrooms at 53, Cardiff Road, Bargoed.

The Elco Electric Manufacturing Co., Ltd., has appointed Mr. H. S. Asbery, of 3, Paradise Square, Sheffield, as its sole agent in Yorkshire, and he will hold stocks of all materials at that address.

Messrs. T. J. Grainger & Co., Ltd., 31, Side, Newcastle-on-Tyne, have been appointed sole agents for the Northern counties for Messrs. Erskine, Heap & Co., Ltd., and Messrs. Elliott Bros. (London), Ltd.

Mr. W. W. Pluck, who was for some years a director of Messrs. Mickelwright, Ltd., of Alperton, is starting business as the Vector Co., at 16, North Wharf, Gordon Road, West Ealing, London, W.13, and will make resistances, rheostats, dimmers, and regulating apparatus. Catalogues and lists are desired.

Early in 1920 the business of James Gordon & Co., Ltd., water-power engineers, was taken over by the English Electric Co., Ltd, and Mr. James Gordon was retained as manager of the water-power department. We learn that it has recently been arranged, on a mutually satisfactory basis, that the business of James Gordon & Co. shall in future be carried on as it was originally. Mr. Gordon notifies us that he is trading as "James Gordon & Co., Ltd."—an entirely independent concern—dealing, as heretofore, in water-power plant of all types and sizes. An illustrated leaflet, showing their turbines and governors, has been issued.

Mr. H. T. Barnett, M.I.E.E., will shortly be commencing business as an electrical and general engineer at 12, Whittington Chambers, King's Road, Portsmouth.

Mr. R. H. Dougan, who is shortly commencing business at 13, Davidson Road, Liverpool, specialising in the electrical equipment of ships, desires to receive catalogues of generating sets, switchgear and accessories.

The Midland Electric Light & Power Co., Ltd., is opening new offices and showrooms at 14, The Parade, Leamington, and desires to receive new catalogues.

Mr. A. F. Smith has opened premises as the Farnborough Electrical Co., at Farnborough, Hants. He asks for price lists, display cards, &c.

Catalogues and Lists.—Heavy Current Electric Accessories Co., Park Road, Edmonton, N.9.—A trade price list of "M.K." switch plugs and sockets, connectors, switches, &c.

Electrico, Ltd., 105, Old Christchurch Road, Bournemouth.—An illustrated booklet dealing with a variety of electrical devices, and a pamphlet advertising the "Ultra-Rapid" hand-driven drill and grinding machine.

Messrs. Phillips & Turner, 115, Edmund Street, Birmingham.—Illustrated lists of electric lighting fittings, &c.

British Electrical Repairs, Ltd., 2, Long Millgate, Manchester.—A booklet giving details of methods of repairing electrical machinery, with particulars of tests, and views of the firm's works.

The Electric Heating Co., 6, George Street, Croydon.—An illustrated card giving prices of electric fires; also an attached order card.

Engineering & Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts.—Two well-illustrated leaflets dealing with street lighting fittings, including brackets, lanterns, anti-vibration disks, &c.

Messrs. Thomas & Stinchcomb, Narrow Wine Street, Bristol.—A priced and illustrated pamphlet describing the "Canorus" "wireless" tuner.

Messrs. Lionel Robinson & Co., 3, Staple Inn, W.C.1.—An illustrated and priced leaflet dealing with double-range voltmeters for wireless equipments. Also a pamphlet illustrating several examples of Western Electric "B.A.G." diffusers for use with gasfilled lamps. Priced.

The Tangent Tool Engineering Co., Ltd., 40-41, Great Marlborough Street, W.1.—An illustrated sheet describing shearing tools, punches, &c.

Messrs. William Sanders & Co., Falcon Electrical Works, Wednesbury.—An illustrated and priced pamphlet dealing with "Presto" ironclad switch and fuse-gear.

Mr. E. Mitchell, 119, Beckside Road, Lidget Green, Bradford.—An illustrated price-sheet of hand-made ornamental switch plates of various designs.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, W.C.2.—An illustrated and priced booklet dealing with "Maxlume" reflectors and lanterns.

Local Exhibition.—The Lancashire Electric Power Co. is holding an exhibition of electric lighting and domestic appliances from September 18th to 23rd, inclusive, at Ramsbottom. There have been demonstrations of electric ironing, cleaning, washing, sewing, heating, and lighting.

Annual Outing.—On Saturday, September 9th, the works and office staff of Premier Electric Heaters, Ltd., Birmingham, held their annual outing. The party motored to Evesham in charabancs, where the day began with a full sports programme in a field on the Avon-side, and boating on the river followed. Various places of interest in the town and district were visited. In the afternoon tea was served in the Public Hall, and at the conclusion the sports prizes were distributed.

The German Electrical Industry.—A German official report states that the reserve manifested in the demand for electrical manufactures in July was accentuated to some extent in August, particularly owing to the scarcity of money. Many schemes for central stations have been abandoned. On the other hand, business was satisfactory in glow lamps, railway safety appliances, and telegraph and telephone apparatus.

Book Notices.—"The Electrical Contractors' Year-book, 1922-23." (314 pp.). London: The Electrical Contractors' Association (Incorp.). Price 2s. 6d.—Every year this handbook increases in size, and this edition shows an accession of forty pages. A classified trade directory is one new feature of the 1922-23 Year-book, and this takes up a great deal of the new space. Another noticeable point is the largely-increased number of branches and sub-branches, there being 41, as compared with 28 in the previous edition. Other additions are the working agreement between the N.F.E.A. and the N.A.S.E., and the overtime, night-shift, and country allowance agreement of February 24th, 1921, and the rules and objects of the Electrical Trades Benevolent Institution. The president's report shows an increase in membership of the E.C.A. of 75, making 743; of the N.E.C.T.A. of 20, making 593; and of the N.F.E.A. of 49, making 743.

"The Brown, Boveri Review," August, 1922. London: Brown, Boveri & Co., Ltd.—The principal article in this issue is upon "Properties of Transformer Oils and their Behaviour when Heated"—a chemical treatise. The remainder of the space deals with "1,500-volt Rotary Converters for Direct-current Railways" and "Economic Advantages of Power-Factor Compensation by means of Phase Advancers."

Journal of the Institution of Electrical Engineers. Vol. LX. No. 311. July, 1922. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The following papers are contained in this issue:—"Electric-Farming, or the Applications of Electricity to Agriculture," by Mr. R. Borlase Matthews; "Protective Apparatus for Turbo-Generators," by Mr. J. Kuyser; "The Provision of Power for Wireless Telegraphy," by Major J. H. Whittaker-Swinton; and the address to the Western Centre by the president, Mr. J. S. Highfield.

Scientific Paper No. 443 of the U.S. Bureau of Standards. "Measurement of the Color Temperature of the More Efficient Artificial Light Sources by the Method of Rotatory Dispersion." (14 pp.). Washington: Government Printing Office. Price 5 cents.—This paper contains data on the colour temperature of the gasfilled tungsten lamp and the carbon arc.

We have received from Mr. N. C. Woodfin, A.M.I.E.E., Cape Technical Institute, South Africa, two useful leaflets. One is a diagram of a typical shunt motor starting switch, and the other is a list of fractional parts of an inch expressed in decimals. Both are primarily intended for the use of students.

"The Universal Directory of Railway Officials for 1922." London: The Directory Publishing Co., Ltd. Price 20s. net.

"Standard Handbook for Electrical Engineers." Fifth Edition. London: McGraw-Hill Publishing Co., Ltd. Price 30s. net.

"Science Abstracts," A. & B.: Vol. XXV, Part 8; August 31st, 1922. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each net.

Trade with Belfast and Northern Ireland.—The following letter has been addressed by the President of the Belfast Chamber of Commerce to the principal chambers of commerce and railway companies in Great Britain:—

"Merchants in Belfast and district have recently received from manufacturers and merchants in various parts of Great Britain letters to the following effect: 'Owing to the unsettled state of Ireland we are now obliged to make the terms cash with order, &c.' They have also learned that officials of railway companies in Great Britain, on the pretext of 'the unsettled state of Ireland,' occasionally refuse to accept consignments of merchandise for Belfast and district. It is assumed that such action on the part of manufacturers and merchants and railway officials is due to ignorance of the actual state of things in Northern Ireland generally, and Belfast and district in particular. I, therefore, wish to point out that so far as Belfast and Northern Ireland are concerned, there is no valid excuse for the new impositions in the matter of terms, which unwarrantably reflect upon the credit of one of the thoroughly solvent parts of His Majesty's Empire, or for refusal on the part of carriers to accept consignments in the ordinary way. Business proceeds in Belfast and Northern Ireland as formerly, and the financial stability of the mercantile community remains intact; for instance, Belfast Corporation stock stands above par; Belfast fine trade bills can be negotiated at the minimum. The facts show that there is no greater risk in carrying merchandise from any part of Great Britain to Belfast and district than is experienced by the carrying companies in the daily conduct of their affairs in any part of Great Britain."

Christianity and Industry.—We are informed that a great deal of work has already been done in preparation for the Conference on Christian Politics, Economics, and Citizenship, which, with the official support of all the larger English churches, is to be held in the early part of 1924. The field of inquiry has been mapped out, and the results of the survey are now available in a series of questionnaires, purchasable for a few pence each from the secretary, Miss Lucy Gardner, 92, St. George's Square, S.W.1. These, and the replies to them, furnished by individuals and groups in all parts of the country, will be the basis of reports which will be placed in the hands of the delegates some time before the Conference meets. A preliminary meeting of those interested is to be held at the Queen's Hall on Thursday, October 26th, at 3 o'clock.

Cable Imports into Australia.—The British Trade Commissioner in Melbourne having reported that a number of cases have occurred in which insulated cable imported into Australia from British sources has been refused admission through non-compliance with the regulations of the Department of Customs, attention is drawn to the fact that the complete text of the regulations and tests governing the importation of rubber-covered wire and vulcanised rubber-insulated electric conductors may be seen at the Tariff Section of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.

Lantern Slides.—MESSRS. E. BENNIS & CO., LTD., of 28, Victoria Street, London, S.W., wish it to be known that they have a large number of lantern slides available for lecture purposes. They cover mechanical stokers, and coal and ash elevating and conveying plant, and a booklet giving the titles and a brief description of the slides will be sent on application.

The English Electric Works at Coventry to be Temporarily Closed.—Our Coventry correspondent reports:—"Considerable regret has been occasioned at Coventry by the decision of the directors of the English Electric Co. to temporarily close their extensive works in the city with staff and workpeople numbering about 800, notices having been issued terminating their engagement. The workpeople have been given four weeks' notice and the staff eight weeks, the reason given being the general condition of trade and the unsettled state of Europe. It is intimated that the works will be started up again as soon as an increased volume of business justifies this step, and meanwhile every effort will be made to absorb at the company's other works as many of the Coventry employés as work can be found for. The other works referred to are at Preston, Bradford, Stafford, and Rugby. The English Electric Co. took over the Ordnance Works about three years ago and proceeded to utilise them for electrical productions. The Mayor of Coventry (Ald. W. H. Grant), in view of the large amount of unemployment already existing in the city, at once decided to get into touch with the directors of the company with the view of modifying the decision if possible."

Callender's (Leigh) Hospital and Distress Fund.—Presiding at the 11th annual meeting of members of the "Anchor" Cable Works Hospital and Distress Fund, held in the works canteen at Leigh on Monday, Mr. J. Bowyer (works manager) congratulated the employés on the fact that after having granted relief in sick and necessitous cases to the amount of £384 during the past year, they had still a balance in hand of £511. The officials of the fund had done excellent work during troublesome times and deserved the thanks of all concerned. The annual grants to charitable institutions sanctioned by the meeting amounted to £91 14s. and included £20 to the local infirmary, 21 guineas to the Manchester infirmary, and £15 to the Leigh After-Care Committee for Consumptive Cases. The following officers were re-elected for the ensuing year. President: Mr. Thomas Petersen (Callender's, London); trustees: Mr. J. Bowyer, J.P., and Mr. C. Hulme; hon. treasurer: Mr. William Mort; auditors: Mr. T. Kearsley and Mr. E. Rigby; secretary: Mr. W. Hulme Jones.

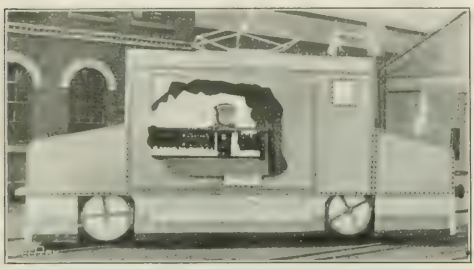
The Oversea Agency Problem.—The Federation of British Industries has on various occasions taken part in bringing about the formation of groups of non-competitive manufacturers to secure joint representation in foreign markets, on efficient and economical lines. The F.B.I. correspondent in Buenos Aires draws attention to the need for action of this nature in South America, where some of the largest British houses act also as agents for American goods to the detriment of British trade. Groups should be formed into limited liability companies, the capital being provided by the member firms interested. This would permit of the maintenance of a large and attractive showroom and an adequate staff. Efficiency of management, together with increased sales, should result in the payment of a satisfactory dividend on the capital employed. The goodwill which usually reverts to the agent would be retained, and such a scheme should be more economical to work than the present methods.

The correspondent points out that previous experiments in this direction have failed because there was an overlapping between the different firms, and because they did not cover a sufficiently wide field.

Economics for Trade Unionists.—The National Alliance of Employers and Employed has arranged a course of lectures in economics and industrial history for members of trade unions. Mr. J. Drummond Smith, M.A., has been appointed lecturer, and the first lecture will be given at the London School of Economics and Political Science on Wednesday, September 27th.

Trade Marks in Latvia.—Under the Latvian Trade Marks Law registration is an essential condition of the protection of a trade mark. Among the information required is the full style and address of the individual or firm. Except by special permission of the Minister of Finance, trade-mark inscriptions must be in Lettish. The initial cost of registration is, at present, 850 Latvian roubles. The British Consulate [illegible] is prepared to make applications for registration upon being provided with power of attorney.

Preston Guild Tableaux.—As briefly mentioned in our last issue, the English Electric Co., Ltd., had three cars in the recent Preston Guild procession. One bore operators carrying out processes in the manufacture of electric lamps; another was symbolical of the progress of light; and the



An "English Electric" Tableau at Preston.

third, which is seen in the accompanying illustration, was a model of an electric locomotive exhibiting the new English Electric camshaft control gear.

Applications for British Trade Marks.—Below is given a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Any firm desiring to enter an objection to any of the applications has one month in which to do so from the dates mentioned below. In the case of foreign firms, the address of the British representative to whom the objections must be sent is also given:—

Crown (design). No. 420,224. Class 8. Electric cables.—E. S. Co., Ltd., 233, Tottenham Court Road, London, W.1. September 13th, 1922.

Amplivox. No. 426,425. Class 8. Telephonic instruments.—The Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.1. September 13th, 1922.

Courtesy. No. 425,604. Class 8. Dimmer switches for use with electric light.—Marvulc Accessories Co., 43, Lamb's Conduit Street, London, W.C. September 13th, 1922.

Tex. No. 427,533. Class 8. Sparking plug testers.—John Hart, 12, Henrietta Street, London, W.C. September 13th, 1922.

Atea (lettering and design). No. 427,920. All goods in class 8.—The New Antwerp Telephone and Electrical Works, 22, Rue du Verger, Antwerp, Belgium (H. A. Gill & Co., 51-52, Chancery Lane, London, W.C.). September 13th, 1922.

Argental. No. 423,539. Class 13. Electric incandescent lamps (ordinary).—Naamlooze Venootschap Philips Gloelampenfabriek, Eindhoven, Holland (Boult, Wade & Tennant, 112, Hatton Garden, London, E.C.). September 13th, 1922.

Questa. No. 427,091. Class 13. Incandescent electric lamps (ordinary).—Francis H. J. Voak, 105-9, Oxford Street, London, W.C.2. September 6th, 1922.

Phonoelectric. No. 414,606. Class 5. Trolley wire.—Bridgeport Brass Co., 106, Crescent Avenue, Bridgeport, Conn., U.S.A. (White, Langner, Stevens & Parry, 88-89, Chancery Lane, London, W.C.). September 6th, 1922.

Mewco. No. 427,410. Class 5. All goods in Class 5.—Maidstone Electric Welding Co., Queen Anne Road, Maidstone. September 6th, 1922.

Rolac. No. 424,486. Class 6. Electric vacuum cleaners and electric washing machinery.—Société Calor, 200, Rue Boileau, Lyons, France (Herbert Haddan & Co., 31-2, Bedford Row, London, W.C.). September 6th, 1922.

AB. (lettering and design). No. 427,013. Class 6. Coal-cutting machines.—Anderson, Boyes & Co., Ltd., Flemington Electrical Works, Robberhall Street, Motherwell, N.B. September 6th, 1922.

Cecophone.—No. 427,617. Class 8. Appliances for wireless telephony.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. September 6th, 1922.

Vio Ray, Violet Ray High-frequency Electricity (lettering and design). No. 425,693. Class 11. Instruments, apparatus, and contrivances, not medicated, for use with, or in the production of high-frequency violet rays for surgical or curative purposes.—Vio-Ray Electric Co., Ltd., 114, Charing Cross Road, London, W.C. September 6th, 1922.

Elexitis. No. 425,359. Class 13. Electrical connecting and supporting devices, switches, &c.—Electric Outlet Co., 8, West 40th Street, New York, U.S.A. (Marks & Clerk, 57-8, Lincoln's Inn Fields, London, W.C.). September 6th, 1922.

Calphos. No. 425,917. Class 13. Electric lamps and accessories therefor.—The Calphos Electrical Co., Ltd., 66, Victoria Street, Westminster, S.W. September 6th, 1922.

AT (lettering and design). No. 425,959. Class 13. Electric lamps (ordinary) and accessories thereto.—Pope's Metaaldraadlampenfabriek, Venlo, Holland (Marks & Clerk, 57-8, Lincoln's Inn Fields, London, W.C.). September 6th, 1922.

FAP. No. 425,921. Class 13. Electric conduits and fittings.—Fitter & Poulton, St. John's Engineering Works, Weston Lane, Greet, Birmingham. September 6th, 1922.

Unemployment.—The Ministry of Labour returns for the week ended September 4th recorded a total of 1,328,000 unemployed persons—a decrease of about 3,400 on the previous week's total. Since the beginning of the year the total has been reduced by about half-a-million. There was also a decrease of 2,000 to 61,500 in the number of workers on "short time."

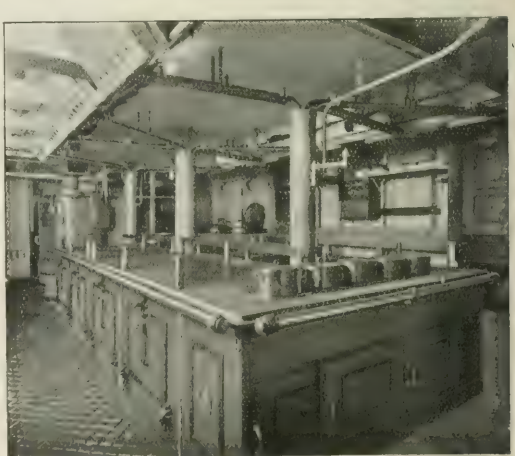
The highest number of unemployed persons occurred in June, 1921, when the total was 2,044,655.

Marking Goods for India.—The importance of marking clearly all British non-proprietary goods shipped to India is emphasised in a recent communication from the F.B.I. correspondent at Calcutta. In order that Indian stockholders may be able to assure their buyers that they are being offered articles imported from Britain, he suggests that the goods in question should be marked neatly and distinctly "Made in England," "Made in Sheffield," "London Make," or with some such appropriate phrase indicating their origin. Goods which are not so marked may be mistaken for those of Indian or Japanese manufacture.—F.B.I. *Bulletin.*

Australian Working Hours.—The Arbitration Court has dismissed claims put forward by the Timber Workers and Amalgamated Engineers for recognition of a 44-hour standard working week. The President of the Court said that industry could not be expected to bear the increased cost of production. The Court rejected a similar plaint in December last. That claim and the one now dismissed are regarded as test cases for all the unions of the Commonwealth.—*Reuter* (Melbourne).

Vulcanised Fibre Inquiry.—A Board of Trade Committee, under the chairmanship of Sir Bernard Mallet, made an inquiry on September 12th into a complaint made by the B.E.A.M.A. (on behalf of Messrs. Sutcliffe, Crumpsall, Manchester) that American vulcanised fibre was being sold in this country at a price below the British production cost. The Electrical Importers' & Traders' Association appeared against the complaint. Mr. Swan, for complainants, said the agreed selling price for foreign vulcanised fibre for mechanical and electrical purposes was 1s. 7d. per lb., but it was only necessary to state that the fibre was for export purposes to evade the agreement and sell it at a lower price. Major Entwistle, for the opposers, said that it was unprecedented for an Act of Parliament to be invoked for the benefit of one individual. Protection would give the complainant's firm an absolute monopoly. After the taking of further evidence the inquiry was concluded.

A Large Cooking Installation.—The White Star Co. has shown its faith in the efficacy of electric cooking by installing in its liner *Pittsburgh* what must be one of the largest electric



Carron Range on the "Pittsburgh."

cooking installations yet erected. This was supplied by Carron Company, and the central galley range is seen in the accompanying illustration.

Lamp Competition in Italy.—The directors of the S.A. l'Incandescence par le Gaz Auer en Italie, reporting on the past year, recall the fact that by arrangement with a Spanish firm the latter had installed a glow-lamp factory in the former's works in Milan, and had given the company the right of selling the production in Italy. But in this respect the company, owing to the absence of import duties, is subject to the keen competition of German and Austrian makers, which has forced down the sale prices of glow lamps in Italy to a level which yields no profits. It had been hoped that import duties would be established, but nothing in this direction has been done down to the present time.

Wages in the Tramway Industry.—A national delegate conference of the Transport & General Workers' Union was held on September 19th, and delegates reported the attitude of their branches towards the proposed abolition of the sliding scale, and the reduction of wages by 12s. a week, in three instalments. The branches had unanimously agreed that all necessary action should be taken to prevent the employers' proposals going forward.

The decision of the conference was placed before a meeting of the National Joint Industrial Council for the Tramways Industry on the following day (Wednesday).

Sunderland Town Council, on the recommendation of its Tramway Committee, last week decided to forthwith cease to recognise the National Joint Industrial Council for the Tramway Industry and to give notice of withdrawal. Ald. New (Chairman of the Committee) said he was not in favour of a sudden reduction of 12s. per week in wages, but the undertaking could not go on paying the scale now in force. Terms were best settled locally, and until they came to an agreement with the men they would continue to recognise the terms of the Industrial Council.

British Train Traders, Ltd.—A company has been registered under the above style with the object of running specially-designed train coaches and aircraft for the exhibition of samples of manufactured goods, after the fashion of the British Trade Ship. The scheme has many advantages, and may meet the needs of manufacturers and dealers better than the usual methods of displaying their wares. The company has issued a booklet describing its aims, and dealing more particularly with its initial project, the running of a train through Canada. The address of the company is Canada House, 42, Blackfriars Road, S.E.1.

New Burnley Kinema.—The new Grand Kinema Hall at Burnley was opened this week. The electric lighting has been carried out by Messrs. J. Walton & Sons, of Nelson. The Sturtevant Co. has installed a new type of vacuum cleaning plant.

American Purchases of German Bonds.—Some astonishment has been created lately in Berlin by the extraordinary rise in the bonds (debentures) of the A.E.G. It turns out that the advance in quotations was due to purchases made for American account, investors in the United States having a preference for just a few German industrial securities, of which the A.E.G. represents one.

Australian Import Duties.—The House of Representatives has agreed to certain Budget tariff amendments relating to wire netting and fencing wire, galvanised iron, and traction engines. The following addition has also been agreed to:—Alternating-current watt-hour meters: 35 per cent., preferential; 40 per cent., intermediate; 45 per cent., general.—*Reuter's Trade Service* (Melbourne).

Jugo-Slavia.—It is reported that the Société Italienne pour le Carbure has disposed of its shares in the Société des Forces Hydrauliques de la Dalmatie (Kerka) to an English syndicate which is understood to be representing a Jugo-Slav group. The change has probably been brought about by the fact that the works are located in that part of Dalmatie which, since the signing of the Peace treaty, has become Jugo-Slav territory.

For Sale.—By direction of the Disposal Board, offers are invited for part of the electrical generating plant at H.M. factory, Gretna. (See our advertisement pages to-day.)

LIGHTING AND POWER NOTES.

Ayr.—Price Reductions.—In view of a credit balance of £11,738 upon the past year's working of the electricity undertaking, the Town Council has reduced the charges for electricity to pre-war rates, plus 25 per cent.

Bishop's Castle.—Street Lighting.—The Town Council has accepted the tender of the Electric Light Co. at £100 for the lighting of the streets. The agreement is for three years.

Bradford.—Loans Sanctioned.—Formal sanction has been obtained from the Electricity Commissioners by the Corporation to the borrowing of the following amounts for electricity extensions:—Buttershaw electricity supply, £5,500 (on account) for mains; Wyke, £3,250 (on account) for mains; and £1,100 (on account) for transformer chamber, &c.

Lighting Economy.—It is reported that a saving of between £20,000 and £30,000 has been effected during the past summer by reduced street lighting. Before the war there was practically no distinction between winter and summer street lighting.

Bo'ness.—Future of Undertaking—The Town Council's agreement with the National Electric Construction Co. expires shortly, which makes it necessary to decide whether the town will carry on the electricity works as a municipal undertaking, or arrange with the company to take it over as a purely private concern. The company has already indicated that it is willing to take over the works, subject to suitable terms being arranged.

Burton-on-Trent.—Plant Extensions.—The Borough Council has received the sanction of the Electricity Commissioners to the installation of one 6,000-kW turbo-alternator and two 40,000-lb. boilers. Sanction has also been given to the borrowing of £104,111 for electricity purposes.

Price Reductions.—The Electricity Committee has recommended the following reductions in the charges for electricity:—Lighting: Flat rate from 7¾d. to 7d. per kWh. outside area; lighting, 7¼d. to 7d. per kWh.; electric picture palaces, 6d. to 5d. per kWh. Heating and cooking, 1½d to 1¼d per kWh. Power: A reduction of 16⅔ per cent., except to consumers with agreements. Tramways: 2d. per kWh as from the March, 1922, readings.

Canada.—Hydro-Electric Development.—The Hull Electric Co. has acquired the Paugan Falls of the Gatineau River, together with the necessary property adjacent thereto, for the purpose of hydro-electric development on a large scale. A dam will be constructed which will create a reservoir ten square miles in area. The ultimate development contemplated is 150,000 h.p., and the cost is estimated at ten million dollars. The falls are situate 35 miles from Ottawa, which is at present dependent upon the Chaudière Falls for the 50,000 h.p. of electric energy employed.—*Reuter's Trade Service* (Ottawa).

Cannock.—Application for Order.—The Urban District Council has decided to apply to the Electricity Commissioners for a Special Order under the Electricity (Supply) Acts, 1882 to 1922, for the purpose of extending the area of supply of the Council so as to include parts of the urban district of Brownhills, the whole of the Rugeley urban district, the whole of the parishes of Brereton, Hatherton, Huntington, and Cheslyn Hay, and parts of the parishes of Great Wyrley and Penkridge. At the same time the Rugeley Urban Council has decided to apply for an electric lighting Order, and the Cannock Council is to be informed of Rugeley's application.

Chatham.—Price Reductions.—The charges for electricity are being reduced by ¼d. per kWh for lighting and ¼d. per kWh for heating.

Clayton.—Projected Supply from Bradford.—Subject to necessary consent being obtained, and to the sanction of the Commissioners to the requisite borrowing powers, Bradford Electricity Committee has agreed to extend its electricity supply services to Clayton, but in view of the recent defeat of the City Extension Bill in Parliament, the Corporation is not prepared to make any definite statement at present as to the incorporation of Clayton, which was one of the few out-districts which desired to be absorbed.

Continental.—Belgium.—His Majesty's Consul at Liége reports that, according to information published in the local Press, the project for the distribution of electrical energy throughout the province of Liége has been referred back for further examination in view of the present financial state of the province, which shows a deficit of over 2,000,000 fr.

Dundalk. Raid on Station.—On September 14th a band of armed men broke into the power station, Chapel Lane, held up the staff, and compelled the engineers to cut off the lighting.

Horwich.—Proposed Electricity Supply.—Mr. Wood, Bolton's electrical engineer, attended a meeting of Horwich District Council with a scheme for the supply of electricity in the district. The Council is applying to the Electricity Commissioners for a Special Order authorising it to generate or purchase electricity in bulk and distribute it within the boundaries of the urban district.

Holmfirth.—Price Reduction.—The Urban District Council has decided to reduce the price of electricity for lighting purposes from 9d. to 8d. per kWh.

Kirkwall. Proposed Electricity Scheme.—An electricity scheme for the burgh is proposed, and the Town Council is to approach the Electricity Commissioners upon the subject.

Knaresborough.—Proposed Water-power Scheme.—The Council has in hand a scheme for generating electricity by the use of the water-power of a mill weir on the River Nidd.

Lampeter.—Permission to Supply Refused.—The Town Council has refused to give consent to the application of Mr William Jones for an electric lighting Order on the ground that he would have a monopoly of electricity supply in the borough.

Llandrindod Wells. Purchase or Electricity Undertaking.—It was reported at a recent meeting of the Urban District Council that the Electric Lighting Co. was willing to enter into a provisional agreement for the sale of its undertaking to the Council for the sum of £22,500, plus £ for the adjoining property. The Council's technical adviser (Mr. J. W. Bird) is preparing detailed particulars, with a view to ascertaining from the Electricity Commissioners the terms upon which the necessary loan would be granted.

London.—St. Pancras.—*Extensions.*—Subject to the consent of the Electricity Commissioners, the Borough Council is to make the following additions and extensions at the King's Road station: Two large boilers, £50,000; extension of boiler house, steelwork, &c., £10,000; switchgear, £3,000; and one 5,000-kW turbo-generator, including pipework, foundations, &c., £39,000; total estimated cost, £82,000.

Price Reductions.—The Electricity and Public Lighting Committee reports that, maintaining the present rates, the estimated profit for the current year would be £42,000. The Committee therefore recommends the following reductions in charges:—Power and heating, from 1½d. to 1d. per kWh; lighting (flat rate), from 6d. to 5d. per kWh; and street lighting, from 3d. to 2½d. per kwh. These reductions, it is anticipated, will reduce the year's profit to £18,000.

Mains Extensions.—The Committee recommends the installation of a new high-pressure cable and distributing mains at an estimated cost of £4,500.

Stoke Newington. *Price Reduction.*—The Electric Lighting Committee recommends a reduction of ½d. per kWh in the charges for electricity for lighting, heating, and power.

Purchase of Cookers.—The Committee proposes to purchase ten electric cookers at a cost of £12 6s. each, to be re-sold on a hire purchase system. It is also proposed to buy, at a cost of £130, a cooker suitable for providing for 90 persons. This will be installed at the premises of the Female Guardian Society, and the latter body will repay the cost at the rate of £25 per year for seven years.

Fulham.—*Loans Sanctioned.*—The Borough Council has received the sanction of the Electricity Commissioners to borrow the following amounts:—Mains and services (including £6,000 for unspecified extensions of mains), £15,896; and for transformers and switchgear, £4,252; total, £20,148.

Mains Extension.—£3,000 is being spent upon a cable from the Waterford Road sub-station to FitzGeorge Avenue, subject to the approval of the Electricity Commissioners.

Shoreditch.—*Price Reductions.*—The Lighting Committee has drawn up a schedule of reduced prices which it is proposed shall have effect as from the present month's meter readings. The following are the principal charges:—Lighting: Maximum demand rate, 7d per kWh for the first 1½ hours, 3½d. thereafter; flat rate, 6d. per kWh; theatres and music-halls, 5d.; outside lighting (signs and arc lamps), 4d.; factory lighting from 3.5d. to 5d. per kWh, according to consumption; electrical showrooms—energy for trade and testing purposes—4d. Heating: 1½d. per kWh. Cooking: 1½d. per kWh. Power: Maximum demand system, 20s. per quarter per electrical h.p., plus 1.25d. per kWh. (A special scale of discounts is also included in this portion of the schedule); maximum price, 10 per cent. load factor, 2.5d. per kWh, less than 10 per cent. load factor, 3d. per kWh.

Hire of Appliances.—A scale of quarterly charges has been fixed for the hiring-out of electrical appliances by the Borough Council. The charge for cookers ranges from 8s. 6d. per quarter for cookers valued at £10, to 32s. for those costing £40. Electric radiators will be charged for as follows:—1-kW, 2s. 6d.; 2-kW, 3s. 6d.; and 3-kW, 4s. The charge for electric kettles (3-pt. size) will be 2s. 6d., including maintenance, or 1s. not including maintenance.

Installation of Feeder.—The Borough Council is seeking sanction to expend the sum of £1,431 upon the laying of a feeder main to the works of the Aston Construction Co., Ltd.

Hammersmith.—*Year's Working.*—The accounts for the year ended March 31st last of the electricity undertaking record a total income of £182,717, as compared with £178,349 in the previous year. The expenditure upon revenue account amounted to £129,968, as against £143,494, leaving a gross profit of £52,808 (£34,855). Interest, sinking-fund charges, &c., absorbed £37,694 (£29,221), making the net result a profit of £15,114, considerably more than the preceding year's profit —£5,633. There was a slight decrease in the amount of energy sold—from 15,497,826 to 15,262,130 kWh, but the average price obtained per kWh rose from 2.64d. to 2.76d.

In his report, the engineer (Mr. G. C. Bell) said that the fuel consumption had been improved from 4.08 to 3.81 lb. per kWh generated; one boiler had been operating on powdered fuel. During the year £130,440 had been expended on capital account. Of this £65,000 was in connection with the two new 10,000-kW sets, and mains, services, and transformers cost about £65,000.

Mansfield.—Application for Order.—The Town Council has applied to the Electricity Commissioners for an Order authorising it to supply electricity in the urban districts of Sutton-in-Ashfield and Huthwaite.

Montrose.—Public Lighting.—The Town Council has accepted the offer of the North of Scotland Electric Light and Power Co., Ltd., of £875 per annum for a period of three years for the public lighting of the town.

North Wales.—Local Supply Agreement.—The draft agreement with the Bangor Corporation for the supply of electricity in bulk has been approved by the Menai Bridge Urban Council and confirmed. It was explained that the cable would be laid by the Bangor Corporation midway across the Suspension Bridge. The Menai Bridge Council would pay towards the capital charges and would also put up a transformer station in its own premises. The charge for each kWh in excess of 20,000 kWh would be 1½d. The guaranteed minimum demand was for 20,000 kWh. Roughly, the consumption at present was 16,000 or 17,000 kWh, but there was every reason to think that additional houses would be wired.

Cowlyd Dam.—On Wednesday the new Cowlyd Dam, which has been constructed by the Aluminium Corporation, Ltd. (in association with the North Wales Power Co., Ltd.), at a cost of over £200,000, was formally opened by Sir John Snell, in the presence of a large number of spectators interested in electrical matters throughout the North Wales and Chester Electricity District.

Northern Ireland.—The *Financial Times'* Belfast correspondent reports that a syndicate has been formed to carry out a hydro-electric scheme employing the Lower Bann River above Coleraine. It is calculated that an annual output of 30,000,000 kWh is obtainable, and it is hoped to supply not only the adjacent industrial towns of Coleraine, Ballymoney, Antrim, and Ballymena, but also to transmit a substantial surplus to Belfast, 35 miles away. A Bill is to be promoted for the purpose in the next session of the Northern Ireland Parliament, and it is stated that the necessary funds are already available.

Oldham.—Price Reductions.—The Electricity Department of the Town Council has reduced the price of energy for lighting and power purposes as follows, with effect from September 26th:—Cotton mill supplies: Increase of 20 per cent. to be discontinued; power (other than cotton mills), increase to be reduced from 75 per cent. to 55 per cent.; lighting, increase to be reduced by 10 per cent., making the increase over pre-war prices approximately 65 per cent. The flat-rate charge for lighting is to be 4½d. per unit. In the case of two-rate meters, the high rate is to be charged from 4 p.m. to 8 p.m., instead of from 6 p.m. to 10 p.m.

Portsmouth.—Pumping Plant Supply.—The Town Council is applying to the Electricity Commissioners for sanction to a loan of £10,000 for new main transmission lines from the generating station, in order to supply electricity for the pumping plant in connection with a new drainage scheme.

Rothesay.—Electricity Supply.—The Town Council is inquiring of the Rothesay Tramway Co. regarding a supply of electricity to the burgh.

Seaton.—Electricity Supply Scheme.—A committee has been formed for the purpose of carrying out an electric lighting scheme submitted by Mr. Royce, of Bristol. It is proposed to form a local company with a capital of about £8,000.

Staines.—Special Order.—The Electricity Commissioners have made a Special Order authorising the Egham and Staines Electricity Co., Ltd., to supply electricity in the parishes of Ashford, Stanwell, Wraysbury, and Thorpe.

Straits Settlements.—Penang.—The Municipality of Penang is negotiating for the construction of a large power station on the Prai wharves, from which Penang will be supplied by means of submarine cables. The station has been designed for an ultimate capacity of 135,000 h.p., and will be capable of dealing with the whole of Penang, Province Wellesley, and possibly parts of Kedah. There will be electric cranes, &c., at the Prai wharves, and the tramway system is being converted for railless electric cars.—*Reuter's Trade Service* (Singapore).

Stirling.—Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. W. R. Murray) record a revenue, during the year ended May 15th last, of £15,514, and working expenses of £10,138, leaving a gross profit of £5,376. To this was added a profit of £4 from the hiring of motors. Capital charges absorbed £3,685, and the net profit, transferred to reserve, was £1,695. The energy sold was 685,291 kWh, as compared with 683,903 kWh in the previous year.

Sunderland.—Extensions.—The Town Council has adopted the following proposals of the Electricity Committee:—The provision of additional switchgear at Dunning Street sub-station, estimated cost, £627; the erection of an open-type sub-station at Hendon Dock, with necessary mains equipment, £2,301; the extension of mains in certain streets, £2,164; and repairs to the roof of Hylton Road works, £1,094.

Walsall.—Extension of Supply.—The Town Council is applying to the Electricity Commissioners for a Special Order authorising it to supply electricity within various adjoining areas, and also for sanction to borrow £2,000 for mains and switchgear.

Western Highlands.—The Lochaber Scheme Delayed.—The British Aluminium Co. is to delay proceeding with the Lochaber hydro-electrical scheme until costs are reduced. The company's Act allows it five years in which to make a commencement of the work.

Wickford.—Electricity Supply.—The Wickford and District Supply Co., Ltd., has applied to the Electricity Commissioners for consent to establish a generating station on the Beeches estate.

Yeovil.—Extension of Time Approved.—The Town Council has approved of a final extension of six months being granted to Petters, Ltd., for carrying out the works under its electric lighting Order.

TRAMWAY AND RAILWAY NOTES.

Canada.—Montreal Harbour Railway Electrification.—Electrification of the Harbour railway terminals, with a total length of 58 miles, is proceeding, and it is expected that by the end of September 42 miles will have been electrified. The remaining 16 miles will probably be completed next season, according to a statement issued by Mr. M. P. Fennell, manager of the Montreal Harbour Commission. Electric locomotives of a type especially suited for harbour work will be purchased by the Commission.—*Reuter's Trade Service* (Montreal).

Chile.—Railway Electrification.—The Chilean Government's policy is to electrify the whole of the broad-gauge railways under its control—over 3,000 miles. It has been considered that the 3,000-V d.c. system is most suitable, having regard to the conditions, and practically the whole of the necessary power will be derived from hydro-electric resources. The contract for the first part of the scheme—the electrifying of the Valparaiso-Chile lines, a distance of 116 miles—went to America, the British tenders having been considerably undercut. Apart from the State railways there is about 1,500 miles of privately-owned track, and the electrification of much of this is being considered.

Dundee.—New Trolley Device.—The Corporation Tramways Committee recently witnessed a demonstration of a new safety device invented by a young Leith mechanic for the preventing of trolley heads from falling off. The device is simple in design and the cost is comparatively small. The inventor was congratulated and a recommendation will be made to have the new apparatus installed on all the department's cars.

Falkirk.—Projected Improvements—Representations as to the unsatisfactory condition of the track between Falkirk and Laurieston having been made to the Falkirk and District Tramways Co. by the Eastern District Committee of the Stirling C.C., the company has intimated that three schemes are under consideration, *viz.*, the renewal of the track with concrete foundations, at an estimated cost of £14,000-£16,000; the relaying of the line on sleepers; or the abandonment of the tramway, substituting therefor a railless vehicle service. The committee decided to send a deputation to interview the company, and a report is to be presented at the next meeting.

Glasgow.—Proposed Extensions.—The extension of the tramways from Clarence Drive to Great Western Road, and the introduction of a railless trolley car service from Clarkston to Eaglesham, are proposals under consideration by the Corporation.

L. & N.W. Railway.—Electrification.—A new cable is being laid along the eastern side of the Liverpool, Waterloo and Southport line of the L. & N.W. Railway. It is understood to be the intention of the management to add to the high-pressure power, and thus enable it to lengthen the trains, which rarely exceed five coaches. By adding one or two more coaches to each train during the business hours much congestion and strap-hanging will be avoided.

Leicester.—Year's Working.—The report on the working of the tramway undertaking for the past year shows a deficit of £20,000.

London.—Late "Underground" Trains.—In reply to questions raised in certain daily papers the "Underground companies have issued a statement showing that the last trains from busy traffic centres leave at about 12.30 a.m. Later trains have been tried, but the traffic was so small as to preclude their continuance. The first trains commence running as early as 4.45 a.m., and as the last train does not cease running until 1.14 a.m., only 3¼ hours is available in which to carry out inspection and overhauling.

City and South London Railway.—A two-minute service is now being operated during the "rush hours" on the line between Clapham Common and Moorgate.

Newcastle-on-Tyne.—New Route.—A scheme is in hand for laying a double tramway track across the High Level bridge, which will connect up Newcastle with Gateshead. The scheme will necessitate considerable reconstruction of the bridge, the estimated total cost being £22,000, of which the Corporation will bear six-elevenths. The North-Eastern Railway Co. is to carry out the work, and will receive ½d. per passenger from the receipts. This connecting link will give a direct tramway route of six miles from Gosforth Park to Low Fell.

South Shields.—New Route.—With the object of providing work for the unemployed the Tramways Committee has submitted a scheme to the Unemployed Grants Committee for laying down a track so as to make a connecting route from the pier head to Westoe *via* the sea front.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—The cable from Ballinskelligs, Ireland, to Harbour Grace (Newfoundland) and Halifax was taken over recently by the Imperial Cable from the Western Union Cable Co. The British Government purchased the cable in November, 1920, for £750,000, but it had remained under Western Union control by lease. The cable taken over was laid in 1874, and was the first transatlantic cable to use the Muirhead duplex system. Its first Nova Scotia landing place was at Torbay, Guysboro' county, but it was moved to Halifax in 1887.—*Electrical News.*

Brazil.—Telephone Rates.—At last the Brazilian Traction Co. has obtained a revision of the concession regulating the telephone service of the City of Rio de Janeiro, in which it is largely interested. The old contract was apparently quite inapplicable to present-day conditions, especially having regard to currency depreciation. A new contract has been signed, under which rates will vary with the exchange, and other onerous conditions are eliminated. The new rates, it is stated, are calculated to afford an adequate return to present and future capital investments, and are subject to revision every five years. Brazil Traction shares have been much in favour of late, and from the lowest of 31 touched at one time this year the price has risen to 53.—*Evening News.*

Cuba.—Wireless Telephony.—An increasing interest is being taken in Cuba in radio-telegraphy and telephony, with the result that considerable orders for apparatus are being placed. It is intended to install a broadcasting station powerful enough to be heard in every town in the Oriente Province. Hitherto, little but amateur work had been employed in connection with the receiving stations in use, the necessary parts having been obtained from abroad and assembled on the spot. Lately, owing to the increased demand for apparatus and accessories, local stocks have been considerably depleted. The proximity of Cuba to the broadcasting facilities afforded by the United States has increased the possibilities for developing a market there for other radio sets.—*Reuter's Trade Service.*

Germany.—Increased Tariffs.—The Reichsrat has approved the new postal tariff by which the postal, telegraph, and telephone fees will be considerably raised. In spite of the large increases, the Minister of Posts declares that there will be a deficiency of from fifteen to twenty milliard marks in the budget for posts and telegraphs. The Reichstag has still to give its approval to the proposed increases.—*Reuter* (Berlin).

Holland.—Illegal Wireless Transmission.—A member of a Dutch banking firm is being proceeded against for sending wireless code messages to London with reference to Stock Exchange transactions. These messages were principally concerned with oil shares. Although the firm had three receiving stations for wireless messages it had been unable to obtain permission from the Dutch Government for the sending of wireless messages to London. The defendant is alleged, therefore, to have bribed a young wireless operator in the Dutch army to send the messages, thus infringing the law. This operator will be court-martialled.—*Daily Mail.*

Ireland.—Postal Strike.—The strike of the Post Office workers in the South of Ireland has resulted in almost a complete paralysis of business. The Belfast telegraphists recently addressed a most indignant protest to the Union of Post Office Workers against having Press and private messages from the South of Ireland sent to England and elsewhere *via* Belfast. The Post Office authorities have replied to the Union that the matter complained of will have consideration. The strike is generally confined to postal workers, the telegraphists not being affected, but in some parts they have been interfered with.

Jersey.—Purchase of Telephone System.—The Jersey States have decided to accept the offer of the postal authorities to sell the telephone system, they agreeing to pay £32,032 and take over all liabilities.—*The Times.*

New Zealand.—Proposed Wireless Station.—Mr. J. G. Coates (the Postmaster General) has informed Parliament that the Government is considering the establishment of a high-power wireless station. It has not yet been decided whether New Zealand will have a system directly communicating with Great Britain or whether it will form a link in the Empire wireless chain.—*Reuter* (Wellington).

Norway.—Wireless Telephony.—Mr. Engset, director of the State Telegraph Administration at Christiania, is reported to have stated that the Norwegian Government has reserved the right to utilise both wireless telephony and telegraphy in that country. A year ago the Marconi Co. carried out wireless telephone experiments between the West of Norway and England, which were satisfactory, and similar trials were recently made by the telegraph administration between Kristianssund and Grip. It is proposed to erect a new wireless station at Trondheim of similar capacity to that at Fredemanden, and also to equip it for telephony. It will be necessary to reconstruct for the same purpose at Fredemanden.

manden and at all the coastal stations, as, for instance, those at Flekkero, Tjomo and Utsire. Mr. Hermod Petersen, one of the State engineers, has been dispatched to England further to investigate the problem in the light of the experience already gained there.

River Plate.—Underground Cables—It is reported from Bahia Blanca that the United River Plate Telephone Co., with the object of improving the service there, intends to replace the overhead wires by underground cables, and that it has already received 58,000 kilos. of cable for this purpose.—*Review of the River Plate.*

Russia.—Wireless Telegraphy. A Moscow message says that the Central Radio Telephone Station at Moscow has succeeded in communicating quite distinctly with Obdorsk, a town in the Arctic region of Western Siberia, a distance of over 1,250 miles.—*Central News* (Copenhagen).

The Telephone Service.—New Exchange.—A new exchange was opened on September 16th at Inverness. A central-battery switchboard with the necessary auxiliary equipment has been installed at the post office in Queensgate to take the place of the magneto equipment at the present exchange in Union Street, which has served the town for about 20 years, and is now inadequate for the growing telephonic requirements of Inverness and district. The new exchange is fitted for the accommodation of 780 subscribers' lines, as compared with 450 lines at the present exchange, and is constructed so that its capacity may be readily increased up to 1,500 lines. The post office building has been enlarged to accommodate the equipment.—*Financial Times.*

Uruguay.—Wireless Telegraphy.—It is announced that a decree will shortly be issued regulating the installation of radiotelegraphic and radiotelephonic stations in Uruguay. Such stations, it is stated, will be permitted anywhere except at points where State stations exist, provided that they are not within 50 kilometres of the sea coast or of the Argentine and Brazilian frontiers, and that they are not installed in important cities or towns.—*Review of the River Plate.*

Wireless Telephony.—Weather Forecasts.—An interesting announcement concerning the distribution of weather forecasts was made by Dr. G. C. Simpson, the director of the Meterological Office, at a meeting of the Mathematical and Physical Science Section of the British Association at Hull. It was stated that the present distribution by wireless telegraphy was made in the Morse code, and one speaker suggested that he was too old to begin to learn Morse. He asked why information could not be sent out by wireless telephony. Dr. Simpson said a scheme of this nature had already been prepared with details worked out for distributing the "general inference" by wireless telephone as soon as there was an organised scheme for broadcasting in this country. When such broadcasting was authorised the Meteorological Office would be able at once to issue forecasts in this way.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—October 23rd. Minister of Public Works. Two water-turbines and generators in connection with the Barren Jack hydro-electric development (September 8th.)

Adelaide, South Australia.—December 5th. Adelaide Electric Supply Co., Ltd. 380 electric motors.

Melbourne.—January 31st. Victorian Electricity Commissioners. Back pressure steam turbine, including one 1,500-kW turbo-alternator (Spec. 308), four water-tube boilers and accessories (Spec. 317). (See this issue.)

Belfast. — September 26th. Tramways Committee. Tramway stores, including electrical accessories, cable, lamps, &c., for five months. (September 8th.)

Belgium.—October 12th. The municipal authorities of Quaedmechelen (Province of Limburg). Concession for the establishment of a system of electricity distribution in the town.

Brazil.—Cachoeira, Rio Grande do Sul.—October 24th. Municipal Council. Six centrifugal pumps, with electric motors, piping, &c.*

Cardiff.—September 26th. Glamorgan Education Committee. Installing electric light in County schools. Secretary, Education Committee, County Hall, Cardiff.

Ebbw Vale.—September 27th. Electricity Department. Three 300-kW rotary converters, transformers, switchgear, &c.; 1,250 yd. 500-V, d.c., .5 x .2 x .5 cable. (September 15th.)

Egypt.—Cairo.—September 30th. Electric pump, accumulator plates, and a 3-phase transformer, for the Asite des Aliénés, Khanka. Engineer-Electrician-in-Chief, Electrical Service, Ministry of Public Works, Cairo.

November 15th. Installation work in connection with a power station and distribution system at Manfalout. Director of Technical Service, Section of Municipalities and Local Commissions, Savoy House, Cairo.—*Reuter's Trade Service* (Cairo).

Hawarden.—October 4th. Board of Guardians. Supply and erection of an electric generating set, and also for wiring for electric lighting the Institution at Broughton. (See this issue.)

Loughborough.—September 29th. Electricity Department. Rotary converter plant; sub-station switchgear. (September 15th.)

New Zealand.—Auckland.—February 1st, 1923. Harbour Board. One 1-ton fixed electric crane.*

Invercargill.—December 15th. Southland Electric Power Board. Turbines and valves, generators, exciters, and battery equipment, steel penstocks and valves, switchboards, switchgear and cables, for the Monswai hydro-electric development scheme. Mr. W. Hinchey, chairman, Southland Electric Power Board, P.O. Box 121, Invercargill, N.Z.

Wellington.—November 21st. Public Works Department. Mangahao scheme. Electrical storage battery and accessories, including a motor-booster and one single-phase testing transformer.*

November 28th. Outdoor and indoor sub-station switchgear in connection with the Mangahao power scheme.*

Reigate.—September 26th. Town Council. H.p. switchgear. (September 15th.)

Southport.—September 25th. Relaying about 1,800 yards of single tramway track with new rails. A. E. Jackson, M.I.C.E., borough engineer and surveyor, Town Hall.

Uruguay.—Monte Video.—November 11th. State Electricity Department. One 10,000-kW turbo-generator. State Electricity Department, Calle Julio Herrera, 1458, Monte Video.*

October 3rd. 10,000 metres 3 mm² rubber insulated cable.

October 4th. 80,000 metres 10 mm², 30,000 metres 20 mm², 25,000 metres 25 mm² paper-insulated cable.*

October 6th. 15,000 metres 2 x .75 mm² rubber-insulated cords for interior use.*

October 9th. 18,600 metres v.i.r. lead-covered cable, various sizes.*

October 31st. Switchgear for 15 transformer sub-stations.*

November 21st. 15,000 metres 3 x 32 mm², 36,000 metres 3 x 64 mm², 15,000 metres 3 x 80 mm², 3-ph., h.p. cable; 450 junction boxes; 350 vertical end boxes.*

Warrington. — September 26th. Board of Guardians. Electrical supplies for three months for Whitecross Institution and Cottage Homes, Padgate. Mr. A. Bottomley, clerk to Guardians, Bewsey Chambers, Warrington.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Orange, N.S.W.—Municipal Council. Accepted: Two 250-kW B.T.H. generators and condensing plant by Zollner, Ltd. (£7,146). Australian General Electric Co., Ltd.—*Tenders.*

Bradford.—Tramways Committee.

20 tons Peckham hand-brake shoes (£190), and 20 tons track-brake blocks (£200).—W. H. Booth.

Electricity Committee.

Steelwork for sub-station in Sunbridge Road.—Hy. Barrett & Sons, Ltd; A. Robinson.

Holmfirth.—Urban District Council. Accepted:—

Alterations to plant in connection with the electricity scheme.—Johnson and Phillips, Ltd.

London.—St. Pancras.—Electricity and Public Lighting Committee. Recommended:—

1,000 tons Bentinck nutty slack (21s. 5d. per ton); 1,000 tons Pinxton low main nutty slack (21s. 5d. per ton); 500 tons Pinxton ½-in. nutty slack (18s. 5d. per ton).—J. H. Beattie & Co., Ltd.

Highways, Sewers, and Public Works Committee. Recommended:—

Supply of two electric motor vehicles.

Two 3-ton electric vehicles (£825 each).—Clayton Wagons, Ltd.

Two 3½ ton ditto (£875 each). Richd. Garrett & Sons, Ltd. (recommended).

Two 3½-ton ditto (£890 each). General Vehicle Co., Ltd.

Two 3-ton Orwell ditto (£865 each, plus extras); or two 3½-ton ditto, plus extras (£895 each).—Mossay & Co., Ltd.

Two 3½-4-ton Newton Derby Electrics (£1,156 each).

Mansfield.—Town Council. Accepted:—

Induced-draught fan and economiser.—Babcock & Wilcox, Ltd.

Portsmouth. Town Council. Accepted:—
Iron electrically-driven vans for scavenging purposes (£1,500 each). Frodsham's, Ltd.

Salford.—Town Council. Accepted contracts in connection with the Agecroft generating station :—
Steelwork for turbine and boiler-houses, &c. (£37,596). F. Wood & Co., Ltd.
Excavations, concrete and brickwork (£73,632). Sir R. McAlpine & Sons.
Cranes, &c. Marshall, Fleming & Co., Ltd.

Sunderland.—Town Council. Accepted:—
Reconstruction of two feeder cubicles.—Met.-Vickers Electrical Co., Ltd.
Two truck-type cubicles.—General Electric Co., Ltd.
E.h.p. switchgear.—Schull & Cullinan and Brush Electrl. Eng. Co., Ltd.
Cast-iron feeder-pillars.—W. T. Henley's Teleg. Works Co., Ltd.
Two recording voltmeters.—Cambridge & Paul Instrument Co., Ltd.
E.h.p. three-phase meter-testing equipment.—Met.-Vickers Electrl. Co., Ltd.
Fifty service boxes.—Callender's Cable & Constn. Co., Ltd.
1,000 yd. single-way earthenware ducts.—Albion Clay Co., Ltd.
6,000 yd. creosoted redwood capping.—Armstrong, Addison & Co.
Parts for air pump.—A.E.G., Berlin.
Tires for electric vehicles.—Dunlop Rubber Co., Ltd.
3 cwt. insulating tape.—India-Rubber, Gutta-Percha & Tele. Works Co., Ltd.

West Indies.—Messrs. Chiswell & Co., of Kingsway, London, have recently placed an order for a new power station roof with Messrs. John Lysaght, Ltd.; and one for a 15-ton crane with Messrs. Herbert Morris, Ltd.

York.—Electricity Committee.
1,000-kW rotary converter, transformer, and switchboard (£4,278). British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Institute of Cost and Works Accountants (London and District Branch).—Wednesday, September 27th. At the Institute of Chartered Accountants, Staple Inn Buildings, W.C. At 7 p.m. Address on "Collection of Data for Ascertaining Overhead Expenses," by Mr. R. Stelling.

Society of Engineers.—Friday, September 29th. At the Engineers' Club, London, W.C. At 3 p.m. Conference of members of engineering societies.

All-British Wireless Exhibition.—September 30th to October 7th. At the Horticultural Hall, Westminster, S.W.

NOTES.

E.S.C.A. Concert.—The third Bohemian concert of the Electricity Supply Commercial Association will take place on Friday evening, October 6th, at 7.45 p.m. Mr. D. C. Clark, of the London Divisional Council, will take the chair, and an excellent programme has been arranged. Tickets (2s. 4d. each) can be obtained from members of the E.S.C.A., or from Mr. G. S. Watts, 121, Little Ealing Lane, Ealing, W.5.

Birmingham and District Electric Club.—The opening meeting of the winter session of this club was held on Saturday last, when Mr. Chris. Jones, M.I.E.E., delivered a lecture on "Coal-getting by Electricity." The lecturer gave a detailed description of the electrical plant installed in a modern colliery, and explained at some length the methods of installation, maintenance, and inspection of the plant so as to ensure safety, economy, and compliance with the Home Office Rules relating to the use of electricity in mines. Evidence was given that the installation of modern electrical methods had very materially increased the output of coal per man. The lecture was fully illustrated by lantern slides, diagrams and drawings.

Fatality.—At the power station, Seaview Road, Wallasey, a man named Davis, employed by the Metropolitan-Vickers Electrical Co., Manchester, and engaged on contract work for the Wallasey Corporation, was recently killed. The deceased was engaged in screwing nuts on a steel plate when he made an accidental contact with the switchboard, which resulted in a fatal shock.

Electrically-propelled Ships.—In the course of his presidential address to the Institute of Marine Engineers (Inc.) on September 12th, Engineer Vice-Admiral Sir Geo. G. Goodwin, K.C.B., L.L.D., remarks that of the methods of effecting the reduction between the high-speed turbine and the slow-running propeller, in America, and to a small extent in this country, electrical gearing has been favoured. It has some advantages over mechanical gearing, but it has also some disadvantages, especially at what may be termed the design stages. As far as he has been associated with such proposals they appear to be expensive in first cost and to require greater weight and space than in some cases can be allowed. Considerable economy in fuel has been claimed for this form of transmission, especially at low speed, and although there is no reason to doubt the accuracy of figures that have been published, care should be taken in making a comparison to ensure that the conditions and attendant circumstances are similar. Diesel engines with electric transmission are also attracting considerable attention on account of the low fuel costs involved and such systems offer some most interesting problems to the engineer. Many minds are working to overcome the disadvantages of electrical transmission referred to, and it is very probable that it will become one of the important problems of the future. The advice of the marine engineer will take a prominent part in [illegible] the cost, and should this system be extensively adopted, then [illegible] engineers, or some section of them, will require [illegible] tions to their knowledge in order to enable them to [illegible] charge efficiently of the additions to the boilers and engines of their ships. Probably those qualified as marine engineers under Government regulations, and holding certificates of competency to take charge of machinery at sea, would require a special endorsement to cover the transmission machinery of this type.

Fire.—During a recent outbreak of fire in the cabin of the 100-ton electric crane at the fitting-out basin of Messrs. Scott's dockyard, Greenock, the switchboard was damaged.

Appointments Vacant.—Two assistant mains engineers (£5), for the Dublin Corporation electricity department. (See our advertisement pages to-day.)

The Tramway Dispute.—As we go to press we learn that the Joint Industrial Council which met on Wednesday failed to find a solution to the difficulty, and unanimously resolved to invite the assistance of the Ministry of Labour. Sir David Shackleton received the representatives of each party separately, and the conference was afterwards resumed, sitting until 7 p.m. On Thursday the employés' delegates were to meet and consider the report of Wednesday's proceedings, after which the Council was to meet again for further debate.

Wireless Telegraphy in Mines.—The Baggeridge Colliery in South Staffordshire, was recently the scene of some exceedingly interesting experiments, undertaken by a party of Birmingham wireless amateurs, with a view to demonstrating that wireless might be made a means of communication in the mine. Their efforts proved that not only is this practicable, but it is possessed of distinct advantages over the present methods, and would be especially valuable as a means of communication with entombed men in the event of a disaster.

The experiments were carried out with the co-operation of the chief electrical engineer of the pit-head staff, and a special permit for the underground transmissions was obtained from the Postmaster-General.

Apparatus similar to that in common use among amateurs was used. The receiving set, which was installed at the pit-head, was an ordinary three-valve circuit embodying reaction, and the aerial was made by suspending copper wire from a point on the steel hoisting gear, 100 ft. above the shaft, and attaching it to an adjacent railway bridge. The earth was a connection to one of the rails in the permanent way.

On this temporary arrangement the experimenters had the satisfaction of hearing the station at Bordeaux before the tests proper were commenced.

The transmitting gear was a portable valve set operated with a plate voltage of 180 V, and this was first installed in the cage. Here the "aerial" was made by winding wire in lattice-fashion across the roof, care being taken to insulate it well from the steel framework. For the earth connection a wire was laid across the steel floor, where one of the experimenters stood on it as a means of keeping it fixed.

Transmission was commenced while the cage slowly descended. It should be pointed out here, by the way, that this particular shaft is 700 yards deep, one of the deepest in the country. Curiously enough signals grew louder as the cage descended. This was due, undoubtedly, to the screening effect of steel structural work which had been built into the shaft for several hundred feet down. When the cage was at a point some 300 yards down, and well past the steel girders, signals reached their maximum strength, and attained a fine clear note, which was easily readable. This was maintained until the cage approached the bottom, where there was more structural steelwork. Here signals commenced rapidly to fade away and became almost inaudible when the cage touched bottom. Accordingly the set was taken out and set up alongside and the aerial improved by slinging it between pit-props. This, however, made but little difference, and the whole of the gear was taken along the workings for several hundred yards. The distance, measured through solid earth, was nearly three-quarters of a mile.

A more substantial aerial was made by laying 90 ft. of cable along the floor. The first transmission from this new position was received clearly above, and telephony was then tried. The carrier wave was heard very loudly and of uniform strength, but articulation was indistinct, only one or two words being distinguished. Variations in coupling were tried, but with little success, and it was manifest that for the time being, at any rate, Morse was more reliable than telephony.

A phenomenon noticeable throughout the whole of the transmissions underground was the extensive leakage of the high-pressure current into the air around. It has been suggested that this was due to the presence of heavy carbonic elements in the air of the mine, which might have a very appreciable absorbing effect upon the liberated electrical energy. Notwithstanding this the experiments were of a very successful nature, and prove that an interesting field for research awaits the radio-scientist and the mining engineer. The day may come when wireless sets will be as common in mines as they are on ships, performing service just as useful, particularly when disaster befalls those who work far below the surface of the earth.

Educational.—Whitworth Scholarships.—Among the successful candidates in the recent Board of Education competition for Whitworth Scholarships and Exhibitions were the following dockyard electrical fitter apprentices: John H. Shuttleworth (Portsmouth), William E. C. Lampert (Devonport), Horace G. Beer (Devonport), and Sydney W. Harman (Portsmouth). The first named secured a scholarship and the others took exhibitions. The full number of exhibitions could not be awarded as the number of competitors was not great enough.

Bradford Municipal Technical College.—The new session offers specially attractive courses in the Electrical Engineering Department by specialists in the construction, operation and principles of design of electrical machinery, &c., in the production and transmission of energy, and also in radio engineering. The civil engineering department has been re-organised and extra facilities provided.

Northampton Polytechnic Institute.—We have received a copy of the Institute's "Announcements" for the session 1922-23, containing a great amount of matter relating to the numerous courses, social activities, &c., of the Institute. The evening courses commence during next week, continuing into May, 1923. The day courses commence on October 2nd.

INSTITUTION NOTES.

Electrical Power Engineers' Association. — Southern Division.—A lecture on "Boiler Efficiency under Test and Working Conditions" will be given by Mr. D. Wilson, of Messrs. Babcock & Wilcox, at the Institution of Electrical Engineers, Victoria Embankment, W.C., on Friday, October 6th, at 7 p.m.

Chief Technical Assistants' Association.—The following is the programme of the meetings to be held during the coming winter:—

October 5th. Discussion on "Electric Vehicles," to be opened by Mr. J. D. Spark.
November 2nd. Discussion on "Inter-running of Generating Stations," opened by Messrs. Chalmers and Mears.
December 7th. Discussion on "Mercury Rectifiers," opened by Mr. H. F. J. Thompson.
1923.
January 4th. Discussion on "A Mains Problem," opened by Mr. F. R. Ingram.
February 1st. Discussion on "The Chlorination of Circulating Water, with Special Reference to the Cleaning of Condenser Tubes and Maintenance of High Vacuum," to be opened by Mr. J. R. J. Bowden.
March 1st. Annual general meeting.

OUR PERSONAL COLUMN

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. Bertram G. Kelly, A.M.I.E.E., has been appointed the first manager and engineer of the Electricity Department of Douglas Corporation.

The Times reports that Mr. William Henry Brown, secretary of the Metropolitan Railway Co., has just completed 50 years' service with the company. He was appointed as secretary in 1908.

On September 13th, at the Royal Victoria Station Hotel, Sheffield, the members of the Sheffield and District Section of the E.P.E.A. presented Mr. Howard Price with a silver tea tray in recognition of his excellent services as honorary secretary to the Section for two years. Mrs. Price was given a hand satchel.

Mr. J. Lally has retired from the Post Office Engineering Department, Leeds, after serving the department, and previously the late Telegraph Company, from 1880. His special work was on the outside portion of the telephone plant, and he laid the first paper-insulated cable in Leeds. Most of the present line plant was constructed under his supervision.

On the occasion of his marriage Mr. S. Simpson, electrical engineer, of Bradford, has been presented with an inlaid mahogany clock by the employés of Messrs. Mark, Shaw and Sons, Ltd., of the Milnsbridge Iron Works, the firm with which he is associated.

The marriage took place at Christ Church, Brondesbury, on September 16th, of Mr Harry A. Moncrieff and Miss Kathleen J. Bramall. Mr. Moncrieff has been on the staff of the County of London Electric Supply Co. since leaving Dulwich College some 15 years ago. He was presented by the Head Office staff of the company with a set of glassware, and by the local offices with an oxydised oval mirror.

Mr. J. Cauthery informs us that he has resigned his position as chief engineer of the Spearing Boiler Co., Ltd., London.

Obituary. Mr. L. H. Walter, M.A.—We deeply regret to announce the death of Mr. Louis Heathcote Walter, M.A., a member of the staff of the Institution of Electrical Engineers, who had been editor of *Science Abstracts* since 1903.

NEW COMPANIES REGISTERED.

Ros Taylor, Ltd. (184,351).—Private company. Registered 1 September 13th. Capital, £2,000 in £1 shares (1,000 10 per cent. preference). To acquire the sole rights, privileges, and patents of an electrical incubator and brooder, the invention of Rosetta Taylor, and to carry on the business of poultry farmers and chicken rearers, manufacturers and sellers of the Ros Taylor patent electrical incubator and brooder, and all kinds of poultry houses, appliances and utensils, &c. The first directors are: Col. A. Borland, 46, Manor Road, Bexhill; F. R. J. Bell, 7, Queen's Gate, S.W.1; Miss Rosetta Taylor, 114, Heythorpe Street, Southfields, S.W.18; W. C. Bartlett, 7, Chantry Road, Brixton, S.W. Qualification: 1 share. Remuneration: £250 per annum, divided between them. Secretary: W. C. Bartlett. Registered office: 41, Lower Belgrave Street, Victoria, S.W.

National Engineering Supply Co., Ltd. (184,349).—Private company. Registered September 13th. Capital, £10,000 in £1 shares. To acquire the business of electrical, mechanical and general engineers and engineering supply store proprietors, &c., carried on at 1, West Bute Street, Cardiff, and elsewhere, as "The National Engineering Supply Co." The subscribers (each with one share) are: F. C. Phillips, 1, West Bute Street, Cardiff, electrical engineer; S. Beamand, 31, Ynis Street, Port Talbot, accountant. F. C. Phillips signs as director. Qualification: £500. Registered office: 1, West Bute Street, Cardiff.

Lincoln Electric Co.—Particulars were filed at Somerset House on September 11th, pursuant to Section 274 of the Companies (Consolidation) Act. The authorised capital was originally 10,000 dollars, but after successive increases, was at December 8th, 1919, 273,800 dollars in 20,000 common shares of 10 dollars each and 738 preferred shares of 100 dollars each. On December 31st, 1919, the capital was reorganised, being divided into 30,000 shares without nominal or par value and 738 preferred shares of 100 dollars each. The total amount of authorised capital was still stated as 273,800 dollars, the corporation certifying that it had assets to that actual value. The company was incorporated in U.S.A. on June 8th, 1906, to manufacture, repair, buy, sell and deal in all kinds of electrical machinery, tools and appliances, &c. The British address is Kern House, 36-38, Kingsway, W.C.2. G. T. Tavenner, of 22, Parliament Hill Mansions, Highgate Road, N.W.5, is authorised to accept service of process and notices. No list of directors has yet been filed. The file number is 2,137F.

Electois, Ltd. (184,253).—Private company. Registered September 8th. Capital, £2,500 in £1 shares. To acquire the business of the "C.A.M. Patents" carried on by W. A. Cuthell and L. Mynne at 18, Rullerton Road, Wallasey, together with all the assets used in connection therewith, including patent No. 33,569, of 1921, and to carry on the business of electrical, mechanical and general engineers, manufacturers of electrical or other motors, and electric or other lighting sets, toys of all kinds, &c. The permanent directors are: W. A. Cuthell, 18, Rullerton Road, Wallasey, marine engineer; L. Mynne, 18, Rullerton Road, Wallasey, electrical engineer. Qualification: £50. Remuneration: £100 per annum divided between them. Secretary: F. M. Stanbury. Registered office: 25, Lord Street, Liverpool.

Radio Components, Ltd. (184,294).—Private company. Registered September 11th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of and dealers in general electrical apparatus and machinery, and apparatus capable of being employed in wireless telegraphy and telephony, &c. The first directors are: A. F. Pope, Teddington, near Dunstable, Beds. (director Plant and Supplies, Ltd.); P. C. Curtis, 14, Cressida Road, Highgate. Registered office: 12 and 13, Henrietta Street, W.C.2.

Darimont Electric Batteries, Ltd. (184,270).—Private company. Registered September 9th. Capital £18,000 in 62,000 ordinary shares of 5s. each and 50,000 deferred shares of 1s. each. To adopt an agreement with L. Darimont and G. Hagemans; to acquire a licence to manufacture, under British Patent No. 180,120, a primary electric cell or battery, and other electrical appliances in the United Kingdom and elsewhere, except in the foreign countries where patents for the said invention have already been granted. The first directors are: L. Darimont, 10, Rue Sergent Debruyne, Brussels; G. Hagemans, 76, Rue Emanuel Van Drische, Brussels; F. Smith, Salisbury House, E.C.; Col. J. H. H. Hogge, 7 and 8, Norfolk Street, Strand, W.C.; W. R. Cooper, 82, Victoria Street, Westminster; B. Weiser, 15, Coleman Street, E.C. The first two are life directors. Qualification: 400 shares. Remuneration: 5 per cent. of the amount distributed as dividend, but not to exceed £2,000 in any year, divided between them. Solicitors: Perowne & Co., 7, Great James Street, Bedford Row, W.C.1.

Radio Installations, Ltd. (184,320).—Private company. Registered September 12th. Capital, £1,000 in 700 shares of £1 each and 6,000 shares of 1s. each. To carry on the business of manufacturers of, agents for, and dealers in instruments, apparatus, accessories and materials of all kinds for use in connection with radio or wireless telegraphy, or with stations, exchanges, and lines for the distribution or reception of radio or wireless waves, &c. The permanent directors are: P. H. Pettyfer, 17, Albemarle Road, Beckenham, Kent; A. J. Hancock, 26, High Street, Beckenham, Kent. Qualification: £100. Registered office: Empire House, 175, Piccadilly, W.

Association of Municipal Traders.—Registered on September 15th as a company limited by guarantee. The objects are: To promote and protect the interests of persons, firms and companies (referred to as "Municipal Traders") engaged in trades, businesses and undertakings, entering into contracts with, doing work for, supplying goods to or employed in relation to the requirements of municipal corporations, county, district, and parish councils, poor law guardians, statutory undertakings or any other corporation, board or authority; to collect information relating to the business of, or of use or interest to, municipal traders and others, &c. The management is vested in a committee, the first members of which are:—F. E. Rowe, St. Stephen's House, Victoria Embankment, S.W.1, engineer; L. W. Benson, Pinners Hall, E.C.; A. M. Bond, 34, Victoria Street, S.W., contractor; H. G. Blakemore, 16, Grosvenor Gardens, S.W.1, engineer; W. H. Prescott, 712, Salisbury House, E.C., civil engineer; J. S. Killick, Shell Corner, Kingsway, W.C., civil engineer; W. H. Chappell, 65, Victoria Street, S.W.1, director. The secretary is A. Hutchinson, and the solicitors are Oldham, Cornwall & Wood Roberts, of 3, Harcourt Buildings, Temple, E.C. The registered office is at 40, Broadway, Westminster. The file number is 184,377.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

T. Jackson, Sons & Co., Ltd.—Satisfaction in full on September 5th, 1922, of debenture, and the collateral security both dated May 21st, 1915, securing £1,000.

Cray Installations, Ltd.—J. T. Matthews, of St. Michael Chambers, 126, High Street, Southampton, was appointed receiver on September 5th, 1922, under powers contained in debentures dated March 17th, 1921.

Gorseinon Electric Light Co., Ltd.—Satisfaction in full on July 5th, 1922, of debenture dated September 11th, 1902, securing £800.

Simms Motor Units (1920), Ltd.—Satisfaction to the extent of £1,698 12s. 1d. on September 5th, 1922, of land registry charge dated April 30th, 1921, securing £4,818 15s.

CITY NOTES.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

Mr. G. C. Howard, presiding at the ordinary general meeting on September 14th, said that the year's results, although disappointing, were not unsatisfactory, when due regard was paid to the circumstances. There had been a railway strike, a tramway strike, and a strike of firewood loaders, each of which had a detrimental effect upon the company. The mines were also handicapped by the lower gold premiums.

The whole of the debenture debt of £61,200 had been repaid out of profits, and the property was now absolutely unencumbered. The chairman considered that compulsory arbitration in Australia had proved a failure and a check upon enterprise.

After the general meeting, a meeting of the preference shareholders was held to consider a scheme of arrangement. It was proposed that the holders should surrender their £150,000 of preference shares, receiving in return debenture stock to the same amount. Their voting rights would be retained. The scheme was approved and afterwards confirmed by a meeting of the holders of ordinary shares and an extraordinary general meeting of the company.

German Companies.

The *German South Sea Wireless Telegraphy Co.*, of Berlin, has now published its accounts for 1915-16 to 1921-22, showing a loss of 169,000 marks for these years on a share capital of 1,300,000 marks.

The *Continental Isola Works Co.*, of Duren, reports net profits of 1,166,000 marks for 1921-22 and a dividend at the rate of 12 per cent., these results comparing with 892,000 marks and 12 per cent. respectively in the previous year.

The *Electro Works Co.*, which owns power stations in Central Germany and whose share capital is held entirely by the State, reports net profits of 14,460,000 marks for 1921, which is the first year since the absorption of similar works. The dividend is at the rate of 8 per cent. on capital of 12,600,000 marks, the balance of the profits being placed to reserve funds.

Stock Exchange Notices.—Application has been made to the Exchange Committee to allow the following to be officially quoted :—

Jutland Telephone.—£500,000 5½ per cent. sterling bonds of 1922 (Nos. A1 to A3,500—£100 and B1 to B300—£500) guaranteed by Danish Government), in lieu of scrip now quoted.

Dealings in the following securities have been specially allowed by the Committee under Rule 159, and they have been ordered to be officially quoted :—

Marconi's Wireless Telegraph.—73,094 ordinary shares of £1 each, fully paid (Nos. 1,473,649 to 1,500,000 and 2,953,259 to 3,000,000).

Prospectus.—*Haywards Heath and District Electric Supply Co., Ltd.*—Last week this company published a prospectus in the Sussex newspaper Press inviting subscriptions for 20,000 £1 shares at par. The area of supply is a residential one with a population of about 15,000. The list is to close on September 23rd.

Hendon Electric Supply Co., Ltd.—According to a financial daily, an interim dividend of 5 per cent., free of tax, on the ordinary shares for the past half year is announced.

Stothert & Pitt, Ltd.—Profit for year ended June 30th, 1922, £28,658, plus £5,153 brought forward, making £33,811. Final dividend of 7½ per cent., free of tax, making 12½ per cent., free of tax, on ordinary shares, carrying £7,020 forward. Outstanding debentures of £25,000 were paid off on June 1st, 1922, leaving assets now uncharged.

Mackay Companies.—An interim dividend of 1½ per cent. for the quarter on the common stock is announced.

Browett, Lindley & Co., Ltd.—Interim dividend of 4 per cent. actual, less tax, on the ordinary shares.

Bruce Peebles & Co., Ltd.—Dividend at the rate of 7½ per cent. per annum, less income tax, on the 7½ per cent. cumulative participating preference shares for the half year ended June 30th.

Whitehall Electric Investments, Ltd.—Interim dividend at the rate of 7½ per cent. per annum on cumulative preference shares for six months ending September 30th.

Dumbarton Burgh and County Tramways Co.—According to the *Financial Times*, the directors have resolved to pass the preference dividend for the half year to July 31st, 1922.

Sir W. G. Armstrong, Whitworth Co., Ltd.—Interim dividend on the ordinary shares of 6d. per share, less tax.

Howard & Bullough, Ltd.—Quarterly interim dividend of 6d. per share on ordinary shares.

British Insulated & Helsby Cables, Ltd.—An interim dividend of 9d. per share, less tax, is announced.

Rangoon Electric Tramway and Supply Co., Ltd.—The *Financier* says that cable advice has been received to the effect that the directors have declared an interim dividend on ordinary shares at the rate of 8 annas per share, payable in Rangoon on October 31st.

Shawinigan Water and Power Co.—Dividend of 1¾ per cent. on common stock for the quarter ended September 30th.

STOCKS AND SHARES.

Tuesday Evening.

International complications laid a heavy hand upon the Stock Exchange markets at the beginning of the week. There was a general fall in the War Loan, Home Railway stocks, and other investment securities. Prices of semi-speculative issues gave way with the rest. Indian stocks and shares have been particularly depressed by the Near East crisis. While nobody affected to believe that Europe would again be plunged into war, the prospect of such a thing came sufficiently near to render the markets apprehensive. In some, a good deal of selling has been taking place; and in most, the ordinary buyer refrained from taking a hand while the outlook continued unsettling and threatening. The more cheerful aspect that developed on Tuesday, led to recovery all round. Many of the falls were recovered, either entirely or in greater part.

For the reasons stated, Home Railway stocks of all kinds went lower. The Undergrounds suffered with the rest. Underground Electric £10 shares, for instance, which rose to 56s. came back to 52s. 6d., and the Income Bonds, after touching 87, receded to 84½. Districts and Metropolitans were lowered in the same kind of way, but the subsequent rally caused a smart recovery in the whole group.

It is being asked how soon the steam companies will put into operation those schemes for electrification upon the strength of which they have received promises of Government-guarantee support for new issues, on the condition that the work should be put in hand without delay. The South-Eastern Railway, for instance, received an assurance of Government guarantee for 6½ millions new capital, of which five millions was to be applied to electrification purposes, provided that the work was started as soon as possible. So far as we are aware, no active steps have been yet taken towards this end, apart, of course, from the evidence that was tendered to the Commission, about four months ago, with a view to ascertaining what source of supply would be the best and cheapest for the railway company to adopt.

Electricity supply shares are not much affected by the general dulness prevailing in other parts of the Stock Exchange. The new County ordinary eased off to 3s. premium, and the new preference to 1s. 9d. premium, the decline being due to the fact of there being another call due on October 1st. Possibly some of the stags, who have been holding on in the hope of getting a bigger premium, are realising at the substantial profit which they can still secure. It is pointed out in the current number of the *Economist* that the electricity supply companies are doing remarkably well on account of the reduction in the cost of coal, materials, labour, and other expenses which have fallen out of proportion, at present, to the cost of the current supplied to customers. This view obviously weighs with holders of the shares, who are disinclined to part with investments upon which there is every reason to expect an improvement in dividends in respect of the current year, and it explains the reason why there are so few shares available for prospective buyers, attracted by the prosperity of the industry. The buyers have to wait, as a rule, for odd lots of "deceased-account" shares which trickle into the market every now and then, and which constitute almost the only source of supply at the present time.

Westminsters have given way to 7⅞ and County of London ordinary at 28s. are 9d. down. Similar loss lowered City of London ordinary to 2 1/16, but London Electrics hardened to 2⅛, business being marked up to 52s. 6d. St. James' rose to 9; South Londons to 4. Whitehall Electric preference are better at 18s. 9d., and the 6 per cent. debentures hardened to 89, on declaration of the dividend on the former. Amongst the manufacturing shares, General Electrics are a fairly active market on the basis of 19s., at which price the quotation shows a slight improvement. English Electric preference stiffened to £1. In the ordinary shares a few bargains are recorded around 15s. 9d. and 16s. Edison Swans have been changing hands at 3s. British Insulated at 45s. are 3s. higher.

Amongst the cable shares, Henleys at 2¼ are 1 16 lower, sellers having been attracted by the way in which the price has consistently risen during the past few weeks. Callenders remain at 2 3/16 and Telegraph Constructions at 25¾. Siemens also being without alteration at 27s. 6d.

Anglo-Argentine Tramways 5 per cent. first debenture stock at 78½ looks reasonably cheap on another fall of 1½ points. Brazilian Tractions at 50 are down 3, other issues in this market being very quiet. Mexicans have once more assumed a dullish tendency, though there are no changes to record in the list of prices. Doubt now seems to be entertained as to whether Congress will be unanimous in ratifying the proposal of the President of Mexico for dealing with the country's debt. It may be, however, that this sentiment is coloured by the dulness engendered by reason of the Near East problems, and, although the latter show signs this Tuesday afternoon of being dispersed, the foreign traction group failed

to recover as promptly as did some of the other sections round the Stock Exchange.

Marconis receded to 2¼, which showed a loss of ½. Radio Corporations gave way to 20s. 6d., the preferred to 13s. 9d. West Indian and Panama shares have been dealt in at 3s. 9d. The first preference drooped to 25s. United River Plate Telephones are 5s. lower at 6¾. Anglo-American deferred at 23½ has gone back to the figure at which it stood before the rise last week. The Eastern Cable stocks show no changes at all.

Several of the Indian issues have gone back a little, in consequence of the Near East quarrel. Indian Electric Supply and Traction 5 per cent. free-of-tax debentures can be bought at 94, the issue price. Calcutta Tramways 7 per cent. second debentures hold their premium of 2½ points on the issue price of 95, while Madras Electric 7 per cent. second debentures, which also came out at 95, are obtainable at a slight discount. British Thomson-Houston 7 per cent. mortgage debenture stock stands at 105, Lancashire Electric 7½ per cent. prior-lien debenture at 107, Midland Counties 5 per cent. first mortgage debenture at 92 and the company's 7½ per cent. mortgage debenture stock at 102.

The rubber market continues a little less dismal than it has been, but it cannot be said that there is any noticeable increase of business. Armament shares are quiet; the Armstrong dividend was better than had been expected. Babcock and Wilcox receded to 58s. 9d. In other engineering issues the tendency is to follow the meagre and irregular changes shown by the market for iron, coal, and steel shares.

British Electric Traction ordinary has gone back to 60. Metropolitan Electric Tramways 4½ per cent. debenture at 68½ is three points higher on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price Sept. 18,	Rise or	Yield
	1920.	1921.	1922.	fall.	p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	8	+ ½	£7 10 0
Charing Cross Ordinary	8	9	7⅞	—	5 17 0
do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	—	4 16 0
City of London	14	14	2½	—9d.	5 11 9
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	28/-	—9d.	5 14 4
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
Kensington Ordinary	9	10	7½	—	6 13 4
London Electric	2½	4	3⅝	+ ⅛	4 16 0
do. do. 6 per cent. Pref.	6	6	6	—	5 17 1
Metropolitan	7	7	6⅜	—	5 14 3
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9	+ ½	6 13 4
South London	7	7	4	+ ½	7 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅞	— ¼	6 11 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	104	—	5 15 5
do. Def.	1½	84/6	28½	— ⅜	7 8 6
Chile Telephone	6	6	[illegible]	—	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 9 8
Eastern Extension	10	10	18⅝	—	5 6 8
Eastern Tel. Ord.	10	10	186½	—	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 8 5
do. do. Pref.	6	6	11¾	—	5 2 2
Great Northern Tel.	24	22	29⅜	—	7 9 2
Indo-European	10	10	35⅞	—	7 0 10
Marconi	25	15	2¼	— ¼	6 6 4
Oriental Telephone Ord.	12	12	28	—	*5 1 1
United R. Plate Tel.	8	8	6¾	— ¼	*5 18 6
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 8
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	56	—1½	4 0 4
do District	Nil	1	47	—	2 6 6
Underground Electric Ordinary	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/6	+6d.	Nil
do. do. Income	3	4	85⅜xd	+1	*4 13 6
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	8⅞	—	8 0 0
do. do. 2nd Pref.	Nil	5½	8⅛	—	7 0 9
do. do. 5 per cent. Deb.	5	5	78½	—1½	6 7 5
Brazil Tractions	Nil	Nil	50	—3	8 0 0
British Columbia Elec. Rly. Pcc.	5	5	76½	—	6 9 9
do. do. Preferred	5	98/-	66	—	*7 1 8
do. do. Deferred	3	124/-	73½	—	*8 11 0
do. do. Deb.	4½	4½	76	—	5 11 6
Mexico Trams. 5 per cent. Bonds	Nil	Nil	70½	—	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	41½	—	Nil
Mexican Light Common	Nil	Nil	20⅜	—	Nil
do. Pref.	Nil	Nil	4⅜	—	Nil
do. 1st Bonds	Nil	5	64½	—	7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	16	2¹¹/₁₆	— 5/6	5 12 8
British Aluminium Ord.	10	10	18/9	—	—
British Insulated Ord.	15	15	2½	+3/-	6 13 4
Callenders	5	5	2⅛	—	6 17 0
do. 6% Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	+3d.	6 13 4
Edison-Swan	10	Nil	8/8	— ⅛	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	5	5	16/-	—	6 5 0
do. do. Pref.	6	6	1	+6d.	6 0 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	19/-	+3d.	5 5 3
Henley	15	15	2½	— ⅛	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	[illegible]	—	1¾	—	—
Met.-Vickers Pref.	8	8	2½	—	6 8 0
Siemens Ord.	[illegible]	10	27/6	—	*7 5 6
Telegraph Con.	90	[illegible]	26½	—	*4 13 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	7¾d.	..
a Ammoniac, Sal	per ton	£63	...
a Ammonia, Muriate (large crystal)	,,	£48	..
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£30	...
a Copper Sulphate	,,	£26 10s.	...
a Potash, Chlorate	per lb.	5d. to 5½d.	...
a ,, Perchlorate	,,	7¾d.	...
a Shellac	per cwt.	£16	..
a Sulphur, Sublimed Flowers	,,	£11 10s.	...
a ,, Lump	,,	£11	...
a Soda, Chlorate	per lb.	3¾d.	...
a ,, Crystals	per ton	£6	...
a Sodium Bichromate, casks	per lb.	5d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£100	...
b ,, Wire	per lb.	1/9 to 2/6	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£150	...
Grade II	,, ,,	£108	...
Grade III	,, ,,	£62	...
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c ,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c ,, Wire, basis	,,	9¾d.	...
c Copper Tubes (solid drawn)	,,	1/1½	...
c ,, Bars (best selected)	per ton	£94	...
c ,, Sheet	,,	£94	...
c ,, Rod	,,	£94	...
d ,, (Electrolytic) Bars	,,	£71 10s.	10s. inc.
d ,, ,, Sheets	,,	£145 10s.	...
d ,, ,, Wire Rods	,,	£81 10s.	10s. inc.
d ,, ,, H.C. Wire	per lb.	10¾d.	...
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
a German Silver Wire	,,	2/6	...
h Gutta-percha, fine	,,	12/6	...
h India-rubber, Para fine	,,	10¾d.	...
l Iron Pig (Cleveland Warrants)	per ton	92s. 6d. to 95s.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£24	...
g Lead, English Pig	,,	£25 5s.	5s. dec.
g Mercury	per bot.	£12 10s. to £12 15s.	...
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/1	...
p ,, drawn bars and rods	,,	1/3	...
p ,, rolled strip & sheet	,,	1/2¾	...
p ,, wire	,,	1/3¾	...
o Platinum	per oz.	£26	...
d Silicium Bronze Wire	per lb.	1/1	...
r Steel, Magnet, in bars	,,	1/-	...
n Tin, Block (English)	per ton	£159 5/- to £159 10/-	...
n ,, Wire, Nos. 1 to 16	per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r, W. F. Dennis & Co.

Scandinavian Power Transmission.—The greatest secrecy has hitherto been observed concerning the schemes for the transmission of power from Norway to Denmark, which question is engaging the attention of a joint committee of these two countries and of Sweden. A final meeting of the technical committee, appointed by the latter, is to be held in Copenhagen at the end of September, when an official statement is expected to be issued. In the meantime it is reported from Stockholm that the scheme for the transmission of power by means of submarine cables laid across the Sound has been abandoned, as it has been shown to be technically practicable to utilise the airway. According to a Christiania newspaper, this project has been worked out by a Norwegian engineer (Mr. Prebensen Nissen) who is a member of the technical committee. It had been thought that the Sound was too deep to permit of the construction of towers to support an overhead transmission line, but this has turned out not to be the case. It will thus be possible to install an overhead line directly between Helsingborg (Sweden) and the west coast of Zealand, which is of the greatest importance for the technical solution of the problem. It was originally proposed to transmit power at 132,000 volts through three submarine cables in the Sound, and subsequently increase the number to six.

Belgian Radium Factory.—The radium factory which is being built at Campine, Belgium, is almost completed, and it is expected that the first supply of radium from minerals obtained from Katanga will be produced by the end of this year. —*Daily Telegraph.*

THE BRITISH ASSOCIATION.—III.

Monday morning (September 11th) was spent by Section G in the discussion of a series of papers on "Economic Steam Production, with Special Reference to Marine Practice," a feature of which was a statement by Dr. C. H. Lander, on behalf of the Fuel Research Board, in which the suitability of oil for steam-raising purposes was discussed. The problem is one which has some interest for those who have to deal with stationary boilers, and those who were forced to adopt oil firing during the war—most of whom have abandoned it since—will be interested to hear, *apropos* of the Government scheme of boring for oil in this country, and the much-criticised expenditure in connection therewith, that the considered opinion of the Fuel Research Board is that the chief source of supply of home-produced oil must come from the distillation of coal in conjunction with processes for the manufacture of smokeless fuel. It has been known for a long time that the Navy has abandoned any reliance upon home oil supplies obtained from borings here, and it was with the idea of making the Navy independent of imported supplies that the boring scheme was commenced.

A paper on "The Acquisition of Skill, with Reference to Training in Industry" was read by Prof. T. H. Pear in Section J (Psychology). This dealt with many of the problems of industrial psychology in a more or less new manner, and the author somewhat caustically compared the care and expense which was often gone to in acquiring skill in games to the general absence of this same devotion to the problems of acquiring skill in work. This paper demonstrated, as had others before this Section, that those who practised the science of psychology in its industrial applications were beginning to realise that a more practical touch must be given to their work, and that the worker could not be regarded as an automaton which could be watched, tested, and generally ticketed and docketed, and expected to give a constant output under all and any conditions. It was clear that the so-called campaign of scientific management and efficiency propaganda, which was belauded a few years ago in this country, had more or less failed in the sense that its originators had had to call upon their disciples to halt. It was indeed amusing to those who had followed this branch to find the psychologists telling the self-styled efficiency engineer—a direct product of the industrial psychologists' teachings—that he, by his methods, had tended to bring the work of Taylor and the Gilbreths into disrepute. A more human point of view was being adopted, and not too soon.

Several of the Sections wound up their proceedings on Tuesday, September 12th, among them being Section A in which the papers on "The Ultramicrometer in Minute Physical Measurements," by Prof. R. Whiddington, and on "The Determination of Dielectric Constants and Susceptibilities by Valve Methods," by Mr. J. E. P. Wagstaff, both reproduced in our last issue, were read and discussed.

Although the title of the only paper read in Section G (Engineering) might not suggest electrical interest, *viz.*, "The Propelling Machinery of the Cargo Carrier of the Future," there were two points to which attention may be drawn. The author was Mr. J. Richardson, who is regarded as one of the leading experts of the Diesel engine. He is an old Central Technical College student, where he received electrical training under Prof. Howe, the Recorder of the Section, and it was Prof. Howe who pounced upon what was perhaps a loosely-expressed remark in the paper regarding the electrical driving of ships, *viz.*, that electrical machinery for marine work was only in its infancy. Prof. Howe stoutly challenged that statement, and said that any reputable firm of electrical manufacturers could do all that was required, and that the failures of which so much was made from time to time were due to the fact that the plant was not specially designed for the particular purpose in view; with this statement the author agreed. Mr. Richardson said that so far as steering gear was concerned, the electric-hydraulic system had proved itself efficient and was finding increasing favour even on steamships. For lights and fans electricity was also required. For the heating of a ship, steam was still the most convenient and the least costly method, although either exhaust-raised steam at sea or some combination of electrically-generated heat and hot-water pipes would no doubt find increasing favour in the future. Therefore, for the remainder of the plant, such as winches and pumps, the choice lay between steam or electric drive. Where first cost was concerned, considerable advantage lay on the side of steam, but the more elegant solution, and the more economical, in respect of fuel consumption, was undoubtedly the electric drive. Electric current was generated by Diesel-driven dynamos, which, except in very special cases, should not be less in number than three. For reasons of interchangeability, these three should be of the same size. One should be sufficient for normal sailing at sea, two were required for manœuvring the ship or for working cargo fully in port, and one was always a stand-by. For ships of 3,000 tons deadweight, three sets each of 50 kW would suffice. From 6,000 tons to 10,000 tons deadweight, three sets of 80 kW to 100 kW were generally required. If special provision had to be made, for instance, for carrying refrigerated cargoes, the power of the sets was greatly increased, and in some cases three or four sets of 150 kW were called for. The consumption of fuel for working cargo and pumps in port with banked fires in a steamship was of the order of 10 times the amount of fuel required by the Diesel electric system of auxiliary working on similar motor ships.

The foregoing referred particularly to four-cycle engined ships. When two-cycle machinery was adopted, the practice of driving the scavenging pumps separately from the main engine to permit of rotary machines being used for this duty would undoubtedly gain favour, and in this case the Diesel-driven generators for supplying electricity for general duties, as well as for driving these pumps, became of very considerable size, approximately 25 per cent. of the power of the main engine.

Such figures led naturally to a consideration whether the correct angle from which to review and attack the problem was not to regard the machinery of the ship as a central electric power station delivering current to electric motors for propulsion and all the other multifarious duties. For special-purpose ships, where the duties apart from propulsion required a substantial measure of the total power as, for instance, dredgers, ferry boats, cable ships, &c., the Diesel-electric system was being adopted and merited the closest attention. It was favoured in America, and had been regarded also, by virtue of the great sub-division possible, as a means of adapting the Diesel principle to ships of the highest power. It was heavy, the first cost was high, and electrical machinery suitable for marine work was only in its infancy, and much development must take place before the electrical equipment was as reliable as the remainder of the installation.

Incidentally, Prof. Hudson Beare, the President of the Section, referred to three fruit-carrying vessels which were being built with electric propulsion, Diesel engines being employed, but the author did not appear to approve of this plan. Another point brought out in the paper was that there was no sign of a reduction of the price of fuel oil to a figure that would enable it to compete with coal on ships, and presumably the same remark applied to land boilers.

Section B (Chemistry) had a more or less full-dress debate on the nitrogen industry, some details of which will appear in a later issue.

Only three sections met on September 13th, namely, Sections G (Engineering), H (Anthropology), and K (Botany). The only paper of electrical interest was that

by Dr. E. O. Turner, before Section G, on "Electrical Ignition Apparatus for Internal-Combustion Engines." Ignition, both by induction coil and by magneto, was discussed at some length, and results of experiments on induction coils designed for use with automobiles and with high-compression stationary gas engines were given. The magneto was considered in two aspects—as a constant flux alternator on short circuit for the first part of each cycle (until the contacts opened), and thereafter as an induction coil breaking the current just established. Expressions for the equivalent magnetic circuit and the "spark flux" were deduced, the latter being shown to be dependent on the short-circuit current and the equivalent permeance of the magneto.

Considerable emphasis was laid on the improvements made possible by the substitution of cobalt steel for tungsten steel magnets, and Dr. Turner predicted that in future cobalt steel would be used almost to the exclusion of tungsten steel, provided that improvements in the design of magnetos were brought about which would make its use an economic "proposition."

Prof. Hudson Beare, the President of the Section, welcomed an old student in Dr. Turner, and mentioned that his work in connection with ignition apparatus had led to his having been awarded the D.Sc. degree of Edinburgh University.

Some Geographical Aspects of Recent Developments of Water Power.

By H. M. Spink.—(*Abstract.*)

Section E.—Geography.

The author said that the question of the development of water-power in Great Britain had not secured the sufficiently wide interest that it deserved, partly due to the supremacy of coal in our industrial life, and partly also because our potential water-power resources were not large as compared with many other regions. This indifference was apt to rather blind us to the remarkable progress in water-power development which had taken place during the past twenty years, and especially to the social and economic effects which were extremely likely to follow such development. Interest was aroused for a time by the scheme for utilising tidal water in the Severn Estuary, and it was readily perceived that its completion would have had far-reaching influence in South-West England and South Wales. That, unhappily, had been forgotten, and it was also to be feared that the report of the British Water Power Committee had aroused insufficient interest. Few countries had made really reliable inquiries into their water-power resources. The value of the water power of streams was greatest where there was least variation in the flow. In regions of strongly marked rainy periods and dry periods, while potential water powers might be very great when the streams were full, such powers might be valueless in the dry season. This made for uneconomical production of power, and lessened the value of the water-power. It was largely because of this fact that the production of power from the streams of Central Africa, South America, India, and South-Eastern Asia might be long delayed. The world's power demands were reckoned to amount annually to 120,000,000 h.p., of which factories, lighting, transport, &c., used 75,000,000 h.p., railways 21,000,000 h.p., and shipping 24,000,000 h.p. Only some 25,000,000 h.p. of hydro-electric power was developed out of a possible world's supply of 440,000,000 h.p. The Congo basin was estimated to possess 100,000,000 h.p., or about a quarter of the world's potential water-power, most of it available in the region about Stanley Falls. It was probable, therefore, that these great stores of energy would be utilised, but not without further development in the matter of long-distance transmission, and until it was possible to organise power demands to coincide with the periods of great stream flow in these regions. It would be said that hydro-electric development was a matter of relative costs, and that it would develop where it could successfully compete with steam plant. It was no part of the paper to discuss relative costs, but it might be said that hydro-electric power was extremely cheap where plants could be operated fairly continuously at full capacity. In Europe the average cost per h.p. year for the larger hydro-electric stations was about £10 5, while under favourable conditions, such as obtained for some of the huge plants of the Ontario Hydro-Electric Power Commission, this charge might fall as low as £1.8.

Dealing with some of the characteristic features of countries where water-power was largely used, the author stated that in South America there was an increasing degree of co-operation between steam-electric and hydro-electric plants. This was of great importance, because it involved no displacement of industry hitherto based on coal, and it suggested a line of logical development for hydro-electric power in areas where steam power was still the main source of energy. A scheme for developing this co-operation was being put into effect in the "super-power" zone in the New England States. Here the hydro-electric powers were of small capacity, incapable of supplying the needs of the area, but affording very considerable aid to steam-electric plants. In that area 25 per cent. of the population of the United States resided, and there were some 96,000 industrial plants, of which 76,000 utilised an average of 350 h.p. per year, mostly derived, uneconomically, from isolated power plants. Under the scheme the power plants would be reduced to 273, of which 218, being large undertakings, already existed, and would be retained. The combination of these steam and hydro-electric plants would almost entirely eliminate the movement of coal, except along specified routes, to the main steam plants. Out of 36,000 miles of railroad 19,000 miles would be electrified, and altogether there would be an annual saving of nearly 50 million tons of coal. In the chief industrial countries the railways were often embarrassed by the movement of coal to and from mines and the industrial centres. In New England the question had become acute, but it would now be largely eliminated.

The Niagara district of North America was undoubtedly first in the production of electrical energy. The Chippawa-Queenston plant, which had a capacity of between 500,000 and 600,000 h.p., was the largest hydro-electrical installation in the world.

A large number of slides of water-power plants in North America were shown, and attention was then given to Norway, Sweden, Italy, France, and Switzerland, the last of which had developed the greatest percentage (80 per cent.) of its available power. In France and Italy most of the hydro-electric power developed was devoted to specific industries rather than to the rural districts, and in this way they resembled the U.S.A. and Canada. In Italy, where there was little coal, great progress had been made, and whilst the lignite deposits were utilised as fully as possible the necessity for importing coal for railways and for smelting works imposed a heavy drain upon a comparatively poor nation. Electrification of railways in the Lombardy Plain was taking place, and there was a rapid extension of iron smelting by thermo-electric processes in the Aosta Valley near the Cogne iron deposits. Both lines of progress, it was to be hoped, would lead to the elimination of coal imports of about 4 million tons per annum. Maps were shown illustrating the great development of the uses of electric power for agricultural purposes on the Continent, possible on account of the cheapness of the supply of power generated by hydro-electric means. The map published by the Cartographical Institute of Stockholm was specially referred to in this connection. At the same time, in Norway, for instance, the amount of power used for agricultural purposes was still negligible, the vast bulk of the hydro-electric power being consumed by the aluminium works. In Sweden, out of 1,200,000 h.p. produced by the hydro-electric stations, 54 per cent. was used by industrial plants, 24 per cent. by thermo-electric processes, and only 7 per cent. for agriculture.

A similar idea, *viz.*, benefit to the rural population, lay behind the extensive Sila Lakes scheme of South Italy. The Sila was a tableland of 1,000 sq. km. in the Province of Cosenza, drained by the rivers Neto, Arvo, Ampollina, and others. It was proposed to convert the courses of these streams into a series of lakes by the construction of dams and impound a head of water with a fall of 1,000 metres. Hydro-electric plant, designed for 160,000 h.p., and capable of extension to 400,000 h.p., would be installed, and would supply power to Calabria and East Sicily. The scheme was to have been commenced in 1920, but the author said he had no information as to the amount of progress made.

The Future of Unemployment Insurance.

By J. L. Cohen, M.A.—(*Abstract.*)

Section F.—Economics.

The author commenced with a study of the criticism to which the present scheme of unemployment insurance was subjected. It was agreed that the proportion of administration costs was too high. The accusation that applicants for relief were not always *bona-fide* unemployed was not accepted. It was pointed out that the normal income provided some nine-tenths of the expenditure. It was not correct to term the benefit "a dole," as unemployed workers had a right to it. Although it was not denied that there were errors in administration, the criticism was considered usually to be without foundation. Three lines of activity with the aim of reducing unemployment were suggested. An international body to correlate statistics of supply and demand was proposed. This body would regularise the demand for labour to safeguard against a boom to moderate its effects, and to prevent a reaction into a slump. It was suggested that benefits should vary with the amount of wages they would normally receive. The principles of the 1920 Unemployment Insurance Act were reviewed, and mention was made of the Bill which had been prepared contemplating the maintenance by each industry of its own unemployed. This scheme had supporters among both employers and workmen. Employers were reacting against the control of war-time economy, whilst trade union officials were fascinated by the guild socialist

ideal. During the war the "rota" system was introduced into the cotton industry. This was administered by the employers' organisations and trade unions. A similar scheme was worked in the Yorkshire wool textile trade for the establishment of a trade unemployment fund for hosiery workers. Schemes for the building trade and the docks industry had been suggested. Certain employers, like Messrs. Rowntree, had contracted out of the State scheme by establishing unemployment funds of their own. Labour authorities had, by a substantial majority, acclaimed the system. The reorganisation of insurance on the basis of industry was aimed at in the Bill of the General Federation of Trade Unions. The funds would be provided by a levy upon employers, one-fifth of which would be recoverable from the employés; the State would refund one-fifth of the amount paid out in benefits. Joint boards of employers and trade union representatives would administer the scheme, and any surplus would be paid at the end of the year to a central contingencies fund, from which deficits by other boards could be repaid. A national committee would adjudicate in disputes. The defects in this Bill were evident upon examination. Among these were the difficulty of defining industries; the marking down of men as belonging to one particular industry would affect the mobility of labour; the machinery of administration would be far too costly; employers would not be prepared to hand over to the unions large sums of money without demanding a very detailed control over them; at present each district had one employment exchange, the Bill would set up one for each industry, and the Government system of exchanges would still be required for unskilled labour. It had been suggested that all the existing schemes of insurance—unemployment, health, old-age, &c.—should be linked up to effect considerable economies; unemployment insurance by industries would render such a scheme very difficult of realisation. The assertion that unemployment insurance by industry would persuade employers to reduce unemployment, or reduce its severity, was stated to be fallacious, for several reasons.

Unemployment took on various forms in different industries, *e.g.*, the work of dockers was casual and intermittent; the gas and building trades suffered seasonal depression. The problem had been attacked in a novel way by Professor Common, of Wisconsin. It was proposed that all employers in the State of Wisconsin should form themselves into an "Employers' Mutual Employment Insurance Company." To prevent constant change of "hands" contributions to the fund would be regulated, being higher for the employer whose staff was constantly changing. This was also subject to the criticism that unemployment could not always be prevented by the employers.

The author's examination of the question led him to the conclusion that insurance by industry would be a troublesome and costly method; that it had no direct advantages over the State scheme; and that the indirect benefits, which were very great, could be achieved by a slight amendment of the existing scheme. The present Act, slightly amended, should be tried for a decade before any fundamental reversion was attempted.

Equal Pay to Men and Women for Equal Work.

By Professor F. Y. Edgeworth, M.A.—(*Abstract.*)

Section F—Economics.

In this paper the vexed question of the payment of women employed in industry was ably reviewed by the author. By "equal work" equal utility to an employer was generally meant; or, on the other hand, equal disutility, in the sense of fatigue or deprivation of amenity, to the employé. Should there be perfect competition between the sexes? This might be answered definitely in the affirmative or otherwise; if undecided, the question might be asked: "What sort or amount of competition is advisable?" It might happen that the unrestricted play of competition between short-sighted employers and desperately-poor workers, though securing a temporary maximum of production, might bring about a degradation of labour and a breakdown or a gradually deepening depression of industry. To this débâcle the competition of women would largely contribute. The minimum of requirements for efficiency was less for women than for men; wives and daughters were often subsidised, *i.e.*, not self-supporting; last, but not least, the woman worker had not acquired the same unwillingness to work for less than would support a family.

The best results would probably be obtained by leaving employers free to compete for male or female labour. Thus equal pay for equal work would be secured; this did not imply that the earnings of the sexes should be equal.

After a consideration of numerous factors affecting the question the author arrived at a number of conclusions, which he summarised as follows: Equal pay for equal work in the sense of free competition between the sexes was advocated, with some reservations and adjustments. Among the features which would have to be excluded was "desperate, disordered" competition, tending to the degradation of labour. There were suggested certain compensations to families for the loss sustained by the breadwinner through the increased competition of women; but among such compensations the endowment of motherhood on a large scale by the State was not included. The advantages weighed were economical in a strict sense; the balance might be affected when welfare or well-being in a wider sense was taken into account.

THE COLFAX GENERATING STATION, PITTSBURGH.

According to Messrs. D. L. Galusha and C. W. E. Clarke, in a paper read before the American Institute of Electrical Engineers in 1921, the Pittsburgh, Pa., district is the foremost steel-producing and manufacturing centre in the United States. Steel plant with furnaces and mills lines the river banks for miles from the centre of the city. Associated industries, attracted by an abundance of natural resources, adequate transportation facilities, an ample labour supply, and proximity to markets for their products, have rapidly established themselves in the adjacent territory. Growth during the war period was extensive, and the district as a whole has been busy since hostilities ended.

By 1912 electricity generating station facilities in the Pittsburgh district had become inadequate to meet the requirements of the rapidly-growing industrial demand. The Allegheny County Light Co. and other companies, owning and operating a number of small properties, were consolidated with the Duquesne Light Co. A steam generating station previously built on Brunot's Island in the Ohio River below the city was considerably enlarged and the foundation laid for a comprehensive distribution system.

By an agreement with the West Penn Power Co. and with the approval of the Pennsylvania Public Service Commission, a definite division of the territory served by the two companies was effected. The Duquesne Light Co., through this arrangement, serves the two counties—Allegheny and Beaver—with an area of 1,154 square miles and a population of about one million and a quarter.

In 1913, the first year after the formation of the new company, the energy output was 283,000,000 kWh. In recent years the output has shown an average annual growth of about 15 per cent. In 1920 the peak, which was somewhat affected by the curtailment of business, was 162,500 kW; the energy output was 805,000,000 kWh, giving a yearly load factor of 57 per cent.

Previous to 1921 power was generated at the Brunot's Island station of 120,000 kW capacity, and by six other plants, varying from 2,000 to 17,000 kW in rating. The total generating capacity safely available from all of these sources under maximum conditions was 160,000 kW.

In anticipation of the need of increased capacity a site for a new power plant had been purchased on the Allegheny River about 15 miles from the centre of Pittsburgh and only a mile distant from the Harwick mine. This mine and the private railroad from it to the power station are owned by interests affiliated with the Duquesne Light Co. Actual construction of the new plant, known as the Colfax power station, was begun in September, 1919, and the station was officially opened for service on December 18th, 1920. Transmission line and sub-station construction was in progress during the same period.

Duplicate 66,000-volt transmission circuits completely surround the city, forming an electric belt 89 miles in circumference, locally known as "The Duquesne Ring." The Brunot's Island and Colfax stations are almost diametrically opposite each other in this ring. Six sub-stations located at intermediate points, fed from either or both generating stations, supply radial 22,000- and 11,000-volt feeders which, in turn, serve other sub-stations and consumers within the industrial district.

The flow of the Allegheny River, upon which the plant depends for condensing water, furnishes a natural limitation to the power which may be developed at Colfax. The minimum flow of this river is sufficient to furnish condensing water for 300,000 kW of plant; therefore, the design is such that the power station can be extended on a uniform plan until all the available condensing water has been utilised. To allow for contingencies and spare equipment a development somewhat beyond the minimum is provided for.

The size of the unit chosen, 60,000 kW nominal, is such that the ultimate development may be divided into five or six steps, and when the plant is completed it will not be complicated with a large number of small units.

The first step in the development, which includes one 60,000-kW turbo-generator and seven boilers, has been in operation for nearly two years, and some particulars of its performance during that period will, therefore, be of interest.

The unit of plant consists of three 20,000-kW steam turbines arranged side by side, the high-pressure element at the centre and the two low-pressure elements on each side, with

their condensers below. They work together as one unit, the generators being electrically connected, synchronised, and switched on to the three step-up transformers and through to the 66,000-volt transmission line as one unit.

This is the third 60,000-kW set that the Westinghouse Electric & Manufacturing Co. has built, the first being installed at the 74th Street power house of the Interborough Rapid Transit Co., of New York City, and the second at the Government Nitrate plant at Mussels Shoals, Alabama.

The turbine of the middle element is of the single-flow type, taking steam at 265 lb. pressure and running at 1,800 revs. per minute. The turbines of the outer elements are of the semi-double-flow type, normally taking steam at 55 lb. per sq. in. and running at 1,200 revs. per min.

The condenser consists of four shells, each having 25,000 sq. ft. of surface, and 5,070 Muntz metal tubes 1 in. in diameter. Exhaust steam enters the top of each condenser through an elliptical opening, 14 ft. by 9 ft., and there is a similar opening at the side for the equalising pipe between condensers.

Steam is supplied by seven Babcock & Wilcox boilers (one being spare), each with 20,876 sq. ft. of heating surface and a superheater of 6,700 sq. ft. heating surface. They are the largest that have been built. Steam leaves the boilers at 265 lb. pressure and a temperature of 600 deg. F. Forced draught is used, and the chimney is 325 ft. above the firing floor and 21 ft. in diameter; the flues enter the chimney above the roof of the boiler-house. The boilers are in two rows parallel with the turbine room and the floor is 30 ft. above the turbine room floor. The main steam leader is 20 in. in diameter, with a double expansion bend of 18-in. pipe.

The three-phase electricity generators deliver 23,600 kVA at 85 per cent. power factor and 12,000 volts, 60 cycles. The windings are star connected and the voltage control is secured by a vibrating regulator with its contacts across the rheostats of a shunt-wound exciter and also by a control element, which adjusts by relay switches the position of the motor-operated contact arm of the generator-field rheostat.

There are four step-up transformers, one being spare, each with a capacity of 23,600 kVA, and the low-pressure side is wound for 12,000 volts in delta and the high-pressure sides of 66,000 or 132,000 volts in star. These transformers rank amongst the largest yet made; they are 10 ft. in diameter and 22 ft. high over the terminals.

The management of the Duquesne Light Co. has been so well pleased with the performance of the first set that it is being duplicated, and the design is the same except for a few minor details. This second set will be in operation by October, 1922.

The Colfax power-house is used as a base-load plant at high-load factor, the variations of the load being met by other stations. The same station economies could be obtained when operating under a "swinging" load, but the system of working calls for the Colfax station to be kept as fully loaded as is possible.

During the greater part of 1921, due partly to system-load conditions, and partly to plant conditions, the management was not able to utilise to the full advantage the possibilities of the first set of the plant, but since November, 1922, it has been operating under favourable conditions and giving consistent performance.

The data given below are for the month of April, 1922, and are representative of six months' performance:

Net output	kWh	31,717,000
Peak load	kW	60,000
Load factor	per cent.	73.3
Total evaporation	lb.	118,485,321
Coal consumed	lb.	45,587,998
Coal rate	lb. per kWh	1.4373
B.th.u.	per kWh	18,691
Boiler efficiency	per cent.	77.2
Boiler rate	per cent.	171.4
Flue gas exit temp	deg. F.	463
Feed water temp.	deg. F.	202

Generating costs.—	Per kWh. Mils.
Superintendence and wages	0.58
Fuel	2.78
Miscellaneous operating expense	0.36
Total generating expense	3.72

The maintenance cost is not included because the data are not representative; considerably more time must elapse in order to determine the normal maintenance costs. The labour cost per kWh of output will drop considerably with the starting of the second set of plant. Fuel costs should decrease sharply, due to the reduction in the price of coal, and this reduction may be as much as 30 per cent.

The Duquesne Co. is especially well situated with respect to fuel supply by having available a very high-grade coal from mines owned and operated by an affiliated company, and a margin in price between producer and consumer is thus avoided.

In connection with the fuel consumption the station performance must be given consideration in view of the fact that no economisers or similar heat reclamation apparatus are installed.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Night Landing Light for Aircraft.

A new combined lighthouse and aerodrome landing light, made by the well-known French firm, Messrs. Barbier, Benard & Turenne, has been shown at the London air port in the presence of representatives of the Air Ministry and several of the Naval and Air attachés. It is not very powerful; its lenses are made of the special optical glass for which the firm is famous; and where employed as a landing light, it has important properties. It sheds light over 180 degrees, with a radius of 750 yards, and it cuts off the light at so low an altitude that an airman coming to ground towards the lamp itself would not see the direct beams until his head was on a level with the lamp; in other words, until he was safely landed.

The light (fig. 1) is composed of a third-order lens having a focal distance of 500 mm. and built up of 21 dioptric elements. (The model illustrated is designed for military use, and therefore has a radius of 180 deg. as, in general, military operations call for light in one direction only. A 360 deg. lens could, of course, be supplied if all-round light was required.) The lens is fitted in a metal lantern carried by three adjustable bearings on a four-wheeled (solid rubber tires) truck; the bearings allow the light to be adjusted to the requisite elevation with considerable accuracy and a spirit-level is fitted for plumbing. The light source consists of a d.c. arc absorbing about 130 amperes at 60 volts (7½ to 8 kilowatts) and the carbons which are automatically fed can also be adjusted by hand. The flashing arrangements consist of the usual Venetian-type shutter controlled by a small motor and a cam gear which can be adjusted to give the periodicity required; a separate lever enables Morse signals to be transmitted by hand.

In order that the light may be visible to aircraft flying close in at high altitudes, the top of the lantern carries a fourth-order lens (250 mm. focal distance) built up of six dioptric elements and subtending 360 deg. At the centre of this lens is fitted, in an adjustable carrier to permit exact focusing, a 500-watt metal-filament lamp which is so wired as to flash synchronously with the main beam. The top of this upper lens is closed by a ventilated glass dome. At the back of the lantern is a large inspection door giving easy access to the carbons and their carrier and on the left side is an instrument board with pilot light.

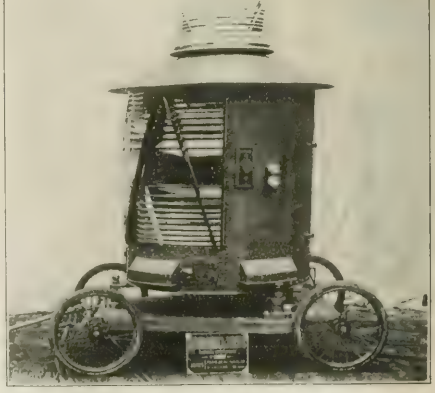


Fig. 1.—Aircraft Landing Light.

When used as a lighthouse, the lantern should be exactly plumb and preferably some five feet or so above the ground, unless situated on an elevation. The main beam has a vertical divergence of about 12 deg. above and below the horizontal line through the light source and the light is visible

to the naked eye at a range of 60 miles in normal European weather, with a considerable extension in dry climates. The light from the upper lens is visible under the same conditions at all flying heights as soon as the upper limit of the main beam has been passed.

When used as a landing light, the flashing device is switched off and the shutters are left open or entirely removed. The lantern should then be installed with its base about five feet above the ground and tilted forward about 12 deg. from the vertical till the upper limit of the beam is horizontal. In this position a semi-circular sheet of light is thrown on the ground giving effective illumination over about 750 yards radius and no direct light is visible to the pilot till his head is level with the top of the lantern. The upper light may still be used as a flashing signal or can be switched off entirely.

The "Wilcox" Tumbler Switch Coupler.

The coupling bar for a pair of tumbler switches illustrated in fig. 2 is the invention of Mr. Edward Wilcox, Beech Works, Heyes Lane, Timperley. It consists of a tube of hard, polished fibre with a hole bored near each end to accommodate the switch dollies. The ends of the tube are tapped to receive cupped screws which retain the dolly-heads securely in position. The couplers are made to suit 3, 5 or 10-A switches.

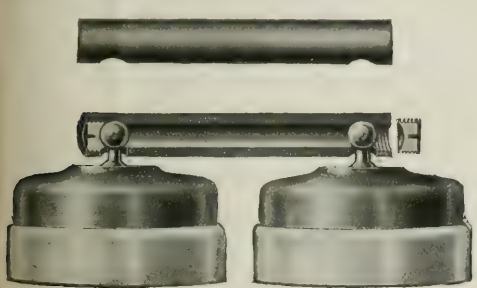


Fig. 2.—The "Wilcox" Switch Coupler.

Voltmeters for Wireless Sets.

It is imperative that the voltage of filament and plate batteries of wireless valve sets shall be checked from time to time. Obviously a combined instrument is most convenient for this purpose, and the Walsall Electrical Co. has filled this distinct want with a two-scale instrument, made up in portable and switchboard pattern. The former (fig. 3) is fitted with contact spike and flexible lead, and the switchboard instrument with terminals and fixing plate. Each instrument reads 0/10 on the low scale and 0/100 on the high. The latter is normally connected in circuit and the former is introduced by a plunger switch at the side of the instrument. Thus there is little fear of the low-scale coil being put on the high voltage. The instruments are neatly finished, and the London agents are Messrs. Lionel Robinson & Co., 3, Staple Inn, High Holborn, W.C.1.



Fig. 3.—Two-scale "Wireless" Voltmeter.

Italian Taxation.—A reduction of taxation burdens as a prelude for the recovery of business pleaded for by influential circles in England is, says the *Elettrotecnica*, much more needful in Italy, where the fiscal regulations by unduly limiting the sale price of energy have lowered the value of electrical, as also other, securities on the Bourse from 1½ above the par value in 1911 to mere par value at the present time. In face of this enormous waste of wealth, the State must eventually end with having either itself to find the money for the new undertakings projected, or, alternatively, concede the needed fiscal relief.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Lightning Conductors on the County Hall.

May I explain, in reply to the letter of "Spark," in the Review of September 1st, that I do not understand how my letter could be read to create "a wrong impression." I simply referred to the fact that the steel framework of buildings had been used as a conductor before the County Hall. On inquiry, it appears that "Spark" is misinformed, in that there are no down tapes fitted to this building, I am surprised to hear from him that the water main only is used for the earth connection. It is a pleasure to hear again from Mr. H. G. Riddell, the electrical contractor, who took great pains in making sound connections bonding the metallic structure of the Mersey Dock Board's office, which occupies, if my memory is correct, the site of an old dock, and the (tubular) earths were sunk in the made ground under the structure. Mr. Riddell is quite right, there were no connections with (Liver) birds.

Killingworth Hedges.

Westminster, *September 13th*, 1922.

["Spark's" reference was to the part played by the National Physical Laboratory, which, he pointed out, did not specify that the steel framework should be used.—Eds. Elec. Rev.]

Estimates for Wiring Installations.

I have noted with interest the communications from Mr. Alan Kirk and "Lodestone," appearing in recent issues of the Electrical Review.

The points raised are of great importance to the electrical industry, and I am pleased to inform your readers that a paper is in course of preparation by members of this Association, which will deal with many of the questions referred to by your correspondents, and will also make reference to the effect of "Ring" prices and good organisation on the high cost of installations.

The paper will be read at the monthly meeting of the Association at the St. Bride's Institute, Ludgate Circus, E.C.4, on December 12th next, and full particulars will be issued through our usual channels. Tickets for the meeting will be obtainable by application to the undersigned.

A. Brammer,
General Secretary,
National Association of Supervising Electricians.

63, Queen Victoria Street, London, E.C.4.
September 12th, 1922.

Therms—and the Gas Bill.

Your excellent article on this subject, in your issue of the 8th inst., puts the whole source of the trouble clearly before your readers, and shows the responsibility of the gas companies as to the modification of burners to meet the changed unit thermal value of a cubic foot of gas.

There is, however, one point on which a question must be asked, namely, "Why therms"?

The gas is measured in cubic feet, and the gas companies state the calorific value of one cubic foot in B.th.u.—why, oh, why introduce in the consumers' bills a multiplication and division of heat units to make up a charge in therms instead of cubic feet of stated heat unit quality?

It looks very like mere cussedness in pedagogic pedantry.

W. Worby Beaumont.

London, *September 13th*, 1922.

The Pamphlet "Labour Trusts."

I have been much flattered by the notice that your reviewer gave last week to my "atrocious literary production," the pamphlet "Labour Trusts." I accept with gratitude the sympathy he apparently holds for me regarding my "endeavours to express my views," my incoherence, and my lack of care and experience in preparing matter for the Press.

I might point out, however, with all humility, that before passing the pamphlet for the Press I handed the proofs to three persons to read through, people who I looked upon as educated. One of them had been connected with technical journalism for many years. It may be that the persons in question got so interested in the contents of the pamphlet that they neglected their voluntary duties as proof readers or it may be that they had the misfortune, from the literary point of view, to have been not "brought up," but "dragged up."

I have in my file nearly 200 letters and press notices regarding the "atrocity," including letters from some people of high standing in the literary, dramatic, journalistic, engineering, and commercial worlds, and it is strange that your reviewer was, so to speak, the "Columbus" who found the

pages of the Electrical Review with examples of my incoherencies.

It is hard, after the learning of so much "midnight electric light . . . and paying washing bills for so many years of "wet . . . ," that my most ambitious effort should have been put on the "Index Expurgatorius." I am not quite alone, as the reviewer of your contemporary, *Engineering*, seems to be in the same dismal literary abyss as myself, as he says some months ago that "the pamphlet would deserve to be printed in full," and "which it is greatly to be hoped will reach a wide circulation."

It is a not unknown expedient of a critic or reviewer, who finds it difficult to make a frontal attack on the statements or arguments of a writer, to criticise the phraseology, the style of the work dealt with, and even the printing, binding and paper; besides, for such treatment only a limited knowledge of the subject in question is required.

If Nature had endowed me with the modern spirit of enterprise I would put a coupon at the end of each copy of the "atrocity" and would offer a prize for the "literary gent" who discovered the most "howlers," though it is probable that even the redoubtable "Captain Coe de Cocoa" would have little difficulty in "spotting the winner."

Your reviewer has, to a material extent, correctly diagnosed my political and social "creed," which I think I can say, has not changed with the weathercock of financial or political expediency. If I was sufficiently adept with my pen and on the platform, with the mixture of soap suds, puffs, hush-ups, and false suggestions so fashionable among "coming men" (photo inset), I might aspire to something almost beyond the dreams of the "Dagos," &c., mentioned by your reviewer, and even outside the range of directors of successful electrical concerns, that is to say, to be put by some great man on the "Honours Free List," which list I judge from the *Morning Post* has for some time been "entirely suspended."

With regard to the "Super-howler" quoted, I have shown it to several people, and so far I have not had to call in the ambulance, and with regard to the significance of the "Woolsack," perhaps your reviewer could obtain the information he wants from our "galloping" Lord Chancellor, or even from some school history book.

Having now been found guilty of a "literary atrocity, and having proved my respectability on more than one occasion by saying "Hang Lenin and Trotsky," the only punishment which could fit such a crime would be a Government concession over the water-power at the North Pole, assisted fraternally by the "nobility and gentry" of Limehouse and Whitechapel.

In sackcloth and ashes, in fear and trembling.

Theodore Rich.

London, *September 18th*, 1922.

The Kilburn Scott Nitrogen Furnace.

When the final report of the Nitrogen Products Committee was published I was in the United States, and only since returning have I been able to investigate a paragraph which appeared on p. 241 in reference to my three-arc furnace for nitrogen fixation. After giving a description of the various features of the furnace, the last two paragraphs read:—

"As the result of trials with a small experimental furnace, it is considered commercially feasible to obtain yields about 50 per cent. higher than the usual yield of 50 to 60 gms. of HNO_3 per kW-hour obtained with standard types of single-phase furnaces (*Journal* of the Society of Chemical Industry, 1915, Vol. 34, No. 3, and 1917, Vol. 36, No. 11).

"According to the information available to the sub-committee, the results of recent trials carried out with a three-phase furnace of about 300 kW capacity have not fulfilled the expectations based upon the working of the small-scale experiments."

There is no doubt that the 300-kW furnace referred to is the one installed at Messrs. Kynochs's work, at Birmingham, in 1917, because it happens to be the only one I have designed of that size. It was carefully tested by Mr. H. Robinson, and I [illegible] be known of the above-mentioned adverse paragraph he wrote to the secretary of the Nitrogen [illegible] as follows:

[illegible]

of the furnace as far as it had gone.

[illegible]

cent. higher yield to be quite sound, and I, personally, have no doubt that this type of furnace will give more than 90 grammes per kWh. My confidence is based on the fact that I have obtained on several occasions over 100 grammes per kWh with an input of 120 kW., which, owing to limitations on the plant, was the average power available during the research.

I [illegible] pleased to give any further information which may be desired.

Yours respectfully,

(Signed) H. Robinson.

He also wrote in much the same terms to the editor of *The Times*, but it appears that his letter was not published.

In June last I wrote to Mr. R. T. C. French, saying that owing to being away in the States, I had recently seen a copy of the above and asking if anything could be done officially to correct the impression given by the paragraph in question. In the letter I said:—

When the final tests were made, the readings of energy were read on an accurately calibrated Chamberlain & Hookham meter installed in the power house and by observers who were quite independent of the tests, being made at the nitrate plant. This meter in the power house recorded all energy going to the furnace, its choke coils and pilot sparking device, and energy for auxiliary operations in the nitrate plant, and it should be noted that the energy of these accessories was relatively large, compared with the input of the furnace.

In addition, the meter recorded the losses in the step-up transformers and in half-mile of cable between the power house and the nitrate plant, and this cable, &c., limited the input to the furnace to about 120 kW. Even with these losses added in, yields over 100 grammes were obtained, whereas I only claimed 50 per cent. increase on 50 to 60 grammes.

I afterwards saw Mr. French, and he said that when the report was published the Nitrogen Products Committee was disbanded and correspondence arising out of the report was merely filed away.

Mr. H. Robinson has written me the following further explanation regarding the incorrect meter reading:—

The power records could be obtained at two points: one on the low-tension side of the system at Witton, which thus included the losses in transformer, transmission line and choke coils, and the other at Holford on the high-tension board, which for some reason never ascertained, read over 100 per cent. higher than the low-tension board. As the high-tension board readings were always available at a moment's notice and the readings from Witton were sometimes delivered a few days after registering, we used the Holford readings for comparison in our experimental work in building up efficiency in the furnace and towers.

It was not until the beginning of 1919 that this matter was taken up, when standard instruments were installed to check the low-tension board at Witton, and a series of tests made with independent observers taking readings with the standard instrument and the low-tension board instrument simultaneously with the Holford readings. These observations established the fact that the Holford meter read 2.02 times higher than the Witton end.

Checking some of our past experience with this factor, we found we had obtained over 100 grammes per kilowatt-hour on several occasions. One eight-hours' run for absorption experiments gave an average of 83 grammes per kilowatt-hour. We also had a satisfactory run at 83 grammes per kWh, and at least two test records of 106 grammes per kWh appeared amongst the records.

I may mention that even when the furnace was worked without the preheater or the cooling boiler in operation, the average of a 7 hours' run was 83 grammes per kW hour, and for this the kW reading included the losses in the step-up transformer and in half-a-mile of cable from power house to nitrate plant. With these allowed for, the yield would be at least 10 per cent. higher.

E. Kilburn Scott.

London, *September 5th*, 1922.

Weldrics, Ltd., v. Quasi-Arc Co., Ltd.

Our attention has been called to a paragraph in your issue of 8th instant relating to an action brought by Weldrics, Ltd., against our clients, the Quasi-Arc Co., Ltd., which action was dismissed with costs against the plaintiffs.

We have to inform you that the statement appearing in your journal that the judge showed by the correspondence which was put in evidence that the Quasi-Arc Co. limited their claim to the use of blue asbestos in the form of yarn is incorrect and calculated to cause considerable damage to our clients.

We have, therefore, to request you to be good enough to insert this letter in your next issue.

Downer & Johnson.

London, *September 18th*, 1922.

The Sandblom Electric Hammer.—Some of the advantages possessed by the Sandblom electric scaling hammer over the hand and pneumatic hammers in the removal of scale and rust from ships' sides were demonstrated at Messrs. R. and W. Hawthorn, Leslie & Co.'s dry dock at Hebburn on September 9th. Mr. E. M. Andrews, secretary of Electric Scaling Hammers, Ltd., of London, conducted the demonstration. By arrangement with Messrs. Alfred Holt, who were represented by Mr. Turnbull, a square yard of rust-encrusted plate on the bottom of the s.s. *Lycaon* was marked out and was tackled by the electric hammer in the hands of an experienced operator. Within 7⅛ minutes this portion of the plate was perfectly and smoothly cleaned of rust without the slightest harm being done to the plate. A hand hammer would have taken about an hour to do the work. A square yard of plate was then cleaned with a pneumatic hammer, but this method took about 15 minutes. Mr. Andrews directed attention to a lighter type of hammer specially adaptable to boiler cleaning, with which, it is claimed, a boiler can be thoroughly cleaned in a third of the time, and therefore much more cheaply than with the hand hammer.—*Newcastle Daily Journal.*

AN ELECTRIC BAKING OVEN.

The Automatic Reel Type.

For many years past electrical methods have been finding their way into the bakery and confectionery trades in spite of the high charges which it is the custom of electricity supply authorities to make for electric power and heating. The fact that electrical methods have been introduced in spite of this handicap is due to the high-grade product, which can be consistently secured by these means, and so give invariable satisfaction to the customer. In view of the fact that nearly all baking operations in large establishments are carried out at night, the electric baking load would seem to be an ideal one from the electricity suppliers' point of view. It should be one means of assisting in the continual struggle to fill up the valleys in the load curve, and in consideration of its aid in that direction such a demand should be encouraged by charging specially favourable rates for electricity.

There are many designs of baking oven at present in use, and all have in view the consistent production of articles of the highest grade, but great as the improvement has been in methods of handling and preparing the raw food products, and in the constructional design of the oven equipment, none have as yet achieved the perfection of the electrically-heated commercial baking oven. With this oven the results are uniform and the food is more thoroughly cooked.

The heat can be confined to the oven in a manner which is impossible except with electricity as the source of heat, and this leads to greatly improved sanitary conditions in the bakehouse.

The popularity of the electric range for domestic purposes is now thoroughly established, and when designing a similar equipment for the bakery trade electrical engineers have spared no time or expense in experimental work, with the result that appliances are now available that demand the serious consideration of those engaged in the bakery and confectionery trades.

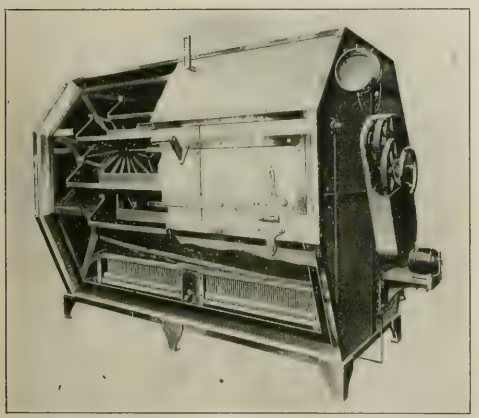


Fig. 1.—Electric Oven, showing Shelves and Heating Elements.

The oven illustrated (fig. 1) is manufactured by the Westinghouse Electric & Manufacturing Co., of Pittsburgh, U.S.A., and is sold in this country by the Metropolitan-Vickers Electrical Co., Ltd. The automatic electric bake oven is built entirely with *heat-insulated panels*. The outer covering of the panel is of heavy gauge galvanised iron; the inner covering is of non-corrodible steel. Outside the galvanised panels are placed sheets of steel finished in three coats of white vitreous enamel baked at 1,700 deg. F., which are held in place by nickel-plated straps and angle iron, thus giving a clean finish to the whole apparatus. The high temperature at which the enamel is baked on ensures that it shall be unaffected by subsequent use of the oven.

Inside the baking chamber is a revolving reel, which supports eight shelves, each 11 in. wide by 71 in. long, perforated to allow free circulation of the heated air between the baking tins. The rubbing parts are made of a special lubricating metal consisting of bronze graphite, and the reel is driven by means of an electric motor through a train of gears; special attention has been paid to the elimination of noise and of friction. The gears are entirely enclosed, and the motor is started and stopped by means of a snap switch; the oven door can be opened and closed with one hand, it is thoroughly heat insulated, and is balanced by means of counterweights fitted inside the oven. The open door forms a shelf at just the right height for use in loading and unloading the oven. The oven is simple and automatic in operation. To indicate the temperature a thermometer with a hand-set indicator is fixed in such a position as to indicate the true temperature of operation, which is controlled by a thermostat, the pointer of which can be set at any temperature required. All that is needed is to set the thermostat pointer and to push a switch button marked "on," and when the baking temperature is reached, the temperature-control equipment operated by the thermostat maintains it continuously and entirely automatically at the point at which the thermostat pointer has been set. When the oven has been loaded and the door closed the reel need only be kept revolving during the baking period; the temperature being maintained constant and the conditions the same, every batch can be made to turn out perfectly, evenly raised, uniformly and richly browned, and thoroughly baked. Actual results obtained by practical bakers show that the automatic reel electric oven is economical in use. It has been shown that the amount of flour required to turn out a specified number of loaves was actually less than with ovens previously installed, and the saving represented by the additional loaves was more than sufficient to pay for the electricity used. Further, the electric oven is constructed to retain the steam driven out of the loaves, so it is unnecessary to inject live steam into the oven, and the use of a steam boiler can thus be avoided. Practical bakers will recognise this as a matter of no little importance. The simplicity of operation necessarily reduces the labour cost—another economy of considerable moment, and the cleanliness and absence of external heat mean healthier conditions in the bakehouse, and they, in turn, affect the quality of the product.

A demonstration model of this newest of electric baking ovens is being erected in one of the most up-to-date bakeries in this country, and considering the advantages set out above the general use of electric bread-baking ovens automatically controlled should not be long delayed.

THE ELECTRICAL SITUATION IN RUSSIA.

According to a Moscow correspondent of a Russian newspaper published in Berlin, many years will be occupied merely with the preparatory works in connection with the proposed electrification of Russia. Apart from this statement, the Russian newspapers themselves show that but little progress is being made, particularly owing to the scarcity of money.

The Council of the National Commissioners a little time ago granted a credit of 6,500,000 gold roubles to the State Electrical Bureau, and of this sum only 12½ per cent. had been paid over by August 1st, 1922. As a consequence the constructional programme has been further curtailed. It has also been necessary to leave in abeyance the schemes for improving the central stations at Petrograd and Moscow, and in other large centres, while there is naturally no question of supply being rendered available for villages, as conceived in the original programme.

A fresh examination of the problem is reported to have been made by the State Electrification Commission, which recently issued a report on the question in which were enumerated the works carried out in recent years.

Among the latter the report mentions the following: (1) The Schaturskaja works, which is 80 miles distant from Moscow and is situated on a large peat moor in the district of Rjasan. It is capable of being extended to 100,000 kW in the future. (2) The Kaschirskaja steam power generating station on the river Oka, about 68 miles from Moscow. The plant installed comprises two turbo generators, each of 6,000 kW, and the supply of current is to begin this year; extensions to 60,000 kW are possible. (3) The Bogorodsk peat fuel station of 20,000 kW. Mention is also made of the Moscow works, which is very old and defective, and is equipped with nine turbo-generators of a total of 51,000 kW, which will soon have to be replaced by new machines. Since 1919 the boiler furnaces have been fired with wood in place of naphtha, but the wood supply is also very defective.

The peat power station of Utkina Saivodj, on the Neva, which is to supply Petrograd, is a new works, which has probably now been set in operation. It is equipped provisionally with plant of 10,000 kW. Besides this there is a steam-power station of 6,000 kW in the Ural, and a large number of small stations, representing a total of 20,000 kW, were brought into use between 1917 and 1921, the plant having been mostly transferred from idle factories and supply works.

As compared with this situation of affairs it is mentioned that there were about 6,000 electricity works in Russia in 1913, of a capacity of from 1,800,000 h.p. to 1,900,000 h.p., and producing about 5,000,000,000 kWh per annum.

Coming to consider the question of manufacturing, the report states that the native works in pre-war times only produced small generators. Thus in 1913, for instance, the output was 14,000 dynamos and motors of a total of 311,000 kW, but the production has enormously declined in recent years,

while the imports have practically ceased excepting certain turbo-generators, which were imported in 1916-1917.

It will be necessary in future for a long time forward to procure from abroad the plant and machinery required in connection with the preliminary works of electrification. The first section of the general scheme comprises the erection of 20 steam-power stations of a total of 1,100,000 kW and 10 hydro-electric works of 640,000 kW. It is calculated that these works will require the provision of 6,000,000 barrels of cement, 150,000,000 bricks, 131,000 tons of iron and steel, 41,000 tons of copper (in machines), 2,000,000 insulators, turbo-generators of 1,100,000 kW, boilers of 170,000 square metres heating surface, and hydraulic turbines with generators for 640,000 kW. The hope is entertained in Russia that American and German firms will assist in the execution of the scheme—by the grant of long credits—in the supply of machinery and plant.

On the latter point it was recently reported that the Siemens-Schuckert works had granted credits to the Russian State Electricity Trust in the form of deliveries of machinery. This statement has now been contradicted in Berlin, where it is mentioned that in the case of former small orders placed by the Russian Government the Berlin firms always demanded payment in advance.

THE SHEFFIELD ELECTRICITY SUPPLY UNDERTAKING.

Annual Report, 1921-22.

The Sheffield Corporation electricity supply undertaking (engineer: Mr. S. E. Fedden), which is third in point of size in the United Kingdom, has again had a successful year, although the net profit was reduced to an enormous extent. Having regard to the vicissitudes through which the city and its staple industries have passed, this is not to be wondered at—indeed, the result may be considered very satisfactory.

The revenue for the year ended March 31st last amounted to £753,148, as compared with £982,546 in the previous year, a decrease of £229,398. The working expenditure did not fall in the same proportion being £150,089, as against £618,005, a decline of £167,916. The bulk of the decrease in revenue was due to the falling off in power consumption, although the lighting and heating income was also smaller, due apparently to reductions in price. The principal decrease in working costs was, of course, due to the smaller coal consumption, the cost of coal (including ash-handling) falling from £402,050 to £246,507. Management and distribution costs showed a small increase, but the costs of repairs and maintenance were lower at £40,399.

The gross profit of £303,059, compared with £364,541 in 1920-21—a decrease of £61,482. Interest and sinking fund payments were higher than in the previous year, absorbing £260,887, as against £232,251, and the net result was a profit of £11,225, which was £95,469 less than the net profit shown in 1920-21.

The installation and motor revenue account showed an income of £43,308 (£99,479), and an expenditure of £20,288 (£22,535), leaving a gross profit of £3,715 (£12,077). Capital charges reduced this balance to £599 (£9,636).

The two balances transferred to the appropriation account, together with an amount of £39,098 from the reserve fund, made a total of £50,922. This was distributed as follows:—Interest on reserve fund investment, £922; rate relief, £30,000; and to renewals and special expenditure fund, £20,000. This last fund now has a balance of £89,813; other balances are:—Reserve fund, £45,766, motor and cooker hire fund, £2,209; sinking fund, £89,051; and stock extinction fund, £260,108.

The expenditure on capital account during the year totalled £234,986; this included £112,119 for mains, £49,294 on equipments and transformers, and £36,469 on machinery and plant for the Blackburn Meadows station.

The total number of kWh sold was 163,170,062, a decline of 38,191,639 or 37 per cent. This decrease was practically accounted for by the smaller sales of energy for power purposes, *viz.*, 67,407,652, as against 100,978,107 kWh. The average price obtained per kWh was 1.74d., as against 1.65d., there being an increase in the price obtained for power, and a decrease in lighting and heating revenue.

The plant capacity now stands at 93,000 kW, and the total connections at the end of the year were equivalent to 203,082 kW. The number of staff and workpeople employed is 874, and last year wages and salaries amounted to £186,666.

Cast Iron Research Association.—We have received from the British Cast Iron Research Association, Central House, New Street, Birmingham, a short report upon work carried out for members (Booklet 3). This is a concise review of the way in which a large number of queries are dealt with. The questions cover a wide range, and deal with production of cast iron, treatment, and moulding.

REVIEWS.

Boiler Plant Testing. By David Brownlie, B.Sc. Pp.104+168; illustrated. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

In presenting this book the author has endeavoured to make out a strong case for a standard international code of boiler-plant testing, and as plainly indicated in his choice of a sub-title, the work is intended as a criticism of the present boiler-testing codes, with suggestions for an improved code which could be adopted internationally.

The work is divided into four parts: the first deals with the results at present being obtained on boiler plants in general, the second is a frank criticism of existing codes, with suggestions for improvement, while the third section is mainly suggestions for new features that may be added in the future to an international code, the author concluding with a fourth part on the design of a new and improved code as a suggested basis for the international code. The Report of the Institution of Civil Engineers' Committee, or the "Civils" code, to use a more homely phrase, comes in for some very severe criticism throughout the book, and in fact one rather wonders whether the author has left even a single paragraph intact, or indeed whether it would not be better to collect the shattered fragments of the code after the author's destructive attack and consign them to the furnace as far as their value for practical testing is concerned. The American Society of Mechanical Engineers code, too, does not escape unscathed, although the author is a member of the society, and obviously considers that its Power Test Committee's findings are more up-to-date and generally superior on the whole to the "Civils'" code.

The first part of the book, which is devoted to a study of the results at present being obtained on boiler plants in general, is most interesting, being based upon the results of the author's investigations on some 400 different plants, representing over 1,500 boilers at work in no less than 41 different industries. The true average net working efficiency of the whole of these 400 plants is only 58 per cent., and the figures given appear to be thoroughly representative of ordinary boiler plants in Great Britain.

This efficiency figure may come as a rude shock to many engineers, but there is no doubt whatever that one is accustomed to see exaggerated boiler-test figures published in engineering literature supposed to be above suspicion; while such "stunt" figures can be obtained, they cannot be maintained in everyday practice. The quality of the fuel used is of great importance, and the author shows that if coal of 12,000 B.th.u. per lb. deteriorates, say 10 per cent. to 10,800 B.th.u., then the loss of evaporation in practice will probably be some 15 to 17½ per cent., and conversely a 10 per cent. increase above 12,000 B.th.u. will give a similar increase in evaporation above 10 per cent. In the section devoted to proposals for a future international code Mr. Brownlie proposes the use of a standard curve of efficiency correction for the diminishing heat value of the fuel, so that the correction figure would increase as the fuel quality decreased. The necessary data would have to be obtained experimentally for typical coals, and as regards British coals, perhaps this matter could form the basis of an investigation at H.M. Fuel Research Station at Greenwich. In connection with the calorific value of fuels, the usual phraseology of coal of so many "B.th.u.'s per lb." is freely used in the text without any distinct qualification as to whether the gross, net, or other specific calorific value is intended. This is a very usual custom, perhaps, but in view of the fact that even experts cannot agree as to standard expressions of calorific value, it seems very necessary to state which particular basis is intended when quoting the heating value of any fuel.

The author apparently uses a Mahler-Donkin bomb calorimeter, and tests the damp coal as fired, thus obtaining the gross calorific value, which includes the latent heat of the steam in the bomb. This value has apparently been used in working out all the tests in order to prevent confusion and simplify results. Regarding the percentage of ash obtained from the boilers when checking results, one cannot be certain that the percentage will always in practice be higher than the absolute non-combustible matter as obtained in the laboratory, although, theoretically, it is, of course, impossible to ensure complete combustion. Figures of 1 to 2 per cent. of combustible matter in the ash are not so easily obtained in general practice, and 5 per cent. is unfortunately not so uncommon as might be supposed. But the correct sampling of the ash and clinker after a trial is a difficult matter unless the whole of the non-combustibles are thoroughly crushed and mixed, although the author does not mention this point, or the fact that with some coals an appreciable quantity of dust and gritty matter is carried away with the furnace gases, and cannot appear as ash in the ash pits.

An interesting coal balance sheet is given for Great Britain, from which one gathers that we consume approximately 90 million tons of coal annually for steam generation alone, or about 48 per cent. of our home consumption. To show the necessity of better boiler management, Mr. Brownlie estimates that only 6½ million tons are being burnt

at 70 per cent. efficiency or over, 13 million tons at from 65 to 70 per cent. efficiency, 15½ million tons at 60 to 65 per cent. efficiency, 21½ million tons at 55 to 60 per cent., 18 million at 50 to 55 per cent., and 15½ million tons at less than 50 per cent. efficiency. These figures are lamentable when one considers that modern boilers and economisers can be operated at a figure of about 75 per cent. efficiency under modern conditions with proper supervision and appliances.

In the second portion of the book we are treated to a very healthy criticism, both destructive and constructive, of existing boiler-testing codes. The idea that boiler testing is a complicated and difficult operation, involving a superior knowledge of chemistry and mathematics, must arise in the mind of the engineer after a study of the "Civils" code, and the author makes it plain that on these grounds alone he is not in sympathy with the code. Boiler-plant testing ought to be regarded as a thoroughly practical proposition, which is necessary to secure economy and save money.

After discussing various sections of the codes the important question of the sampling and analysis of the fuel is considered at some length, as naturally so much depends upon accuracy in this matter. Sampling is, after all, largely a matter of common sense, and the suggestion is made that two separate samples should always be taken and the results worked out on the average of the analyses. The "Civils" code decides that the efficiency calculations shall be worked out on the lower or net heating value of the fuel; whilst the American "Mechanicals" code takes the simple or gross value of the dried coal as determined in an oxygen bomb calorimeter. The Barrus calorimeter given in the list of apparatus required in the "Civils" code is not, of course, a fuel calorimeter, as is supposed by the author, and the code does not recommend any specific make of calorimeter, although it states that a compressed oxygen bomb type should be used. The question of gross and net calorific values is fully discussed, and Mr. Brownlie considers that the chief objection to the method of using the calculated net or lower heating value is the necessity of carrying out a complicated and troublesome chemical analysis of the fuel in order to determine the percentage of hydrogen contained. Boiler-plant testing is, after all, a practical business for engineers, and the suggestion of abandoning the calculated net or lower calorific value in the proposed international code would certainly simplify matters, as is done in the existing American code. The method of taking the gross heating value determined in the oxygen bomb calorimeter on the dried fuel and then correcting for the moisture contained in the coal, is a much simpler proposition in practice, and has much to recommend it, although, if the correction for evaporation loss is included, it is necessary to fix the upper and lower temperature limits for the furnace conditions. Strangely enough, the author does not actually criticise the "Civils" formula for the calculation of the net value, nor does he even quote the paragraphs in Appendix II of the Code wherein the exact methods of calculation are laid down on the assumption that the water condensed in the bomb is cooled to 60 deg. F., and that the moisture and hydrogen have been properly determined. The "Civils" method is essentially academic, and is only correct for certain specific conditions, and one cannot but feel that the extra trouble and complications involved are not worth while in the practical testing of boiler plant, whilst the difference in the calculated efficiency is only of the order of 3 per cent.

With regard to methods of flue gas analysis, both Codes are considered to be out of date, as they favour the use of hand apparatus such as the Orsat, and disparage combustion recorders. The author's experiences with CO_2 recorders appear to have been very happy indeed over a period of twelve years or so, although the names of the particular instruments are not given in the text. Later the author states that only within the last few months has a continuous gas analysing machine for CO_2 and CO been perfected in Stockholm and placed upon the American and British markets under the name of the "Duplex Mons" automatic gas analysing machine.

Methods of measuring the boiler feed water are considered in detail, and the question of the determination of the moisture in the steam is discussed. This latter determination is important where superheaters are not in use, and the author criticises the methods of steam calorimetry recommended in both of the Codes, and suggests that owing to the difficulties of obtaining accurate results, the determination of moisture should be abandoned in the International Code. With regard to the specific heat of superheated steam, it is suggested that Knoblauch and Jakob's figures should become the standard, and no mention whatever is made of Callendar's data on the subject. The question of steam tables for the proposed International Code has not been dealt with, although, of course, there is not a great deal of difference on the whole between such authorities as Callendar, Marks and Davis, and Smith and Warren, yet it would seem desirable to secure unification on this matter in an International Testing Code. In working out the evaporation of the boiler, the usual figures of actual water per lb. of coal and water "from and at 212 deg. F." are given in both Codes, but Mr. Brownlie suggests that in the International Code a new figure of "lbs. of water from and at 212 deg. F. per 1,000,000 B.th.u." should be included in order to obviate the error due to the varying heating values of different fuels. Both Codes are considered to be unnecessarily complicated in the methods [illegible] the results of the tests, the actual heat [illegible] unnecessary and immaterial in [illegible] the author's opinion. More modern methods of calculating the results are given in the text, and they are certainly fairly simple.

The author's treatment of the subject throughout is very sound, and his criticisms of the existing Codes should appeal to engineers who have had much to do in connection with power plant tests. There are one or two obvious errors in the text, but on the whole the book is lucidly written and well illustrated, and it should prove valuable to boiler-house superintendents and power-plant engineers generally.

M. J.

Elementary Determinants for Electrical Engineers. By Herbert P. Few. Pp. 98; figs. 32. London: S. Rentell and Co., Ltd. Price 4s. net.

Many electrical problems reduce to a set of simple simultaneous equations, and it is then always possible to arrive at the solution by any of the usual methods for eliminating all but one of the unknown quantities, but frequently such methods call for a considerable amount of algebraic manipulation and arithmetical computation, so that the process becomes lengthy and laborious. But if the terms of the set of equations be arranged in a certain order, it is possible to derive mechanical rules by the aid of which all the unknown quantities may be evaluated. By using these rules all the algebraic operations on the original equations necessary to secure solution are avoided, and only the arithmetic peculiar to the problem remains. To evolve and understand this mechanical rule it is necessary to discuss the relationships that exist between the coefficients of a set of simultaneous equations, for which purpose a special concise form of notation is adopted; this section of mathematics is known as determinants, and is perhaps not sufficiently well known by those who would regard mathematics as a tool for practical use, for in many books on practical mathematics it receives no mention. While it may be admitted that determinants are not essential in everyday practical calculations, yet they may be exceedingly useful as a labour-saving device when certain types of problem are frequently met with. It is with the object of emphasising the advantages of the determinant method in certain problems of direct interest to electrical engineers that this little monograph on the subject has been written.

The scope of the book is practically limited to the solution of simple simultaneous equations, the matter being very clearly and logically arranged and profusely illustrated with practical electrical examples.

Starting with a statement of the advantages of the use of determinants, the ordinary method of solving two or three simple simultaneous equations is explained and illustrated by simple examples involving Kirchhoff's laws. The determinant notation, the rule of Sarrus, and the mechanical rule for evaluating the unknowns in three simultaneous equations are then explained. The application of the method to simple practical examples is assisted by the use of Clerk-Maxwell's rule for current values in networks. Some of the important principles and properties of the determinant notation are then discussed, leading up to the evaluation, in a routine manner, of determinants of any order.

The remainder (about one-half) of the book is devoted to the practical application of the determinant method in solving problems on Wheatstone networks as employed in measurement and testing, on telegraph and telephone circuits, power networks, magnetically-coupled circuits in radio work, and in various interesting academic problems on resistances of networks.

The book is well produced, clearly written, and is interesting, and should be very useful to those who are continually meeting with problems such as are treated therein. Each chapter is followed by a number of examples to be worked, and to which answers are given.

One criticism may be made, viz., many of the worked and set examples involve considerably more knowledge than that which, judging from the preface, the reader is expected to possess. It is stated in the preface that "no knowledge of algebra beyond that involved in the solution of simple equations is required of the reader," yet in the second half of the book will be found mention of trigonometrical expressions, logarithms, factorial notation, exponentials, imaginary quantities, calculus notation, and a differential equation of the second order. In view of the advanced and specialised nature of some of the problems discussed, a reader whose mathematical equipment is limited to simple equations is hardly likely to be interested in such problems. The foregoing quotation is true as regards the bare determinant principles treated in the book, but is certainly not applicable to a large proportion of the practical examples; indeed it is an unfortunate sentence, and would be better omitted.

The modern symbol for $\sqrt{-1}$ is j; the use of the older symbol i is particularly inadvisable in a book whose main theme is the solution of electrical problems in which i is constantly being used to denote current.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Copies [illegible] obtained by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

[illegible] Western Electric Co., Ltd. (Western Electric Co., Inc.) September 8th.

23,785. "Radio receiving apparatus." H. T. Inston and S. Peplow. September 1st.

23,793. "Electric switch actuating mechanism." H. P. McColl. September 29th, 1921.

[illegible] W. Lawrence and Mayer [illegible] September 2nd.

[illegible] R. A. Fribergen. September 2nd.

23,823. "Electric switchboards." P. J. Gates. September 2nd.

[illegible] L. A. Ferguson and L. A. Mayer. September 2nd.

23,832. "Brush holders for dynamo-electric machines." W. F. Grafton. September 2nd.

[illegible] "Wireless signals." W. Isaacson. September 2nd.

23,847. "Sparking plug for internal-combustion engines." A. H. Price. September 2nd.

23,857. "Time switches, &c." Landis & Gyr Akt. Ges. September 2nd. (Switzerland, September 3rd, 1921.)

23,866. "Manufacture of sparking plugs." H. G. Longford and Sphinx Manufacturing Co., Ltd. September 2nd.

23,874. "Electric switches." J. Anderson. September 2nd.

[illegible] "Receiving [illegible] for wireless telegraphy." F. Harrison. September 4th.

23,910. "Electric lamp holder." M. Endeau. September 4th.

23,928. "Electrical transformers." Metropolitan-Vickers Electrical Co., Ltd., and A. E. L. Scanes. September 4th.

23,929. "Means for testing ignition and sparking plugs for internal-combustion engines." J. W. T. Cadett. September 4th.

23,931. "Recuperable electrolytic cell." C. F. Buffard. September 4th (France, September 15th, 1921.)

23,941. "Method of signalling over telephone conductors." Siemens and Halske Akt. Ges. September 4th. (Germany, September 5th, 1921.)

23,970. "Controlling devices for dynamo-electric machinery, &c." J. H. Whittaker Swinton. September 4th.

23,977. "Electrolytic gas generating systems." J. P. Scott. September 4th.

[illegible] "Electric heat apparatus." F. Sorgues. September 4th.

24,001. "Resistances for wireless apparatus." G. Shaw. September 5th.

[illegible] "Switches for alternating currents." F. F. Wall. September 5th.

24,016. "Device for indicating temperature of windings, &c., of electric machines." E. Schroder. September 5th.

24,017. "Device for indicating temperature of windings, &c., of electric machines." E. Schroder. September 5th.

[illegible] "Electric motors." A. H. Reading. September 5th.

24,029. "Crystal detectors." R. L. Murray. September 5th.

24,038. "Electric machines." W. C. Lindemann. September 5th.

24,051. "Flexible torque couplings and electric locomotives employing same." H. G. Dempster. September 5th.

24,052. "Magneto brush and force feed attachments for internal-combustion engines." W. Martin. September 5th.

24,061. "Electric switches." F. Handley and O. Lucas. September 5th.

24,063. "Sparking plugs." J. Kurcharek. September 5th.

[illegible] "Electric [illegible]." New Antwerp Telephone and Electrical Works. September 5th. (Belgium, September 8th, 1921.)

24,079. "Electric radiators." G. H. Collins and H. F. Collins. September 6th.

24,086. "Inductance coils for wireless receiving apparatus." S. H. V. Abbott and E. W. Scammell. September 6th.

24,087. "Magnetic separators." S. B. Morgan. September 6th.

24,094. "Electric foot and food warmers." T. Shepherd. September 6th.

24,103. "Hydraulic telemotor system." J. Patterson. September 6th.

24,116. "Telephones." A. T. Collier. September 6th.

24,122. "Receiving apparatus for wireless signalling." H. P. P. Rees. September 6th.

24,135. "Rectifying devices." A. R. Angus. September 6th.

24,149. "Steam turbines." Metropolitan-Vickers Electrical Co., Ltd. September 6th.

24,150. Electric power shovels." Metropolitan-Vickers Electrical Co., Ltd September 6th. (United States, September 12th, 1921.)

24,165. "Electricity meters." Chamberlain & Hookham, Ltd., and S. James. September 6th.

24,170. "Emergency device for escalators, &c." Otis Elevator Co, and Waygood Otis, Ltd. September 6th.

24,171. "Emergency device for escalators, &c." Otis Elevator Co. and Waygood Otis, Ltd. September 6th.

24,180. "Electrically-propelled invalid carriages, &c." J. & A. Carters, Ltd., and L. W. G. Payne. September 6th.

24,196. "Electron discharge devices." J. Gray. September 6th.

24,187. "System of wireless transmission and reception of energy." H. Kirschfeldt. September 6th.

24,189. "Aerials for reception of wireless waves." B. E. Major. September 6th.

24,196. "Hand irons." Electric Heating and Hardware, Ltd., and F. J. Wineberg. September 7th.

[illegible] "Electric [illegible] tubes, &c., for producing electricity, &c." T. M. Adair. September 7th.

[illegible] "Control of prime movers." A. H. Railing. September 7th.

[illegible] "Electrically-lighted sewing machine." W. Fairweather (Singer [illegible]). September 7th.

[illegible] "[illegible] for [illegible] telegraphy." [illegible]. September 7th.

[illegible] "[illegible] Co., Ltd., and [illegible]." [illegible]. September 7th, 1921.

24,274. "Galvanic batteries." J. Oldham and Oldham & Son, Ltd. September 7th.

24,275. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. September 7th, 1921.

[illegible] "Electron [illegible]." British Thomson-Houston Co., Ltd. September 7th, 1921.

24,277. "Radiation measuring devices." British Thomson-Houston Co., Ltd. September 7th, 1921.

[illegible] "[illegible] A. H. Stevens and H. G. Thompson. September 7th.

[illegible] "[illegible] telephony." A. E. Mitchell. September 7th.

[illegible] "[illegible] E. J. Dow. September 7th.

24,297. "Burglar alarms." G. B. Carpenter. September 7th.

24,298. "Asynchronous induction motors." T. Torda. September 7th. (Hungary, September 22nd, 1921.)

24,312. "Sparking plugs." G. B. Sykes. September 7th.

[illegible] "[illegible]." Electric Heating and Hardware, Ltd., and F. J. Wineberg. September 8th.

24,346. "Electrically-heated casting irons and tongs for pianoforte construction." T. G. Hems. September [illegible]

24,384. "Controlling device for illuminating electric signs, &c." C. L. Morris. September 8th.

24,388. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 8th. (United States, November 22nd, 1921.)

24,389. "Devices for testing sparking of electric sparking circuits." Edison Swan Electric Co., Ltd., and P. Freedman. September 8th.

24,392. "Systems of connections for coil conductors." Siemens and Halske Akt. Ges. September 8th. (Germany, June 15th.)

24,401. "Electric motor interrupter." Reiniger Gebbert and Schall Akt. Ges. September 8th. (Germany, January 12th.)

24,405. "Systems of connections for coil conductors." Siemens and Halske Akt. Ges. September 8th. (Germany, June 15th.)

24,425. "Electric soldering apparatus and soldering agent for band saws, &c." R. Kapp. September 8th.

24,430. "High-tension spark indicators." J. Schwartz. September 9th.

24,471. "Electrical apparatus for high-frequency circuits." A. H. S. MacCallum. September 9th.

24,477. "Manufacture of electric incandescent lamps." Handelsvennootschap onder de Firma Vogels & Co. September 9th. (Holland, June 26th.)

24,491. "Sparking plugs." J. H. Im Thurn and N. E. Maude-Roxby. September 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

6,167. "Thermionic amplifiers employing resistance couplings." Dr. S. Loewe. February 23rd, 1920. (159,472.)

6,272. "Apparatus for electrically welding the flanges of metal rims of [illegible]." [illegible] February 24th, 1921. (184,822.)

6,326. "Automatic electric cut-outs." O. Szaszovsky. February 25th, 1921. (Convention date not granted.) (159,478.)

10,935. "Three-electrode discharge bulbs or valves." Soc. Anon. Pour l'Exploitation des Procédés Maurice Leblanc Vickers. April 15th, 1920. (161,587.)

11,349. "System of pole-changing for polyphase induction motors." Dr. O. T. Blathy. April, 19th, 1920. (161,973.)

11,375. "Electric battery with depolarisation by means of air." K. Warnon. April 20th, 1921. (184,841.)

11,890. "Furnaces for electric heating." A. H. Pehrson. April 26th, 1920. (162,285.)

[illegible] "Relays." S. M. Day. May 12th, 1921. (184,847.)

13,572. "Wiring systems for electric light and power installations." L. J. Lapsie. May 13th, 1921. (184,849.)

13,865. "Windings for electric transformers and the like." Siemens-werke Luchard Kraft Akt. Ges. and F. Haberle. May 25th, 1920. (163,704.)

13,952. "Wireless receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). May 18th, 1921. (184,562.)

14,143. "Electron discharge apparatus." British Thomson-Houston Co., Ltd (General Electric Co.). May 20th, 1921. (184,875.)

14,151. "Electric current limiting devices." W. H. Glaser and W. H. Glaser, Ltd. May 20th, 1921. (184,876.)

14,324. "Dynamo-electric machines." A. H. Midgley. May 23rd, 1921. (184,889.)

14,561. "Electric discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). May 25th, 1921. (184,903.)

14,573. "Wireless signalling." C. S. Franklin and P. P. Eckersley. May 25th, 1921. (184,904.)

14,777. "Ignition magnetos for internal-combustion engines." British Lighting & Ignition Co., Ltd., and E. O. Turner. May 27th, 1921. (184,905.)

14,858. "Shock-absorbing supports, suitable, for example, for head-lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). June 3rd, 1921. (184,917.)

15,645. "Magneto-electric machines." R. Bosch Akt. Ges. June 7th, 1920. (164,344.)

15,869. "Electromagnetic stop motions for textile machinery, such as roving or the like machines." W. Whitehead, N. Whitehead, C. Smith, and I. W. Varley. June 9th, 1921. (184,262.)

16,062. "Flow meters." British Thomson-Houston Co., Ltd. (General Electric Co.). June 10th, 1921. (184,926.)

16,243. "Electric motors." British Thomson-Houston Co., Ltd., and F. H. Clough. June 13th, 1921. (184,931.)

16,442. "Sparking plugs of internal-combustion engines." H. Lodge. June 15th, 1921. (184,934.)

16,569. "Automatic electric-circuit breakers." A. H. Railing, A. E. Angold, and H. C. Turner. June 16th, 1921. (184,935.)

16,619. "Operation of processes and cells for electrolytic decomposition of alkali salts." M. Wilderman. June 16th, 1921. (184,938.)

16,833. "Means for reducing irregularities in the voltage generated by direct-current generators." G. Sutton. June 20th, 1921. (184,941.)

16,889. "Lamp holders for electric incandescent lamps." Dr. A. H. Mollik and Merz-Werke (Geb. Merz). October 18th, 1920. (170,552.)

17,008. "Electric switch boxes." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th, 1921. (184,950.)

18,126. "Method of and apparatus for cleaning the discharge electrodes in apparatus for the electrical precipitation of suspended particles from gases." Lodge Fume Co., Ltd. (Metallbank und Metallurgische Ges.). July 4th, 1921. (184,959.)

18,311. "Sound amplifiers." A. E. Stebbing. July 6th, 1921. (184,960.)

19,354. "Electric traction." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (184,978.)

20,117. "Devices for locking electric lamp bulbs to their carrier sockets." C. A. Ely. July 27th, 1921. (184,982.)

21,025. "Electric switches." R. Alkan. March 24th, 1921. (Addition to 149,940.) (177,485.)

23,241. "Manufacture of storage battery electrodes." Fuller's United Electric Works, Ltd., and R. E. Beswick. September 1st. 1921. (185,023.)

23,471. "Control of electric lamps for cabinets, desks, and the like." C. J. Barnet and K. O. Davis. September 3rd, 1921. (185,026.)

24,026. "Vacuum tubes and method of making same." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 9th, 1921. (185,030.)

24,782. "Sockets or bases for trolley poles for electrically-propelled vehicles." E. M. Munro. September 19th, 1921. (185,031.)

34,898. "Galvanic cell." A. Heil. December 28th, 1921. (Convention date not granted.) (173,515.)

1922.

179. "Couplings for insulators." British Thomson-Houston Co., Ltd (General Electric Co.). January 3rd. 1922. (185,058.)

395. "Electric radiators." E. C. R. Marks (Fabbrica Apparecchi Elettrici F.E.R.T.). January 5th, 1922. (185,059.)

667. "Locking device for electric lamps." S. D. White and C. W. Saunders. January 9th, 1922. (185,060.)

2,089. "Controlling devices for the motors of electrically-driven vehicles." F. Krupp Akt. Ges. February 4th, 1921. (174,922.)

3,057. "Electric batteries." Soc. Anon. "Le Carbone." April 19th, 1921. (178,804.)

8,215. "Joints or connections of electric cables and the like." J. H. van Viersen. November 1st, 1921. (185,069.)

8,890. "Electric overload protective systems." F. Krupp Akt. Ges. May 26th, 1921. (180,636.)

13,471. "Regulating devices for electric installations." Etablissements de Dion Bouton (Soc. Anon.). June 27th, 1921. (Addition to 178,418.) (182,445.)

16,327. "Relays." S. M. Day. May 13th, 1921. (Divided application on 184,847.) (185,074.)

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TRAVELLING REPRESENTATIVES ABROAD.

AT a time like the present, when the volume of our export trade in general is considerably less than in the years preceding 1914, and when the competition in the world's markets of certain nations which experienced extensive industrial development during the years of war has become more severe, it is most essential that we should make the most strenuous efforts to recover our former position, and to strengthen it wherever possible. This is all the more necessary because certain former markets —Russia, for example—are either temporarily closed or their financial situation has been seriously strained through the effects of the war, or new Customs barriers have been or are being raised against other countries, including Great Britain.

A recent issue of the United States *Commerce Reports* contains a long article by the Director of the Bureau of Foreign and Domestic Commerce, dealing with the necessity for better salesmanship abroad and discussing the personal qualifications which are deemed to be indispensable for the advancement of United States trade with other countries. It is not our intention to deal with the many capabilities which are suggested as the requirements of American travelling representatives, but we may direct attention to one point in particular. This is the employment of naturalised Americans as foreign representatives of American firms. These men have proved to be unsatisfactory because although born in Europe and acquainted with the languages of their respective countries, their family connections and the personal and political antipathies involved in these connections were such as to prevent success in these particular countries. Similarly the engagement of men for the South American countries merely because of their knowledge of Spanish, while they lacked the requisite acquaintance with the goods they had to sell, has also (as might have been foretold) turned out to be a failure; and a similar observation likewise applies to American "hustlers" when sent from the United States to other countries.

The mention of the employment of non-native born travelling representatives has been made particularly for the purpose of referring to a statement which was published from a Lisbon correspondent by a leading German commercial newspaper on August 27th. The German writer there complains that great German industrial firms, owing to the apprehension that as former enemies of Portugal they would now be unpopular with the Portuguese, have entrusted their representation in Portugal to men of foreign nationality, either Portuguese or even Frenchmen and Englishmen. On the other hand, he asserts that certain English firms having a world-wide reputation, who were represented by Germans in Portugal in pre-war times, have now been glad to renew their relations with the latter as their representatives in Portugal. If this statement is correct, it is certainly worthy of investigation, for it is obvious that the needs of British manufacturers can only be best looked after by natives of these islands.

The problem in general is largely a question of markets and the selection of men most fitted to work them. According to the Board of Trade, we have already recovered a portion of the export trade to Argentina and Brazil that had been temporarily lost to the United States during the years of war; but there is still a lot of ground to cover before we wholly regain our former position in these two markets. Latin-Americans possess the remarkable characteristic of attaching importance to the social side of business, or rather to the social side apart from business. Every travelling representative of a foreign firm who wishes to promote the trade of his firm in Latin America has to learn to discuss matters of general interest with his prospective customers before touching the actual question of orders; he has to learn how moderately to entertain these Latin-American customers and to be polite and tactful; but any "hustling" tactics, as the North Americans have found out to their cost, are of no use in South America. So well do the Germans understand the Latin-American character that they have been known courteously to "hang on" to prospective customers for a year before being able to secure an order; but patience, politeness and determination have eventually won the day. Once a representative "gets in," future matters are plain sailing, provided that the representative is the same and has not been replaced by another man; and the competent representative never completely loses touch, as he always makes a friendly call when leaving the vicinity, and also sends a letter or card from a distance.

Under these circumstances it is necessary for the travelling representative to be fairly liberally supplied with funds both for travelling and for social purposes, in addition to a salary which will render him fully contented and stimulate his efforts not to be beaten by any competitor in the same line. Naturally the traveller must be acquainted with the language of the country as well as with the details of the manufactures which he desires to sell, and also be competent to arrange any modifications of manufacture in order to meet the particular requirements of customers without having to refer to the home office for information, save in exceptional cases. The works' trained man, with knowledge of the inside commercial experience of the firm, linguistic ability, and adequate remuneration, appears to be the best man for the position, provided that he possesses the other necessary qualifications.

If the expenditure to be incurred in properly endowing a travelling representative with the necessary facilities for the promotion of business in, say, South America should be beyond the capacity or wishes of firms individually, a way out of this difficulty lies in the constitution of non-competitive groups for sharing the expenses, a co-operative policy which has been advocated in these pages again and again, and one which has been tried by a number of groups in the electrical and engineering industry. As was mentioned in our issue of September 22nd, the F.B.I. has received a letter from Buenos Aires pointing out the desirability of securing joint representation in South America, where some of the largest British houses also act as agents for American goods, to the prejudice of British trade. The correspondent suggests the formation in Great Britain of non-competitive groups in the shape of limited companies, the capital being provided by the participating firms. This would permit of the establishment in South America of large and attractive showrooms and an adequate staff, and the goodwill of the business, which usually reverts to the agent, would be retained by the members of the company. In his opinion such a scheme would be more economical to work than the existing methods. Some previous experiments in this direction are said to have failed because of overlapping on the one hand, and because on the other they did not cover a sufficiently wide field.

Although the days of individual private enterprise are by no means past, there is much to be said in favour of the extension of the system of joint representation in foreign countries. Unless development in this direction takes place now that the conditions of the world have undergone such a remarkable change in recent years, it is to be feared that individual firms in working foreign markets may be unable in the long run successfully to withstand the strength and activity of our greatest competitors—the great corporations and trusts in the United States—while Germany, owing to the depreciation of the mark and the consequent enhanced cost and difficulties of obtaining certain raw materials, looks like gradually losing her power of offering successful rivalry in the markets of the world.

Two Points in the Labour Problem.

Sir Lynden Macassey, than whom we have amongst us few more experienced authorities on trade disputes, has been addressing a conference of works managers, directors, foremen, and forewomen at Balliol College, Oxford. He dissected the Labour problem, and, after disposing of the extremists' suggestions for eradicating the capitalist from industry and showing the failure of syndicalists wherever they had tried to control industry in their own interests, turned attention toward serious proposals for reform.

Sir Lnyden does not anticipate the approach of industrial peace until the unemployment question has been settled, and he holds that the worker has got to be assured also that he is getting a fair share of the products of the industry with which he is connected. The problem of unemployment is older than most of us, and many propositions have been advanced to deal with it—with what result? To-day, as winter approaches, we have unemployment on a deplorable scale, and more works have been lately closing down. If unemployment is a cause of industrial unrest, as we believe it is, it is certainly also the fact that the absence of industrial peace has been the cause of a great deal of the unemployment of the past year or so. We too readily get into the way of looking to the Government to give us a lead in dealing with such problems, and when it was announced a few weeks ago that the Cabinet was considering the question of unemployment and the means for its mitigation during the approaching winter, some may have imagined that the Prime Minister would be able to make a speech which would raise the hopes of the community. But this is too tough a problem to be dealt with hastily while so many things in the international economic situation are unsettled. Indeed the probability is that we should stand a better chance of finding a practical solution if we looked less to the Government and more to ourselves, for business is not revived by Governments however valuable may be the measures of encouragement that they have it in their power to give.

During the past few years leading authorities have advocated the idea of each industry carrying its own unemployed, but we suppose it is not possible to make headway even with that idea until our industries are able to get on to economic production and to carry the burdens that are already strapped about them or to cut the bands thereof. Sir Lynden Macassey supports the legitimate claim of the workers to have a fair share of the products of industry, but unfortunately just now many businesses are fearing that they will have little or no products (profits we presume) to show from the current year's operations because of the slackness of trade due to recent industrial disputations, the international situation, and other causes. It looks very much as though the two points that we have selected from Sir Lynden's dissection of the labour problem are unlikely to be effectively dealt with until we all concentrate on the revival of trade at home and abroad.

The events of the past few weeks in the Near East have temporarily deferred the return of confidence and stability, and have hindered trade revival there; probably other menacing points will arise which must be cleared up before this poor old world will be at rest, but there is much ground for hope for electrical trade revival, and pessimism is unjustifiable here at any rate; possibly the settlement of the Straits question will help to bring order out of chaos elsewhere.

A third point mentioned by Sir Lynden was the conferring upon the worker of a human status—giving him a voice in determining his condition; but in respect of all three points, nothing would be done until they had a real educational campaign—a campaign in economics for both employers and employed.

Insulating Materials.

In the early days of electrical "engineering," when the most advanced practitioners were but experimental amateurs, the insulating materials employed were of simple character, consisting largely of glass, sulphur, and shellac for electrostatic apparatus, and of cotton or linen tape, silk, shellac, and varnished wood for appliances operating at lower pressures. Wonderful results were achieved with these elementary means, but the insulating material, then as now, was always the weakest factor in the structure of electrical devices, and was the subject of many gibes on the part of mechanical engineers, accustomed as they were to the handling of steel and brass, and contemptuous of textiles and resins. The introduction of rubber and ebonite, vulcanised fibre, and mica wrought great changes in electrical practice, porcelain took the place of glass, and oil, paper, bituminous compounds, and formaldehydes have found most valuable applications; yet the fact remains that the physical properties of the available insulating materials leave much to be desired. Prof. Miles Walker states that "all the good insulators are mechanically weak in some respects." Those that best withstand compression lack ductility, and all insulating substances are weak in tension, compared with other structural materials. Textile fabrics impregnated with varnishes "form the most flexible insulators known; but their flexibility is destroyed when the material becomes dry," and consequently they cannot be used at a temperature of or exceeding 100 deg. C., so that a rigid limit is imposed upon the load that a machine can carry continuously with safety.

Insulating material then is still the controlling factor in the design of electrical apparatus. It is true that the practical working pressure attainable has been gradually raised to more than 200,000 volts, and far higher pressures can be reached, by increasing the dimensions of the insulating material employed—but the temperature limit is inexorable; were this removed, or even raised to 200 degrees, the cost of electrical apparatus could be greatly reduced. Even in the case of d.c. generators and motors, this holds good, for the commutation limit is a matter not of material so much as of design, and has been raised to a degree which leaves the temperature limit the dominant factor.

When we reflect that with air at 25 deg. C. the permissible temperature rise is only 65 degrees with a reasonable margin of safety, and that if the temperature limit were raised to 200 degrees, the permissible rise would be 175 degrees, the importance of the question will be evident. The efficiency of a machine would as a rule be lower at the higher temperature, but in these days of high capital charges, high output per lb. is of far greater importance than high efficiency.

In view of these considerations, the close attention which is being given to research on insulating materials is clearly justified. The work is mainly directed at present to the properties of insulating materials which are suitable only for temperatures below 100 degrees C., and several articles on this subject have appeared in our columns in recent months, as well as communications emanating from the British Electrical and Allied Industries Research Association; the immediate aim of the Association appears to be to place the methods of investigation on a firm basis, enabling true comparisons to be drawn between the results of different experimenters. In November last year we published the results of an investigation carried out by the Research Association on the best form of spark gap to determine the dielectric strength of insulating oils; and in the *Journal* of the Institution of Electrical Engineers last issued suggestions are made by the Association for the adoption of standard methods for determining the electric strength of fibrous insulating materials, with a view to placing the subject on a sound basis and producing comparable results. These directions, which have been arrived at after careful consideration of the various methods previously used, should be very helpful to research workers, and at the same time, if generally adopted, undoubtedly will very greatly increase the value of the results obtained.

Smoke Abatement.

In the forthcoming session, the Smoke Abatement Bill will reach the report stage in the House of Lords. In the meantime it behoves those who are dissatisfied with the measure to consider how they wish the Bill to be altered. Lord Onslow, as Parliamentary Secretary to the Ministry of Health, speaking on the Bill on the second reading in July, suggested this postponement so that the considered opinion of all those interested in the matter might be ascertained by private consultation.

The electricity supply industry will probably have something to say on the matter, since, as the law stands at present, smoke, to be a nuisance, must be *black* smoke, whereas the new Bill rules that *any* smoke may be a nuisance, and furthermore includes under the term 'smoke" soot, ash, or gritty particles. Moreover, it makes the penalties very much stiffer; and if a local authority does not take the matter up, the County Council can do so over its head.

But the chief defect of the measure seems to lie in the lack of definition. The Smoke Abatement Committee's report, on which the Bill is based, recommended that the Ministry should *fix standards* with regard to smoke, but the Earl of Onslow said that there was great difficulty in carrying this resolution into effect. He did not at present see any practical method of doing so. Possibly he was not acquainted with Ringelmann's smoke charts, which enable the density of smoke to be estimated with a reasonable degree of accuracy. As regards culpability for smoke nuisance, generally speaking the electricity supply industry does not seem to be a very great defaulter—at any rate in the London area. Last year, for instance, the Public Control Committee of the L.C.C. stated that there were no fewer than 42 electric generating stations in the County of London, and that in recent months serious smoke nuisance had only been observed in four instances, all municipal. The Report went on to say that in the other 38 cases the nuisance had either been occasional or non-existent. The London companies are to be congratulated on a further remark in the Report, which pointed out that it was significant that there was not "a single case of serious smoke nuisance from power stations belonging to any of the electricity companies." But that was under the present Act: whether all these company undertakings would remain as impeccable when tested by the severer conditions of the new Bill, remains to be seen.

The Bill, however, contains one section which may be actually in favour of electricity supply undertakings, namely, the one by which urban authorities are empowered to make by-laws requiring that in any new buildings (other than dwelling-houses) the arrangements for heating shall be such as are calculated to prevent or reduce the emission of smoke. Electric heating may here come into its own. The Bill should certainly receive the early consideration of any undertakers who think that the measure in its present shape is likely to bear hardly on the industry. But in offering opposition to the Bill, the undertakings must not forget that one of their own slogans is "no smoke, no smell, no dirt," and that "smoke abatement" in principle is one of the things they are themselves out for in their propaganda.

D

NORTH-EASTERN RAILWAY ELECTRIFICATION.

A Main-Line Express Passenger Locomotive.

The first high speed passenger locomotive designed for service on a British trunk-line railway has recently been completed, and is now in experimental service on the Newport-Shildon branch of the North-Eastern Railway.

This locomotive, which is the one referred to by Sir Vincent L. Raven, K.B.E., in his paper before the N.E. Coast Institution of Engineers and Shipbuilders,* has been designed for hauling express passenger trains over the main line of the North-Eastern Railway between Newcastle and York; the mechanical parts of the locomotive were designed by the North-Eastern Railway Co.

The main motors are bolted solidly to the cross members of the main frame, and transmit their torque to a hollow shaft or quill which surrounds the main running axle, this hollow shaft being journalled in special axle bearings on the motor frame. The torque is transmitted from the hollow shaft to the driving wheels by a system of helical springs attached at their respective ends to the arms of the quill and the brackets which are attached to the driving wheels.

With this arrangement of drive, the dead non-resiliently-supported weight on the driving wheels is re-



Fig. 1.—Locomotive Hauling a Train.

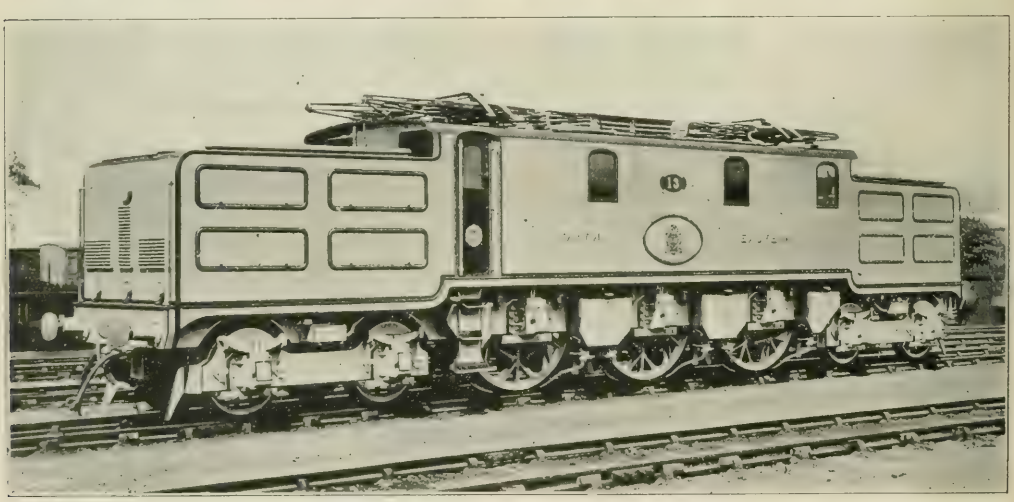


Fig. 2.—Main-line Express Passenger Electric Locomotive.

and constructed at its locomotive works in Darlington, and the electrical equipment was designed and manufactured by the Metropolitan-Vickers Electrical Co., Ltd., at its works at Trafford Park, Manchester.

The locomotive is capable of hauling 14 of the East Coast Joint-Stock main-line coaches, weighing 450 tons, between Newcastle and York, a distance of 80.3 miles, in 90 minutes, and performing the journey in the reverse direction in 95 minutes; on straight level track it is capable of hauling a similar train at a speed of 65 miles per hour. All the mechanical parts of the locomotive and also the motors and gearing are so designed that the limits of safety will not be exceeded when the locomotive is running at 90 miles per hour.

The locomotive, which is of the 4-6-4 type, consists of a plate underframe carried on three pairs of main driving wheels of 80 in. diameter, and supported at each end by a four-wheel bogie of the Adams type.

duced to a minimum, as, with the exception of the main driving wheels, the only non-spring-borne weight is that of the main axles, axle boxes, and spring brackets.

The locomotive is designed to obtain its current supply either from an overhead trolley line or from a third rail, at 1,500 volts. Current is collected by means of two pantograph trolleys or four collector shoes.

The main motors are of the twin-armature type, each armature being fitted with a pinion which meshes in a common gear wheel, mounted on the hollow shaft or quill which surrounds the driving axle. Each twin motor is rated at 600 h.p. at the one-hour rating, and 400 h.p. continuously; thus the locomotive is capable of exerting 1,800 h.p. at the one-hour, and 1,200 h.p. at the continuous rating. The tractive efforts corresponding to the hourly and continuous ratings are 15,900 lb. and 9,480 lb. respectively.

With a view to obtaining as flexible a locomotive as possible, arrangements have been made whereby current

* Electrical Review, December 16th, 1921, and January 6th, 1922.

can be diverted from the main motor fields by means of reactive shunts, and this arrangement, in conjunction with the varied motor groupings, gives 12 economical operating speeds.

The control system is electro-pneumatic, the motor current being handled by electro-pneumatic line switches, contactors, and cam-type switches. The cam switches are used for reversing, for motor combinations, and for field shunting, and the line switches and contactor switches for handling the main current and as resistor switches.

All these switches are operated by means of air pressure at 70 lb., the air valves being operated by means of small magnets actuated by current at 50 volts, which is obtained from a small auxiliary battery. The air for operating the switch is obtained from the main air compressor, which supplies air for the Westinghouse brake, whistles, and sanding gear, through the medium of a reducing valve.

Each switch is a complete unit in itself, with its own blow-out coil, arc chutes, operating air cylinder, and magnet valve, and the switches are arranged in groups on either side of the high-pressure compartment in such a way that any one switch may be removed without disturbing adjacent switches in a group.

Inspection of the arc chutes, contacts, and control interlocks can be done from the front. All the main circuit connections are made from the back.

The control of the motors by means of the contactors and other apparatus is effected by the master controllers through an auxiliary circuit which energises the small magnet valve of the various contactors and cam switches. One master controller is placed at each end of the central compartment of the locomotive, so that the locomotive can be run equally well in either direction. The running positions are clearly marked on the controllers, and each set is indicated on a notch plate.

There are two operating levers, an accelerating lever and a combined motor combination and reverse lever.

The following auxiliary machinery is installed in the locomotive:—

Motor-driven air compressor.
Motor-driven intermittent exhauster.
Combined motor-generator and continuous exhauster set.
Motor-driven blower set.
Auxiliary battery.
Electro-steam boiler.

The compressor, which is of the two-cylinder geared type, supplies air for the "Westinghouse" air brake, whistles, and sanding gear at 100 lb., and, as previously stated, air for the control system through the medium of a reducing valve.

In order that the locomotive may be able to operate trains fitted with the vacuum-brake system, two rotary exhausters have been installed.

The continuous exhauster, which corresponds to the small ejector on a steam locomotive, is coupled to the motor-generator set which provides l.p. current for charging the auxiliary battery and the control system. The exhauster itself is so arranged that it can be disconnected from the motor-generator set when the locomotive is operating trains fitted with the "Westinghouse" air brake.

The intermittent exhauster, which corresponds to the large ejector in a steam locomotive, is used for releasing the brakes after an application, and is automatically started up as soon as the driver's brake valve is placed in the "release" position.

The motor-driven blower set provides air for ventilating the main motors and the reactive shunts.

The boiler, which is used for supplying steam for heating the passenger coaches, is of the fire-tube type, each tube containing a heating element consisting of a tube of quartz, in the interior of which is a spiral of high-resistance wire. The boiler contains in all 144 of these elements, and switchgear is provided so that the number of elements in circuit can be reduced as desired when the full output is not required from the boiler.

The particulars and leading dimensions of the locomotive are as follows:—

Weight in working order ...	about 102 tons.
,, of mechanical portion	,, 72 ,,
,, of electrical portion	,, 30 ,,
,, on driving wheels ...	,, 18 tons 10 cwt.
,, on bogie wheels ...	,, 11 tons 12½ cwt.
Type of locomotive	4-6-4.
Motor equipment	Three 600-h.p. twin motors.
Control equipment	Electro-pneumatic.
Traction system	1,500 volts supply to overhead line or collector rails.
Current collectors	Pantograph trolley and collector shoes.
Brakes	Dual fitted (Westinghouse and vacuum).
Length over buffers ...	53 ft. 6 in.
Length over body	49 ft. 8 in
Distance between bogie centres	37 ft. 2 in.
Distance between driving wheel centres	8 ft.
Rigid wheel base	16 ft.
Bogie wheel base	6 ft. 6 in.
Total wheel base	43 ft. 8 in.
Diameter of driving wheels	6 ft. 8 in.
Diameter of bogie wheel ...	3 ft. 7¼ in.
Gear ratio	24 : 85.
Centre of gravity	about 5 ft.

LOCAL CO-OPERATION.

By H. R. TAUNTON.

The small electrical contractor—too often a man of narrow outlook—is so jealous of his petty independence that the bare suggestion of co-operation with his local competitors makes him snort. Without wasting time in thinking it over, he dismisses the idea with a few terse expressions of suspicion, ridicule, and irritation.

The basis of his distrust is that any scheme which might benefit him must also benefit his competitors. He would rather sink with them than that they should swim with him. If he happens to want an odd lampholder, he would rather write up to London, and pay the carriage on it, than buy it off his fellow tradesman round the corner, lest he put a penny profit in the latter's pocket.

So half a dozen small men in a radius of a quarter of a mile struggle on, each equipping an unsatisfactory showroom, each stocking the same articles, bought in small quantities at heavy carriage charges and unfavourable discounts, each with his staff and labour troubles, his ineffective advertising schemes, his disproportionate standing charges; all of them struggling tooth and nail to get what work is going, or at worst, to prevent the other fellow getting it. In their absurd jealousy they quote prices which they know must mean a loss to them if they are to do honest work. If they don't get the job, they console themselves with the reflection that the other's success is another nail in his financial coffin. If they do get it, they are driven, all too often, lest it should be a nail in their own coffin, to cut the quality of their material and labour.

The public, though at first sight they may appear to benefit by competitive prices, suffer in the result from shoddy work. The industry suffers: directly by diminished turnover of good wiring material and reduced employment of skilled labour; and indirectly by the bad reputation which follows bad installation work, and clings to electricity and all its applications. And

finally, the contractors themselves suffer—sooner or later, they share the fate of the Kilkenny cats.

It is often argued that competition is a salutary rule of nature. The fiercer the better—elimination of the unfit—survival of the fittest. If the unfit would only eliminate themselves quietly, and be done with it, the argument might pass. Unfortunately their bad deeds live after them, even if they themselves do not come to life again in another name and another district. And besides, for every one unfit eliminated, two more spring up to take his place.

The law of the survival of the fittest, which means too often that of the most unscrupulous, has long since been rejected in the social order. It is equally an anachronism in commercial life. Far better for trade, for six small men to combine, more or less completely, into one strong whole and continue in active business, than for five of them to perish singly, and leave the sixth man crippled.

Small contractors, with limited capital, cannot hope individually to compete with the attractions of supply authorities' showrooms, run without regard for profit and loss, at the expense of the ratepayers. Nor will they be able to compete with the new multiple-shop syndicate which, so rumour has it, proposes to open showrooms throughout the kingdom for the sale of electrical appliances.

Contractors are threatened with the loss of one of the principal mainstays of their business—their cash sales. Their only hope of withstanding the onslaught of these moneyed competitors lies in intelligent co-operation. Some months ago a writer in the Review made the same suggestion; but the co-operation he proposed was of too wide and comprehensive a nature: practically amalgamation of all the local contractors for all business purposes. It left no scope for individuality, for reasonable competition, or for the independence so dear to the small business man. The only co-operation that has any chance of appeal or of success (at least as a beginning) is in respect of showrooms and stock. If a co-operative scheme embracing these two factors were adopted and worked harmoniously, possibly other developments might follow: interchange of skilled labour, for instance; or combined advertising; or even some tentative schedule of minimum prices for standard work.

For the present, however, it will be more practical to consider simply a broad scheme of co-operation between local contractors, of which the two main articles would be a joint showroom and a common stock.

Take the showroom first. Every contractor aspires to a showroom of some description. Often enough most of the show is in the window. For the rest, a small, badly-lit shop, overcrowded with cheap and ill-assorted fittings, and dusty shades; a fan, a kettle or so; a litter of bell materials and small accessories; a motor, perhaps, or other plant "on sale or return": all against a background of gaudy posters. No originality, no taste, no method. No "note" is struck—there is nothing to attract the passer-by, or to hold him if he happens to come in.

Often the fault is lack of taste and discrimination: more often, simply lack of capital. A good showroom—one which will bring good business—is expensive to equip and maintain. It must be commodious, well planned, and artistically decorated and furnished; it must be equipped with a wide selection of fittings, some of them costly, to appeal to a variety of tastes; it must offer a complete range of electrical domestic devices and novelties; it needs a trained salesman or saleswoman, with one or more assistants; it has to be kept brilliantly lighted, and clean, and fresh, and up-to-date.

The average contractor simply cannot afford the initial expense, or even the maintenance. He has to be content to see potential customers going to the Corporation showrooms, or to those of the wholesale suppliers, or even of some large furniture dealer or decorator, and there spending their money freely on articles which carry vastly more and easier profit than does competitive wiring: money which would make all the difference, to him, between a shaky and a sound business, could he but attract it to his own doors. Of course, he realises the value of an attractive showroom. His trouble is that he also realises that he cannot afford one. But he could afford, say, the sixth part of one: initial cost and maintenance.

There is nothing but prejudice and jealous suspicion to prevent him and, say, five of his fellows, combining together to rent a suitable shop in a good thoroughfare—not in immediate proximity to the premises of any one of them—and putting up the capital, or contributing from their existing stocks, to equip it.

Clearly the simplest instrument of association would be a small limited company, in which the contractors would be shareholders and active directors. If they were of pretty equal standing, they would put up equal shares of the initial cost. If one of them were in a fairly big way of business, or two or three of them in a very small way, their initial shares of the costs, and the profits, would vary accordingly.

A certain reserve of capital would be necessary in the early days to meet standing charges, salaries, and maintenance costs. The staff required would be small; and, of course, it would have to be specially engaged, and be quite independent of the existing organisations of the firms concerned. An expert salesman who would act as manager, responsible to the co-operators; one or more assistants, perhaps, according to the size of the showroom; and a handyman or boy. All book-keeping and correspondence would be conducted on the spot (one of the assistants could do what little clerical work were needed) and not in the office of any one of the firms—that would open the door to suspicion and intrigue. All books and files, needless to say, would be open to any of the members at any time.

Once started, such a showroom would not only pay for itself, but would yield profits considerably in excess of the aggregate profits the firms concerned could hope to derive from the sale of fittings and accessories in their own small shops. It would be in a position to compete with anything likely to come up against it: corporation, wholesale house, or syndicate. Its very existence in a good shopping centre would be a great advertisement for the co-operating contractors; and its attractive window display would stimulate a demand among shoppers for electrical gear, undreamt of in the side streets in which contractors usually languish.

The financial results of the venture would be divided among the members; first, according to their direct introductions, secondly, according to their initial shares. Each member would have a book of numbered tickets, in duplicate, bearing his name, and a space for the name of the customer he introduces. He would hand in his ticket when he brought his man round; or give it him to hand in. All invoices made out for purchases by such customers would be entered accordingly to the credit of the introducer. At the end of the quarter, or whenever it might be found convenient to pay a "dividend"—probably more often than in the case of an ordinary limited company—the total sales would be divided into two headings: (*a*) sales made to introduced customers; (*b*) sales made to casual purchasers. The first figure would be subdivided into the amounts of the sales credited to each of the members, easily ascertained and checked by the tickets and their duplicates. To these varying amounts would be added the share of the second figure to which each member would be entitled according to his holding. The profits would then be divided in proportion to the final amounts so arrived at.

To take a simple example. A puts up three-tenths, B and C two-tenths each, D, E, and F one-tenth each of the original outlay. The total sales in three months are, say, £2,000. A is directly responsible for £500 of this, B for £300, C for £200, and unlucky D, E, and F have not been able to introduce any customers at all. The remaining £1,000 of sales represents casual purchases. The profits would be divided, therefore, as follows:—A, 40 per cent. (representing a total of £500, plus £300, three-tenths of the casual purchases); B, 25

per cent.; C, 20 per cent.; D, E, and F, 5 per cent. each.

Thus, A, B, and C would get the proportionately larger share due to them for their success in introducing customers, just as they would have done if they had sold from their own shops; while D, E, and F, who were unable to introduce any business, still get a return on their original investment—probably more than they would have got under similar unfavourable circumstances if they had kept their share of the co-operative capital in their own not very flourishing concerns.

All six members, too, will have saved a large proportion of their outlay in reduced rent, salaries, and other standing charges of their own businesses, owing to their not having to maintain a showroom, or an apology for one, or to handle fittings and appliances. Or, at the worst, they will have other compensating advantages, such as increased office accommodation, and less congestion of clerical work.

So much for the joint showroom. If it be admitted that that is possible, the keeping of a common stock is a simple corollary.

Stock—overgrown stock—dead capital continuously depreciating—has ruined more contractors, big and little, than any other factor. The only safe policy where stock is concerned is: as small as possible, and moving as quickly as possible, so that no item appears in two consecutive stock lists. That is an ideal that is comparatively easy of attainment by co-operation.

The premises taken for the joint showroom should have a basement, or other annexe, which would form a store for wiring material and accessories. The only other extra initial cost will be the fitting of the usual bins and shelving. The only extra running cost will be the wages of a store-keeper, with any assistance that may be found needful, according to the volume of the stock. He would be under the control of the showroom manager, and would, of course, have to be a thoroughly reliable and independent man.

Here would be kept a stock of all the ordinary wiring material and accessories wanted for contract or jobbing work: conduit, cables, switches, lamps, and so on; and on this common stock each of the co-operators would draw as he required it. Suitable requisition forms would be used, duplicate copies being handed to the storekeeper. One of these would be returned to the contractor after issue of the goods, priced at cost; and the other, similarly priced, would be filed for record. Definite rules would be laid down for payment; no member, for instance, would be given credit beyond the amount of his share in the company.

On paper the stores would naturally show a loss, as goods would be passed to members at net cost, leaving the standing charges still to be met. These—consisting of storekeeper's wages and an agreed proportion of the rent and so on of the whole premises—would be divided among members in proportion to the total amounts of their requisitions. If A, for instance, in a given period, took a third of the total goods issued, and B only a quarter, they would pay a third and a quarter of the overhead charges respectively, either in cash or as a debit against their share of the showroom profits.

Alternatively, an agreed definite percentage might be added to each invoice, estimated to cover amply the percentage of overhead charges; any surplus, when accounts were balanced, being divided as before.

Whatever the amount each member had to pay to meet his share of the overhead charges of the stores, it would certainly be less than it would have cost him to run his own store. This is obvious from the fact that the six (in our example) separate stores, each involving expense in rent, lighting, wages, &c., would be replaced by one common store, the overhead charges of which would be little more than those of any one of the six.

The saving of expense, however, is a minor advantage. Even if each member had to pay as much for the common store as for his own, this would be more than compensated for by the great economies effected both in volume and cost of stock.

A large proportion of every contractor's stock is surplus to his actual requirements. A certain surplus is unavoidable; but it is generally much larger than it need be. If our six contractors had their stock in common, the surplus on the combined stock need not be any larger than it would be on any one of the individual stocks. The aggregate volume, therefore, would be reduced by the amount of about five surpluses.

One of the causes of a surplus stock is that a contractor, to secure discounts, buys in dozens or grosses, when he only wants units or dozens. Six contractors together, however, would quickly get through the dozen or gross lots. They would be ordering, therefore, little in excess of their immediate requirements.

As a matter of obvious fact, supplies would be ordered from makers in much larger quantities than any one member could order. This would mean greatly improved discounts and rebates. Take E.L.M.A. lamps as an example. Probably each member, singly, would be only graded near the bottom of the lower scale. Buying together, in the name of their co-operative company, they would almost certainly qualify for a grading in the higher scale, and so save something like 10 per cent. on every lamp. Or take cable. Each member may be buying from a different C.M.A. maker, and hardly qualifying for the minimum rebate. Buying together, their turnover and consequent rebate would be considerable.

In short, each of the six small contractors would be buying his material, through the co-operative company, on the same terms as the largest contractors in the trade, who, by reason of their large annual turnover, enjoy preferential terms of anything between 5 per cent. and 10 per cent., or little short of factors' terms.

Indeed, it is arguable that such a co-operative company could legitimately claim to be classed as factors, and to be entitled to terms accordingly. The company itself would not be a contracting firm, and would be buying only for resale to the trade—the contractor-members.

For the matter of that, there is no reason why they should not sell to the trade: the little firms, and the jobbing wiremen, who would not be members of the company; and to whom they could afford to sell at ordinary trade prices, so realising a certain profit towards their standing charges.

The great point is that stock would always be moving, keeping it up to date, and reducing the chances of loss by makers' price reductions and normal wastage. There are other minor advantages of one common stock instead of a number of separate ones, such as saving in carriage, reduction of labour in packing, and simplification of the "empties" problem.

The principle might be extended to the holding of a common stock of heavy tools and plant, such as stocks and dies, ladders, and the like, which could be hired by members at nominal rates. Six independent contractors, for instance, would each have an expensive testing set, which, on an average, they would only use, at most, a couple of days a week. Working together, they would only need one or two sets, effecting a saving of at least four. If there were more than six members (that number has been taken throughout only for the sake of a convenient example) the saving would be so much the greater. There is no reason why twenty contractors should not join together—the more the merrier, and the greater, obviously, the results.

One could continue to fill columns dilating on the advantages of co-operation between contractors, even if confined to showrooms and stock. Enough has been said, if not to convince, at least to afford food for thought and discussion. It is difficult to see any tangible reason why some such scheme of local co-operation should not be successfully inaugurated in every considerable centre.

Except, alas, the one reason given in the [illegible] paragraph of this article!

THE STATUS OF ELECTRICAL CONTRACTORS.

By H. MARRYAT (President of the Electrical Contractors' Association, Inc)

My Association is grateful to the Electrical Review for the part you took in its formation and your interest in its welfare ever since. Your editorial comment and criticism has been well-informed and always welcome. It is therefore with the greater regret that we read the article by H. R. Taunton in your current issue, which is likely to do injury to electrical contractors generally and to this Association in particular.

Unfortunately the prominence of this article renders it difficult to reply adequately in your "Correspondence" column, and it is desirable that you should review the subject again in a manner calculated, so far as possible, to counteract the damage done. To this end I shall be pleased to place the facts at your disposal and to substantiate them from the records at the Association's office.

Mr. Taunton's object is apparently to help the Association: it is regrettable, therefore, that he did not seek information here before writing. If he will do so now he will appreciate the humour and the offence his contentions have aroused. Every one of his 32 paragraphs is misleading.

Admittedly this section of the industry is not so strong financially as others; but this arises out of difficulties which we are steadily overcoming. Apart from this I say as a business man of no small experience that the organisation, management and discipline of the Electrical Contractors' Association compares not unfavourably with that of any other section of the industry.

It is not necessary in this communication to deal with the mis-statements which permeate the whole of the four-column article: they are founded on four fundamental errors.

1. That the Association is not fully representative. Your writer says: "there are a number of firms of standing who have hitherto not considered it worth while joining the Association." And again: "There are many firms of repute who at present refuse to become members."

Will Mr. Taunton give me a list of these, as I am most anxious to find them? A special committee is now making great efforts to get into touch with the remaining outstanding firms, but at present we do not know their names. In October a special issue of the *Electrical Contractor* will have the same object in view. By a comparison with manufacturers' and wholesalers' mailing lists it appears that the E.C.A. represents 90 per cent. of the buying power of genuine electrical contractors.

2. That our membership is not sound. "There are a number of members of the Association who are not firms of good standing (at least, as electrical contractors), whose only qualification is the ability to pay their subscriptions."

I defy Mr. Taunton to mention one.

There are many references to "shoddy" and "dud" firms members of the E.C.A. The reply is that there is none such, and if one is discovered the Council will have a very brief way of dealing with the case. If Mr. Taunton cannot make good these aspersions he should apologise.

3. That entrance to the Association is unguarded. "For every 'dud' firm struck off the list three or four firms of repute would hasten to join. Nobody values membership of an organisation which admits any Tom, Dick, or Harry who will pay his fee."

Mr. Taunton lays down qualifications which he thinks should be required of members. The absurdity of all this is that the Association requires qualifications more far-reaching than your writer suggests, and every application must be accompanied by references which are sifted with the utmost care, so that it usually requires several months to complete the election of a new member. Certainly no capital qualification is required, as we encourage the qualified small man, but we do require a reputation for honest straightforward dealing, good work, and evidence of technical training.

4. That members do jerry work, use poor material, and cut wages. He says: "All members should employ labour on the terms agreed with the E.T.U."

Is Mr. Taunton not aware that this is a condition of membership of the N.F.E.A., which is the branch of the E.C.A. organisation dealing with labour matters?

One of the most amusing (to us) errors which Mr. Taunton falls into is the suggestion that the E.C.A. might enforce a minimum standard of wiring if they could count upon the supply authorities to report infractions. Why, it is the supply authorities who object to the introduction of the minimum standard. They fear it will increase the cost of wiring. The whole of my membership earnestly desires this reform, and I challenge anyone to show that the work of my members is not of an average higher than that set by supply authorities.

A REPLY BY THE AUTHOR.

Mr. Marryat apparently construes my article as an attack on the E.C.A. I am sorry, for nothing was further from my thoughts. Any allusions in it to the Association were by way of friendly criticism. If I have failed to give due meed of admiration to its scheme of voluntary registration—and that, reading between the lines, is, I think, the kernel of my offence—I am surely entitled to express a personal opinion without being called upon to "apologise" because it does not coincide with that of the Committee.

Mr. Marryat sweepingly dubs all my "32 paragraphs" as misleading; but mercifully he only particularises four points, and with these I will try to deal.

1. He objects to my statement that there are "a number of firms of standing" or "many firms of repute" who are not members of the E.C.A., but in his next paragraph he practically admits the same thing, giving my indefinite quantities, "a number," "many," the definite value of "10 per cent. of the buying power of the trade." Not to quibble about words, however, it is evident the essential difference between us is that he considers the membership figures of the E.C.A. satisfactory, and I venture to think the opposite.

According to the "Year Book," there were in May last 672 full members. On Mr. Marryat's figures, therefore, there are only about 750 contracting firms of repute in the Kingdom! Or to take a concrete example: in East Anglia (the counties of Norfolk and Suffolk) there are only, I believe, two contracting firms which are members of the E.C.A. Does Mr. Marryat suggest that these represent 90 per cent. of the buying power of the trade in that extensive area, or anything like it?

2. Mr. Marryat can scarcely expect me to put my hand in the fire by citing any one member of the E.C.A. as a "shoddy" firm. If he really lacks information on the point, he can get all he wants in the frankness of the after-dinner hour, in the smoking room of the Engineers' Club.

Moreover, he ignores the fact that, in speaking of these firms, I emphasised the point that they are mostly of the "side-line" class—firms which may be of the highest standing as drapers, plumbers, and so on, but whose nondescript electrical department certainly does not qualify them to be considered genuine electrical contractors, and should not qualify them to be members of the E.C.A.

3. What are the far-reaching qualifications which Mr. Marryat says the Association requires of its members? I take his word for their existence, but why are they not printed in the "Year Book," for the guidance of intending, and of existing, members? One suspects—I suggest it with all diffidence—that they are rather in the nature of pious aspirations, than hard and fast rules. I have been intimately associated with the industry since 1898, and I have never heard of them. I have to-day looked through a voluminous file of correspondence with the E.C.A. and found no allusion to them. And all I can see in the "Year Book," remotely referring to them, is on page 147, where it is stated that, under the terms of the B.O.T. licence, the Association is debarred from "imposing any restrictions on its members"!

As to the references of which Mr. Marryat makes a point, they, like all references, may mean much or little. The Bank of England, if it yearned for membership of the E.C.A., could produce most excellent references; while an honest, intelligent wireman, starting as a contractor on limited capital, might find it difficult to give any references at all.

4. I am well aware that all members of the N.F.E.A. are supposed to comply with the terms agreed with the E.T.U. But surely this is beside the point. We are discussing the E.C.A., not the N.F.E.A. All members of the E.C.A. are not members of the N.F.E.A., and *vice versa*. Obviously, therefore, there are a comparatively large number of members of the E.C.A. who are under no obligation to pay their men at E.T.U. rates, and thus are at liberty to compete unfairly with other members who, by joining the N.F.E.A., have accepted that obligation.

Finally, Mr. Marryat is "amused" by my suggestion that the E.C.A. might enforce a minimum standard of wiring if it could count on the supply companies to report infractions. Divorced from its context, my suggestion reads like the blind leading the blind, but if he will re-read it he will see that it was dependent on the previous suggestion that the E.C.A. would be powerful enough to make the supply companies more amenable to its wishes than they now are.

I want again to assure Mr. Marryat that my article was written in no antagonistic spirit. No one would be better pleased than I to see the E.C.A. grow rapidly into the strong and powerful organisation that the industry needs to raise its status from its present low level. Where I—and many others, both members and non-members—differ from him and his Committee is in not being so completely satisfied that their present policy is that best calculated to achieve that end.

H. R. Taunton.

THE HUMAN SIDE OF ORGANISATION.

By W. J. HISCOX.

Despite the fact that the human side of industry has come to the fore during recent years, by the development of welfare organisations and the like, it cannot be said that the workers' suspicion of "innovations" is much less marked than it was, say, ten years ago. It is perhaps more in connection with "system" and shop procedure that he is still apprehensive, for he is educated sufficiently to appreciate the advantages of the labour-saving appliance, and the introduction into the factory of such a piece of apparatus does not as a rule cause a deal of comment.

But when a change of system is mooted—when a man is brought into the factory for the purpose of effecting a thorough reorganisation—then it is that suspicion is aroused, and the importation is regarded with hostility and dislike. He is looked upon as a "soulless" creature—a "sweater" and a "grinder"—a man whose whole mind is concentrated upon the problem of getting the highest possible yield for the lowest possible expenditure.

To the worker this implies harder work and lower wages, and the organiser is regarded as an enemy. The shop stewards have their eyes upon him, ready to catch him up should he trip, and he is the subject of much argument in the works manager's office. He is not attacked openly, for he is very exclusive, and is, as a consequence, regarded as formidable, but every opportunity for a covert attack is taken advantage of. He is obviously unable to defend himself, and is to a great extent unaware of the nature of the attack. Without any definite reason (save that of prejudice) his every action is construed into a direct challenge of the workers' aspirations, and the thought that he is a human being, with a full share of human emotions and human weaknesses, and that he is sensitive to the attacks made upon him, does not for one moment enter the minds of his detractors.

Yet he is intensely human, and he never once loses sight of the fact that he is dealing with fellow beings. He realises the influence his actions will have upon their lives, and those actions are formulated accordingly. His mission is to lighten the labourer's task, and yet make him more effective—to eliminate fatigue, and to stimulate interest. These are the points which inspire his policy, and which govern his every action.

He does not enter the factory full of the belief that the men are not working hard enough, or that they are too highly paid. On the contrary, he believes that they are working far too hard, and he would lighten their labours. He sees no reason why their wages should not be increased, and he is prepared to supply the necessary facilities.

He is a business man, but there is nothing inhuman in the term. It is true that the term has been (and is still being) abused by the unscrupulous who cloak their rank inefficiency under a barbarous guise of what they term "business." These are the people who are at the bottom of the so-called "labour trouble." Their methods cause the term "business" to emit a bad odour, and the victims fall an easy prey to the extremist "quacks."

The real business man is an honourable fellow, expecting and giving a fair deal, and the organiser will be found in this category. He is engaged for the purpose of providing the facilities whereby the product can be manufactured to *sell*, and this means that production must be increased and cheapened.

He recognises that the manufactured product is the direct fruits of Labour, assisted by Capital. Without the latter Labour would have to rely wholly and solely upon its own exertions, and as a consequence the energy expended would be tremendous, the output limited, and the workmanship (in many instances) decidedly crude. Capital added to Labour ensures a well-lighted and commodious factory, and the mechanical appliances which increase the output of the worker whilst reducing the expenditure of energy.

But, to ensure the best results, both Capital and Labour must be controlled and exploited, and it is here that management enters. It is obvious that, if a fair return is to be given to the working partners, the value of their product must exceed the cost incurred, and it is for management to ensure this. So a working system is drafted out and put into operation, this being devised to assist both Capital and Labour by giving each every opportunity to develop. It is designed to eliminate

waste and to arrange a wise distribution of capital with a view to affording the utmost assistance to labour. The machine becomes the unit of labour, controlled by the ingenuity of the man.

But business is progressive and must be ever marching onward. The "peak" of this year is the starting point for next, for the progress of industry must be commensurate with the progress of the human race. As we develop mentally, so our needs are of a higher order, and industry must supply those needs. A still wiser use must be made of Capital and Labour, and there comes a time in the history of every factory when further development can only be accomplished by a reconstruction of the system, and then it is that the organiser enters.

He is engaged to devise the ways and means whereby Capital and Labour may be more fully exploited. He is a specialist in the art of organisation, and his knowledge of methods and procedure outside that factory constitutes his strongest point. He has before seen situations similar to those constantly arising in the factory, and he knows from experience how they should be treated. He can speedily discover the weak places in the system, and he appreciates that those weak places constitute an injustice for some one.

This injustice is apparent in many forms, of which the following may be deemed representative, *viz.*: (1) the overworking of the individual; (2) the restricted scope afforded the individual; and (3) the failure of the individual to surmount the obstacles encountered.

An overworked individual is never really efficient, for his interests and responsibilities are too many and too diverse for each factor to receive the attention it deserves. His ability is taken advantage of by the management, for he is recognised as a "good" man, to whom the work may safely be entrusted. There is, however, a limit to every one's capabilities, and when that limit is exceeded efficiency begins to deteriorate. This is not recognised either by the management or by the man, for the latter sets out to do the best possible, and the management is convinced that nothing better can be obtained. Yet, were some of those duties delegated to other people, much better results would be secured, because of the higher standard of efficiency attained.

In every factory will be found the individual whose capabilities are not extended by the duties he is called upon to perform. His ability is recognised to a point, but he is kept at the job for which his proficiency is recognised, and, as a consequence, is not given the opportunity of showing the full extent of his capabilities. Just as efficiency deteriorates when the limit of one's capabilities is passed, so also does it deteriorate when development of ability is retarded by the mediocre character of the task assigned, for the individual, having no hope of advancement, or of exercising his ingenuity, degenerates into a state of apathy, and in course of time the very job itself suffers for want of attention.

The failure of the individual to surmount the obstacles encountered may be due to the formidable nature of these obstacles, and to the lack of assistance afforded by the management. The system here is directly to blame, for the individual, struggling to do his duty, is so hedged around by convention and precedent that he is quite unable to show good results for the energy expended and the ingenuity displayed. He is expected to show certain results, and could accomplish these but for the procedure insisted upon. As it is, he is constantly in trouble, and becomes soured and disappointed. He works hard, and receives but little thanks, and, if he remains for any length of time in such a position, he becomes a typical example of a "good man spoiled."

These are the facts which are apparent to the organiser before he has long been in the factory, and in seeking to remedy these evils it cannot be said that his motive is anything but humane. It is true that he is there for business, but, after all, business is a human institution, and the real efficiency and value of business is based upon a proper appreciation of the human element. If the organiser can improve the business of the factory by lightening the tasks of one man, providing the gate for the aspirations of another, and assisting a third to do what is expected of him, then surely he cannot be regarded as a "soulless creature," whose one mission in life is to enrich the employer at the expense of the worker.

But, perhaps, whilst giving him credit for his motive in this direction, it may be argued that so far he has confined his attention to the foremen and the other staff officials. From the worker's (*i.e.*, the mechanic's) standpoint, it may appear a good move on the part of the organiser to ingratiate himself with the heads of departments, for the latter may be used as his tools for the oppression of the working man. So much depends upon the foreman that undoubtedly he would prove a valuable ally, and his goodwill is therefore essential to the schemes of the organiser.

Thus argues the worker and, in his favour, let it be said that he has had cause to be suspicious of every move on the part of the management. He has seen new "systems" introduced, which have been followed by rate cutting and other crude "economical" measures. It perhaps cannot be expected that our present-day organiser will be regarded with immediate favour, for a stigma is attached to his profession by the action of his predecessors, and this must be removed before his motive can be appreciated by the workers.

As an organiser who has, at the outset, encountered the opposition and the prejudice of the officials and the workers of the factory, and who has ultimately won their goodwill and confidence, the writer is well able to appreciate the feeling which exists, and he can assert that the organiser is concerned as much with the welfare of the worker as with that of the factory official.

He is there to obviate rate cutting by eliminating the necessity, and to stimulate employment by producing an article which will sell. If a man, by working hard, can produce each week 40 articles at 2s. 6d. each, he earns £5 per week, but if, with a less expenditure of energy, owing to the facilities provided by the organiser, he can produce double the quantity at 1s. 3d. each, his weekly earnings have not decreased.

The man may argue that the only advantage he gains is that he does not work quite so hard, but because the illustration shows the cost per piece decreased by one half, this does not mean that every job will be reduced by this amount, neither does it mean that the increase of quantity in each case will be fixed at 100 per cent. The organiser is concerned, not with low wages, but with low costs per piece, and he is an advocate of high wages, provided that these yield the production which will ensure the lowest possible cost per piece.

It is the individual cost which determines the selling price of the product. It is the selling price which determines the market, and it is the market which determines the quantity to be produced, and, incidentally, the volume and continuity of employment. When but 40 articles per week are produced, the costs are proportionately high, the selling price is accordingly regulated, and the market is limited; but when the factory can produce 80 per week at approximately the same aggregate cost, the selling price per piece can be considerably reduced, there is a much wider market, and the chances of an increased demand are much greater.

The worker wants high wages and shorter hours, and these the organiser wishes to give him. He is prepared to go further than this, for he would minimise the arduous nature of the task. He provides facilities whereby the natural ability of the worker is reinforced, and every effort is rendered productive. All he asks in return is that the worker shall exploit those facilities to the utmost, so that the money expended will yield a good return. And in insisting upon this it cannot be shown that the organiser exhibits a lack of human consideration, for, as a result of his efforts, the worker benefits just as does the business.

WATER-POWER DEVELOPMENTS IN NORTH WALES.

THE COWLYD DAM.

The opening ceremony in connection with the new dam at Cowlyd Lake was performed by Sir John Snell, the chairman of the Electricity Commissioners, on Wednesday September 20th, in the presence of a large number of representatives of public bodies in North Wales who had accepted the invitation of the Conway and Colwyn Bay Joint Water Supply Board and the Aluminium Corporation, Ltd., which owns the controlling interest in the North Wales Power Co. The visitors met in the morning at the works of the company at Dolgarrog, situated in a delightful spot in the Conway Valley, and were conveyed up the steep narrow-gauge track which had to be constructed by the company to carry all the materials necessary for the construction of the dam. This track in places is "one in one," and the party had a nerve-racking experience before arriving at the top of the incline, where they were transferred to specially constructed trucks and were taken to the lake three miles distant right in the heart of the mountains, which form part of the Snowdon range. After inspecting the work, which was explained to them by the water board's engineer, Mr. C. F. Farrington, the party returned to Dolgarrog, and were entertained at luncheon in the assembly rooms attached to the works, which had been transformed into the semblance of an Eastern tent and charmingly decorated. Sir John Snell was presented by Mr. John Porter, the clerk to the Joint Water Board, with an Elizabethan goblet and cup, and having filled the goblet from a special pipe laid on the dining table he sipped the water, declared the dam open, and dedicated the waters behind it to the service of those who were entitled to it.

In proposing the toast "Success to the Cowlyd Dam," Sir John expressed his pleasure at being present to inaugurate the completion of such a scheme of conserving water power. He had the honour of being on a Committee appointed by the Government to consider as a matter of national economy what advantage could be taken of the natural resources of this country. The Committee felt that where water was required for domestic and sanitation purposes that had a prior claim over what was required for power purposes. Rain which fell into natural reservoirs, or was impounded, could, he felt sure, be used for the dual purpose, namely, for the health and sanitation of the inhabitants, and to provide a natural source of power. That was proved to be the case that day, as with public spirit the Water Board and the Corporation had joined together for the joint and wise use of the water they gathered for a dual purpose. That power could be used without destroying the amenities of the district was proved by the fine piece of engineering of which they were celebrating the completion that day. The dam had been raised forty feet not by an erection which was a blot on the landscape but by a natural dam. Nature had been assisted unseen, as the concrete and its strength was hidden away. The recent survey of North Wales proved that there were vast natural resources remaining to be developed. A short time ago the Chief of the Swiss Federal Railways informed him that in 10 years the whole of the railways in Switzerland would depend entirely on electric transport, whilst all the towns would be lighted and heated by energy derived from the same natural sources of the country. Owing to this question of the development of natural resources having been neglected in this country British engineers had been ousted by the foreigners to a considerable extent. He was pleased to see, however, that they were advancing, as they were moving towards establishing a chair of hydro engineering at one of the Universities. South of the Caledonian Canal there was sufficient water power to do away with all the coal-driven power stations in Glasgow and other towns in the South of Scotland. He believed the completion of the Cowlyd Dam was only the beginning of a much wider development to take place under the North Wales Power Co. at Festiniog, and there were still other sources of power which could be tapped. He could foresee in the near future the L. & N.W. Railway from Crewe to Holyhead driven by electric power derived from the natural resources of North Wales, and the residents were assured of power for lighting, heating, and cooking, a power which God had blessed this country with.

Later, in reply to the toast of the chairman proposed by the Mayor of Conway, Councillor G. W. Hyde, J.P., Sir John appealed to the ground landlords in the district not to delay but to assist the company by granting way-leaves as by so doing they would be conferring a benefit on the general public.



—Plan shewing Cowlyd Lake and Site of— —New Dam.—

Fig. 1.—Plan of Cowlyd Lake and Dam.

In reply to the toast of the Conway and Colwyn Bay Joint Water Supply Board, Mr. George Bevan, J.P., the chairman, said the Board was formed in 1891 before the great rush of English towns to Wales for their water supplies. The Board's agreement with the Aluminium Company had a two-fold effect; they were enabled to ensure the residents in the area supplied by the Board of a constant supply of water for domestic services, and on the other hand the surplus water was devoted to giving them a cheaper supply of electrical energy. This was being supplied by the company at 1¼d. per unit, against the present cost of 4d. or 5d. per unit, the cost to produce by coal. The supply of electricity to Colwyn Bay by the company was giving every satisfaction, and Llandudno and Conway were hoping to get a bulk supply within the next few months. Next year the price of water supply would be reduced to 6d. The policy of the Board in entering into an agreement with the Aluminium Co. was, therefore, justified by the results. Ald. J. M. Porter, Denbighshire County Council, in responding to the toast of the Public Authorities, pleaded for less interference by Whitehall in local matters. There was a danger that continued interference would stop men from taking part in public affairs.

The toast of "The Aluminium Corporation," was responded to by Messrs. R. Taylor, a director, and Henry J. Jack, the managing director of the company; the latter paid a tribute to his staff for the loyal co-operation they had given him in the work. That day marked an epoch in the public history of North Wales. It was essential that the natural

resources of the country should be conserved as it had been recently stated that the South Wales coalfield would be seriously depleted within the next 60 years. If that were true then prices would naturally harden and working costs would increase. By developing the water powers of North Wales they were providing for those who would come after. If one's ideal of work did not include work for the public weal, life became a barren thing. He was touched greatly by the presence of Sir John Snell, who had broken his holiday to be present. If the work of developing the natural resources of the country was put in hand at once they could provide work for many of those who had fought for their country, and were tired of living on doles. When the dam started it was anticipated it would cost £70,000 and he had the money in the bank to pay for it, but through the war the cost had mounted to over £250,000.

The toast of "The Engineers" (Sir Douglas Fox & Partners and Messrs. F. B. Farrington & Son) was responded to by Mr. C. F. Farrington, and that of the contractors, Sir Robert McAlpine & Sons, by Mr. A. McAlpine. During the proceedings songs were given by local artistes and selections by the works orchestra. In the evening a carnival ball was held.

The following is a brief history of the companies formed to develop the water powers in North Wales:—

Many years ago, far-seeing pioneers formed a company called Gwalia, Ltd., and acquired all the important water rights of Snowdonia, their freehold land extending from the Conway Valley to the Western Slopes of Snowdon. Unfortunately, history repeating itself, support was lacking, and the company was unable to carry out its development. Part of the water rights was sold to a company called the North Wales Power & Traction Co., Ltd., of which the late Sir Thomas Beecham was chairman. The Cowlyd Lake was sold to the Water Board, and the remainder of the lands and water rights by auction to various buyers.

The North Wales Power & Traction Co., Ltd., developed the water power on a portion of Snowdon.

The Portmadoc, Beddgelert & South Snowdon Railway Co. was formed, and partly constructed a railway from South Snowdon to Portmadoc, designed to use the power, but was unable to complete.

The Snowdon Mountain Tramroad & Hotels Co. was formed, and built a rack railway to the summit of Snowdon, but failed to use the hydraulic power.

The Oakeley, Dinorwic and Penyrorsedd Quarry Companies were the first people to realise the advantages of the cheap energy, and transmission lines connecting Cwm Dyli Power Station to their quarries were built and put into operation in 1906.

Later, the North Wales Power & Traction Co., Ltd., sold their land and water rights in the Conway Valley to the Aluminium Corporation, and this portion of the power was developed and a 20,000-volt transmission line 13 miles long, to connect the two power stations at Cwm Dyli and Dolgarrog, was constructed.

In 1918 the Aluminium Corporation purchased the controlling interest in the North Wales Power & Traction Co., Ltd.

The Cowlyd Valley water rights were originally the property of Gwalia, Ltd., and the lake was the basis of the original scheme of development. The dam, therefore, completes the original scheme of hydraulic development for Snowdonia, as envisaged by the pioneers who formed Gwalia, Ltd., so many years ago, and it bodes well for the future of this great conception that the control of the North Wales Power Co., the Aluminium Corporation, the Portmadoc Beddgelert & South Snowdon Railway, the North Wales Narrow Gauge Railway, the Festiniog Railway Co., and the Snowdon Mountain Tramroad & Hotels Co., Ltd., is centred in one office at Dolgarrog.

Nearly thirty million units of electricity were actually generated by the two stations during the past twelve months; the storage capacity has now reached a total of 780 million cubic feet; there are over 100 route miles of high-pressure transmission lines in operation; practically all the slate and granite quarries of North Wales are supplied with energy, together with the Marconi Wireless Station and the town of Colwyn Bay; the towns of Llandudno, Conway and Bangor will be connected in the course of the next few weeks, while plans are in active progress to extend the network of transmission lines over the 4,000 square miles of North Wales from Holyhead to Crewe. The aluminium manufactured by this Welsh water from the ores produced by the company's mines in the South of France, is well known and bears a high repute all over the world.

Cowlyd Waterworks.

The following extracts from a paper read by Mr. C. F. Farrington before the Liverpool Engineering Society are printed by permission of the Council of the Society:—

Llyn Cowlyd is situated in the heart of the Carnarvonshire range of mountains, about four miles from Llanrwst, three miles from Trefriw, and two miles from Capel Curig. Its extreme length is nearly 1¾ miles, its extreme width over a quarter of a mile, and the top water level is 1,206 ft. above Ordnance datum. The watershed, which is owned by the Board, has an area of about 1,250 acres, with an average annual rainfall of 90 in.

The Board and the Corporation are entitled to draw the available water in the lake above the level of 1,170.50 ft. above Ordnance datum for the purposes of their respective undertakings, but the Board is alone entitled to the whole of the water in the lake below 1,170.50 above Ordnance datum.

The Corporation is now carrying out a scheme for bringing the waters from the Llugwy watershed into the new lake by means of catchwaters, and this will increase the catchment area by 1,880 acres. The total capacity of the enlarged lake is 3,110,000,000 gallons.

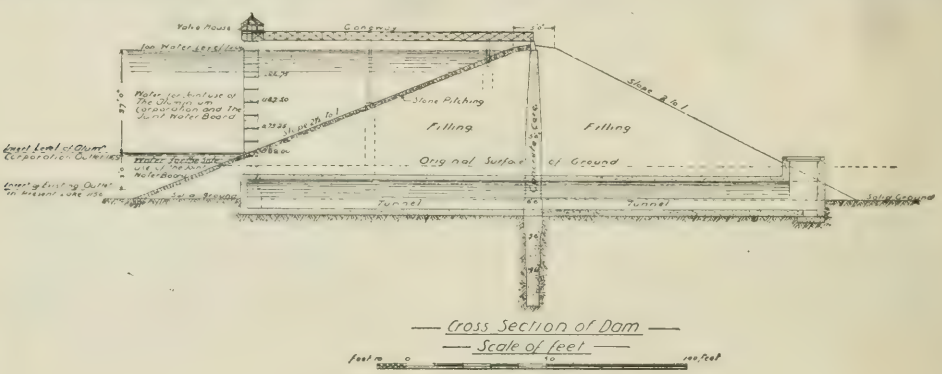


Fig. 2.—Cross-Section of Cowlyd Dam.

The new dam is formed of earthwork, with an inner core of Portland cement concrete carried down into impervious strata. The total length of the dam is about 450 yards, its maximum width at the base is 72 yards, the maximum height above original ground level is 45 ft., and the greatest depth of the core wall below original ground level is 50 ft. The concrete core wall, for the full depth of the excavations, varies in thickness from 4 ft. 6 in. at the bottom to 6 ft. 6 in. at solid ground level, at which level the concrete is reduced to 5 ft. 6 in. in thickness. At this thickness it is carried to 1,176 ft. above Ordnance datum and then to a height of 1,206 ft. above Ordnance datum, the thickness of the concrete being reduced by battering on both sides to 2 ft. 6 in. at the top. The core wall is reinforced by steel rods ½-in. diameter, 2 ft. apart vertically, 4 ft. apart horizontally, from 6 ft. below solid ground level, both sides of the wall and 4 in. from the face of wall, to 6 ft. from the top, with stirrup bars 4 ft. each way. The spillway—160 ft. wide, 1,206 ft. above Ordnance datum—which is constructed entirely of concrete, has a foundation of solid rock.

A rectangular concrete tunnel with semi-circular roof, 11 ft. wide by 10 ft. 6 in. high, has been constructed through the dam for the purpose of conveying the outlet pipes, &c., of the Water Board and Corporation. The inner slope of the dam is 2½ to 1 with 15-in. stone pitching fixed on edge, and the outer slope 2 to 1 seeded. The top of the dam is 15 ft. wide, and has a rubble stone storm wall built on top of the concrete core to a height of 1,211 ft. above Ordnance datum.

In the construction of the dam electric power was freely used for quarrying and crushing stone, haulage, concrete mixing, &c. The supply of electricity was obtained from the Cwm Dyli Power Station, situate at the foot of Snowdon, whose transmission line passes through the Cowlyd Valley, a transformer reducing the voltage from 20,000 to 440 volts for use at the works.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Santon" Switch Plug.

Fig. 1 illustrates a new switch plug manufactured by Messrs. Santon, Ltd., 34, Bridge Street, Newport (Mon.). This is so designed that it cannot be removed while the current is "on," and its rated capacity is 15 A, although it will safely withstand 25 A. By a spring action "making" and "breaking" is executed instantaneously on both poles independently of the speed of operation.

The plug is wired by inserting the wires through an aperture in the front and bringing them to cheese-headed screw terminals. The end cap has recesses for these screw heads, and it also has a wedge-shaped projection which acts as a separator and cord grip for the leads. The flange of the plug is metal covered, and the corresponding surface of the base also has a metal cover mounted on a thick insulating washer.



Fig. 1.—The "Santon" Switch Plug.

The M.B. Electric Soldering Iron.

The M.B. Electrical Co., 105, Whitta Road, Manor Park, E.12, has designed an electric soldering iron which possesses several new features, making it a compact and efficient workshop appliance. The iron is illustrated in fig. 2. The heating element is in cartridge form and, therefore, easily replaceable for a different voltage. The copper bit is made from the solid bar, with a shank extending into the element, this giving a continuous path for the heat to the tip. The nickel-plated body is of the same diameter as the head of the bit, enabling the iron to enter into corners that are not usually easily accessible. The loading is equal to about 127 watts, which makes the cost of operation practically negligible even for long periods. A substantial wooden handle is fitted, rendering the use of the appliance comfortable and safe. The leading-in wires are secured by a cord grip which takes all strain off the terminals. The iron is easily dismantled and re-assembled.

The firm also supplies an adjustable stand upon which the iron can be mounted to enable a succession of joints to be brought up to the iron, freeing the operator's hands and permitting him to employ them in holding the work. Another device supplied is a three-heat switch for regulating the supply.

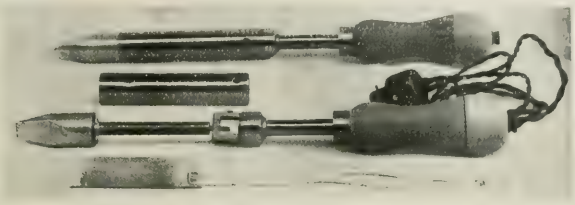


Fig. 2.—The M.B. Soldering Iron.

The "Adjusto-Lite" Fitting.

An electric light fitting which has a considerable vogue on the American Continent has been placed upon the British market by Messrs. S. Guiterman & Co., Ltd., 35 and 36, Aldermanbury, E.C.2. This is a reflector fitting mounted upon a short standard, the base of which fits into the top of a strong spring clip. This clip enables the fitting to be attached to any projecting part of furniture, &c. The "Adjusto-Lite" is made of brass in three different finishes, it is 12 in. in height, the reflector is 5½ in. in diameter, and the clip measures 3 in. by 5 in.; it weighs 20 oz.

Trade Union Membership.—Statistics of trade union membership appeared in a recent issue of the *Ministry of Labour Gazette*. It is shown that from a total of 4,189,000 in 1913 the number steadily rose to 8,433,000 in 1920. Since that year membership has been declining for several reasons, and in 1921 it had fallen to 6,793,000—a decrease of 20 per cent. on the year. In 1920 the total number of such societies known to the Department was 1,425, but amalgamations reduced this to 1,296 in 1921. Some persons are members of more than one society, and making due allowance for this the net total membership for the United Kingdom is about 6,700,000. The iron-foundry, engineering, and shipbuilding unions lost about 82,000 members during 1921.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The British Association on CO_2, CO and O Recorders.

In his paper before the Engineering Section of the British Association, Engineer-Commander Fraser Shaw (chief engineer of the Fuel Research Station, Greenwich) made some very interesting comments on CO_2 recorders.

Commander Shaw pointed out that a CO_2 record alone does not show the true state of combustion and that the CO or O must be known in addition. That is clear enough. Where there are three factors two must be known before the whole is clear. But snap tests for CO or O are of very little value. They must be recorded in the same way as the CO_2 is recorded by continuous control. My firm has been working on this problem for some time and we have brought out the "Arkon" combined CO_2 and O recorder for this very purpose. This instrument is a twin recorder with separate analysis and two charts but drawing its gas from a single pipe. Caustic potash is used for the absorption of the CO_2 and stick phosphorus for the O.

The instrument is made for water drive (see illustration) and for electric drive. The latter is preferred in the few cases where a water supply and drainage is not convenient.

These recorders are by no means experimental but have a fine record of useful service in many different branches of industry. Of course, where a CO_2 recorder is already in use only an oxygen recorder is required to supplement it.

Now as to CO. It is my firm opinion that the fear of CO is very largely groundless. I would almost say that our industrial boiler plants would be none the worse for a little CO in the flue gas. Most boiler plants up and down the country stand in no danger of it.

The proportion of boiler plants which have CO_2 recorders (or indicators) installed is probably between 10 per cent. and 20 per cent. The 80 per cent. to 90 per cent. of plants *without* CO_2 recorder are not in any danger of having the wasteful CO in the flue gases.

Of the remainder, the only plants in danger are those which have been tuned up to a very high pitch with CO_2 recorders constantly in use and with a restricted air supply. Further, of these cases CO is possibly only in plants steaming with easy load. A demand for "more steam" chases all CO out of the flue gases.

Some boiler furnaces, of course, are structurally defective and cannot complete the combustion properly. That is a fundamental condition and not an operating condition.

In fact, no steam user need be disturbed by the fear of CO in flue gases. We are not really near to it yet. Our boiler plants will be working much more efficiently when we are.

In CO recording there are many difficulties in the way. The absorption in cuprous chloride (as used in the Orsat test) is too slow for an automatic recorder, so that recourse is made to burning the CO to CO_2 either by means of an electrically-heated wire or by a tube of copper oxide heated by a bunsen burner. There are, in addition, difficulties in the way of volumetric measurement. The net result is that only one CO recorder, the "Mono" recorder of Sweden, has found its way on the market as yet.

But as I have said above, the average boiler plant will not yield any CO and when it does yield it, steps are taken to stop it at once. Therefore, when a CO recorder is installed on a properly worked boiler plant it shows nothing on its chart! That is quite sound for the economics of boiler plants but psychologically it is rather deadening. Why put in a recorder which will not and should not show anything on the chart?

On the other hand, the oxygen content will usually be round about 6 per cent. which is quite a measurable quantity, clearly shown on the chart. And as the root of all combustion troubles is excess of air, this recorder puts another check on it.

A particular application of the combined CO_2 and O recorder which may interest some of your readers is the case

of boiler or furnace firing with blast-furnace gas. As there is already some CO_2 in the unburnt gas the final CO_2 alone is not a proper guide to the combustion and a second check is necessary. This is furnished by the oxygen part of the twin recorder.

Another case is kiln firing. The CO_2 record alone is misleading because of CO_2 escaping from the material being dried. In this case also the combined CO_2 and O recorder gives a real check.

W. W. Crosweller, A.M.I.Mech.E.
Walker, Crosweller & Co.

London, *September 26th*, 1922.

Power Station Engineers' Salaries.

A point that is not often given the prominence it should have is that the salaries of the technical staff are but a small fraction of the total cost of generation and distribution; coal, capital costs, and wages (as distinct from salaries) are the big items.

Taking as a concrete case the undertaking I am with (figures being approximate only), the yearly output is about 40,000,000 units, and the salaries of the technical staff amount to about £14,000 per annum; this works out, roughly, at 1/12d. per unit, a small item in the total cost of the latter. So, if salaries were halved (which Heaven forbid), the resultant saving would not be a very appreciable factor, quite apart from any question of efficiency and contentment. As can be seen by a study of company and municipal reports, the bulk of the country's undertakings are more than paying their way. I suspect the employers are out to reduce salaries more "on principle" than for the alleged economy resulting; there is also the moral effect on the wage earners to be considered. Remembering the scandalous pay and conditions of the staff employés (and to a lesser extent the workmen) in pre-war days, I think the E.P.E.A. could afford, in justice, to press for a rise in salaries. Judging by the recent action of the British Medical Association in boycotting an underpaid (in *their* opinion) appointment, it would appear that the E.P.E.A. could with advantage take a leaf out of their book. The doctors get practically what they demand, solely by their solidarity, and not on the merits of the case at all.

Further, the *Labour Gazette* cost-of-living figures are, as is notorious, quite unfair to staff men, being applicable mainly, judging by the necessaries mentioned, to "buck" navvies only.

It is to be hoped the E.P.E.A. will follow up the Civil Service associations and others, and endeavour to get a fairer basis for these figures.

K. V. A.

September 19th, 1922.

How to Buy.

On reading the article in the Electrical Review for September 15th "How Not to Buy," the only remedy appears to be as outlined by your correspondent: "Not to Buy at all."

I think most contractors will bear me out that the factor's traveller does not misrepresent (I will not say lie) to such an extent as the manufacturer's traveller. The factor, after making a promise, has very little excuse for not keeping it, but the manufacturer can always point to labour troubles and raw material over which he has no control, and it must be obvious to anyone who has done any buying that if there is any delay at all, it must be owing to the manufacturers not being able to deliver.

As regards stocks, I can name quite a number of factors who hold far more stocks than manufacturers, and if the factor rings up a dozen or so other factors, and probably the manufacturer as well, and none of them has the particular article in stock, what advantage would the contractor have in sending his order direct to the manufacturer?

On the other hand, he has a distinct advantage in knowing that a factor will supply from one source or another, if it is possible to procure the goods.

The whole article seems to be written with the idea that the factor's traveller is a liar, and secondly, that he obtains his business in the public house, which is a libel on any representative whether working for a factor or any other section of the electrical industry.

The contention that any contractor can be a factor by having his paper printed as such merely shows the inaccuracy and want of experience of the writer.

It is only a few years since one of the largest manufacturers in the country determined to do without factors as being an "unnecessary evil," but to-day they are endeavouring to get the factor to support them again by offering special inducements, and the reason is that the factor must buy in large quantities, and meet his accounts when they become due, and have (inside) men who have far more knowledge than just to carry out travellers' promises.

I consider this article is in very bad taste, and one which should not have been written, as it is not helpful either to manufacturer, factor, or contractor.

W. C. Jeary,
Managing Director.
The Jeary Electrical Co., Ltd.

London, *September 19th*, 1922.

Estimating for Internal Wiring Contracts.

In your issue of the 8th inst., "Lodestone," in commenting upon my article on estimating for internal wiring contracts, gives three basic reasons which he thinks account for the discrepancy in prices of tenders, namely:

1. Faulty specifications.
2. Failure of proper supervision by the purchaser.
3. Lack of standards for materials.

Incidentally he makes out a very strong case in favour of the adoption of electrical bills of quantities, because by the employment of that method the first and third of his basic reasons would be eliminated. His second basic reason is so unsound, both in principle and fact, that I am astounded to see such an excuse advanced by an electrical contractor who claims experience and standing.

"Lodestone" asserts that failure of proper supervision by the purchaser (or adviser) is a definite cause of price difference in estimated costs, but the only way by which the estimated costs could be affected would be by the tenderer taking advantage of a known laxity on the part of the adviser and consequently allowing in his estimated costs for a deliberate scamping of the work.

"Lodestone" apparently does not appreciate my dictum that the proper carrying-out of a contract is a joint liability shared by the adviser and accepted contractor, wherefore a neglect of duty by one party does not exonerate the other party from a proper execution of his contract.

With regard to the details enumerated by "Lodestone," it can safely be asserted that the remedy for all such evils lies in the adoption of electrical bills of quantities, whereby definite quantities of specified materials are given to the tenderers for pricing, accompanied by all necessary plans and specifications which enable the tenderer to estimate accurately the labour costs of erection.

Alan Kirk.

London, *September 25th*, 1922.

Trade Jealousy.

The most delightful example of jealousy I ever heard of came to my notice the other day, and your readers will no doubt be pleased to share the laugh it has caused.

A well-known firm of electrical engineers engaged on the installation of a public electricity supply not 50 miles from here sent to the local gas company's works for coke breeze, in which to bury an earth plate, but on learning the use to which the breeze was to be put the company's servants refused to supply it!

W. E. P.

Redcar, *September 24th*, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—Joseph Richardson Norris, trading as the Acme Electrical Co., of Norbreck.—At Blackpool Bankruptcy Court, on September 22nd, this examination took place. The deficiency, on gross liabilities of £812, was estimated to be £564. Debtor attributed his failure to bad trade and losses on contracts. He stated that he first commenced in business at Oldham as J. R. Norris & Co. with £150 capital of his own. He later traded at Prestwich until 1921, when he came to Blackpool. He had confined his activities to contract work only. The examination was adjourned.

Clarence Albert Sidebotham, of Keswick Road, Blackpool.—This examination was also adjourned. Debtor attributed his failure to bad trade, sickness, and the failure of Farrow's Bank. There was an estimated deficiency of £150. Formerly a commercial traveller, he commenced business with a capital of £60 as a merchant dealing in electrical fittings. He did not think there had been any profit in the concern.

H. J. A. Maullin (Wilton Engineering Co.), electrical engineer, 124, Devonshire Street, Birmingham.—First meeting, October 5th, at the Official Receiver's Office, 191, Corporation Street, Birmingham; public examination, October 25th, at the Court House, Birmingham.

H. Garniss, electrician, 107, Beverley Road, Kingston-upon-Hull.—First meeting, October 2nd, at the Official Receiver's Offices, York City Bank Chambers, Lowgate, Hull; public examination, November 13th, at the Guildhall, Hull.

T. Scott and J. Campbell (T. Scott & Co.), wholesale electrical suppliers, 42, Handysides Arcade, Percy Street, Newcastle-on-Tyne.—First and final dividend of 1s. 8½d. in the £, payable October 5th at Messrs. Brittain & Brittain, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne.

B. T. Dale, electrical engineer, Erick Street, Newcastle-on-Tyne.—First and final dividend of 2s. 2½d. in the £, payable October 4th, at Messrs. Brittain & Brittain's offices, 4, Northumberland Street, Newcastle-on-Tyne.

C. J. Haxby and E. Brady (Haxby & Brady), electrical engineers, 1a, East Parade, Harrogate.—Receiving order made September 22nd, on debtors' own petition.

E. Durden & Co., electrical engineers, 13, Queen Street, Liverpool.—Receiving order made September 21st, on creditors' petition.

J. F. Ludlow and R. R. Ludlow (Ludlow Bros.), electrical contractors, 196, Church Road, Redfield, Bristol.—First and final dividend of 8½d. in the £, payable at the Official Receiver's Office, Bristol.

Company Liquidations. Rapid Submersible Ship Cleaner Co., Ltd.—At the annual meeting, held in London last week, Mr. B. A. Levinson stated that, in consequence of want of funds, it had been decided to recommend the shareholders to wind up the company. He referred to efforts that had been made to put the plant to commercial use. They had cleaned some large steamers, but through bankruptcy their bill in one case was not met. Their finances ran out and the bank pressed for payment of the overdraft secured upon the wharf. They had also had correspondence with a view to disposing of the rights or of licences, and had correspondence with reference to the Straits Settlements and South America, and if they had had sufficient finance they would have been able to continue and to apply themselves principally to making arrangements for working the process in tropical waters. The resolution to wind up the company was carried.

Wareham Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator: Mr. A. H. Edwards, Cornhill Chambers, Doncaster. Meeting of creditors, October 2nd. Particulars of claims to be sent to the liquidator by October 20th.

John Brotherton, Ltd.—Winding up voluntarily. Liquidator: Mr. M. Wilkie, 22, Darlington Street, Wolverhampton.

Trade Announcements.—Mr. W. F. Haldane has been appointed manager of the Dublin office of the British Thomson-Houston Co., Ltd., in place of Mr. E. C. Handcock, who left the company in April last.

Automatic & Electric Furnaces, Ltd., are removing to larger premises to meet the growth of the business. Their address from to-day, Friday, is Elecfurn Works, 173-175, Farringdon Road, London, E.C.1. ('Phone: Clerkenwell 5234; tele.: "Elecfurn London.") New machine tools, &c., are being installed to improve deliveries, and there will be new demonstration rooms equipped with large and small electric furnaces, and muffles will be shown in operation.

Venner Time Switches, Ltd., have taken over a foundry for casting their aluminium boxes, owing to the growth of their time switch business, and they are open to deal with requirements in gunmetal, brass, or aluminium castings, and pattern making.

Messrs. Falk, Stadelmann & Co., Ltd., are hurrying forward the restoration of their buildings at Glasgow, which were visited by a disastrous fire on September 11th. For a week or two London stocks will be drawn on through a specially set-up Glasgow department in London, and a daily air-service between Glasgow and London is being taken advantage of. Communications for the branch should be sent to the temporary address: 19-21, York Street, Glasgow.

Messrs. Mayall & Co., Ltd., electrical and mechanical engineers' merchants, Birmingham, have recently appointed Mr. R. E. Akers, who will reside at Christchurch, as their sole representative in New Zealand.

Messrs. Harris & Russell, factors, have removed from Dyers Buildings, Holborn, to 3, Percy Street, Tottenham Court Road, London.

Catalogues Wanted.—Mr. J. C. Elvy, 12, Tavistock Street, W.C.2, wants particulars of electrical equipment for slate quarrying.

Catalogues and Lists.—Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., U.S.A.—A profusely-illustrated brochure upon mine and industrial locomotives, showing numerous types developed by the Westinghouse Co.

Messrs. C. F. Elwell, Ltd., Craven House, Kingsway, W.C.2.—An illustrated pamphlet giving particulars and prices of cabinet receiving sets, portable sets, loud speakers, valves, and other "wireless" components.

Messrs. Falk, Stadelmann & Co., Ltd., 83, 85 & 87, Farringdon Road, E.C.1.—Catalogue No. 484, giving prices and details of condensers, head telephones, aerial equipment, and other "wireless" accessories.

Messrs. Santon, Ltd., 34, Bridge Street, Newport (Mon.). —An illustrated pamphlet descriptive of "Santon" switch plugs.

A.G.E. Electric Motors, Ltd., Stowmarket. (London representative, Mr. Thomas T. D. Geesin, 4, Clevedon Road, S.E.20).—Two well-illustrated brochures dealing with "Bull" d.c. dynamos and motors, together with a card giving net trade prices.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Booklet No. B.C. 2815.—An illustrated catalogue, giving full details and prices of "Geecophone" crystal and valve wireless receiving sets, components, and accessories. Details of aerial erection are included.

The Pulsometer Engineering Co., Ltd., Nine Elms Iron Works, Reading. An illustrated and priced pamphlet describing the "Pulsometer" ring pump—a new design.

Book Notices. "Filtration," by T. Roland Wollaston, M.I.Mech.E. (102 pp.). London: Sir Isaac Pitman and Sons, Ltd. Price 2s. 6d. net.—A sub-title describes this work as "an elementary treatise on industrial methods and equipment for the filtration of liquids and gases for those concerned with water supply, ventilation and public health, chemists, mechanical engineers, and others." The bulk of the volume is devoted to the treatment of water, and for this reason is likely to be of assistance to students of power station operation. The numerous types of filter are described in sufficient detail and the work is well illustrated. The filtration of oil and air receives treatment in separate chapters; but the author is not one of those who believe that filtered and clarified oil retains the whole of its lubricative value. In the chapter on air the quotation of a long passage from the *Observer* on the evil effects of atmospheric pollution seems to be somewhat superfluous.

"Working Diagrams of Valve Amplifying Receiver Circuits," arranged by H. W. Sullivan. London: H. W. Sullivan. Price 1s.—This is the fourth edition of these diagrams, and includes a number of additions. The principal improvements are diagrams of switching arrangements to control the number of valves in operation, and a plate (No. 33) showing the method of adding a note-magnifying valve to the circuits shown in other diagrams. Thirty-four plates appear in this edition. For amateurs not versed in the reading of electrical diagrams, the last plate provides means of identifying the various components of a valve receiving set.

"Handbook of the Electric Power Club" (364 pp.). Cleveland (Ohio): The Club. Price 50 cents.—The Electric Power Club, Cleveland, is an association of manufacturers of electric power apparatus and control equipment, organised for the standardisation, improved production, and increased distribution of electrical machinery and apparatus. Its handbook, of which the present is the 14th edition, contains definitions, symbols, &c., and is a compendium of the standardisation work executed by the Club in electric motors, generators, transformers, tools, locomotives, and switchgear, and in many other branches of the industry. The Club has recently issued a bulletin, which gives what are believed to be the first attempts at standardising portable electric drills. This bulletin lays down voltages, frequencies, cutting rates, &c. A note in the publication shows that the Club's activities extend to Canada.

"The Brown-Boveri Review" for September contains a detailed description of the erection and testing of the single-phase alternators for the Ritom (Switzerland) power station, which supplies power to the Gothard section of the Federal Railways. Several excellent illustrations accompany the article. Other subjects dealt with in this number are the firm's "Type E" switch-boxes, motors for centrifugals, and mercury arc rectifiers for d.c. pressures of 5,000 V.

Messrs. Haseltine, Lake & Co., of Southampton Buildings, London, W.C.2, have issued for the use of their clients (there is a charge of 10s. 6d. for extra copies) a booklet of 64 pages entitled "Information on the Subject of Trade Marks." It deals with the subject in a general manner, and endeavours to remove misconceptions which they have found to exist regarding the legal and semi-legal considerations involved. The definition and function of a trade mark; its value; the effect of registration; infringement; selection; validity and maintenance; and how to apply for registration are among the points covered. The classification of goods is also referred to as well as registration abroad and registration at Customs.

"The *Bulletin* of the Hydro-Electric Power Commission of Ontario," August. Toronto: The Commission.—The bulk of this number is devoted to salesmanship notes. An educative article shows the necessity for public "utilities" to sell appliances to their own employés first. The article is based on a questionnaire which, while showing that employés were somewhat behind expectations in their use of electrical appliances in their own homes, would no doubt compare very favourably with the position in this country; but this, of course, would apply to the general use of appliances also. The technical part of the *Bulletin* deals with lamp testing, and the choice of suitable distributing cables.

"Universal Directory of Railway Officials, 1922." (Pp. 644+101). London: The directory Publishing Co., Ltd. Price 20s. net. The 28th edition of this valuable work has not altered in form to any extent. It is pointed out in the preface that the grouping of the railways of the United Kingdom which is now in progress will probably involve considerable changes in *personnel* and organisation, but it is unlikely that the directory will become out-of-date before its next appearance. The immense scope of the work may be gauged from the fact that nearly 3,000 railways are dealt with, including 564 in the British Isles. The term "railways" has been interpreted in a technical sense, and for this reason the work contains details of the officials of tramway systems and numerous light railways. Special value attaches to the list of countries covered, and the personal index of railway directors and officers, comprising about 22,000 items.

The volume is strongly bound, and its size is small for the amount of information embodied in it.

Journal of the American Institute of Electrical Engineers. Vol. XLI, No. 9, September, 1922. New York: The Institute. Price $1.

German Electrical Exports in 1920-22.—In the Festival number of the *Elektrotechnische Zeitschrift*, published on the occasion of the 28th annual meeting of the Union of German Electrotechnicans at Munich, 1922, an article is published in which the position of German electrical export trade is reviewed. It states:—

"Before the war the output of electrotechnical products of the whole world amounted to a value of about four milliard gold marks. According to the then development of the electrotechnical industry, and the world's demands for its products, it might be reckoned that, saving any great disturbance of production, this output could be doubled in seven years. Whether that has occurred or not, the statistics to hand do not allow of our ascertaining. A considerable increase in the world's electrical output since the period before the war has, however, actually taken place albeit the economic power may have received a serious setback. The greatest increase in output possibilities has undoubtedly occurred in the United States. The extension of their electrical industries in the other combatant countries was hindered by the war. A considerable increase in later years has taken place in France, where there is talk of a doubling of the production. England, too, may institute a notable extension of its electrotechnical industry. Germany, which before the war produced about one-third of the aggregate production of the world in the electrotechnical department, was forced by the hostile alliance to take a back seat and yield up its preponderating lead as regarded quantity of products—not to England as was believed in some quarters—but to the United States. How far German production in some branches, which depends less on the economic conditions (as weak current articles, meters, glow lamps, &c.) has reached the peace level, or even a little beyond, cannot at the moment be stated. An exact estimate of the development and present position of the world's output of electrotechnical products is difficult to ascertain owing to the currency situation in each country. On this account it is especially difficult—almost impossible—to form an estimation from the published export values and export quantities. The English statistics of general foreign trade appear to be the only ones which carry out since the war a blameless method of value fixation as they give side by side with the declared value of present-day exports the export quantities, enabling thereby a comparison of the export values both before and since the war. As for the rest of the countries the declared value appears only in dollars, French paper francs, Swiss paper francs (gold francs since the end of the year only), paper marks, &c. It is attempted in the following table (ignoring the quantities) to ascertain from the declared values the peace value of the present exports, in order to make a comparison with 1913.

Land.	1913. Absolute worth of the exports reckoned in gold marks.	1913. Share in the total exports of five lands. Percentage.	1920. Absolute worth of the exports reckoned in gold marks.	1920. Share in the total exports of five lands. Percentage.	1921. Absolute worth of the exports reckoned in gold marks.	1921. Share in the total exports of five lands. Percentage.
United States	9·5	16	36	34	34	40
England	13·0	22	18	19	24	28
France	3·6	6	5·6	8	4·6	6
Switzerland	2·1	3·5	5	5	4·8	5
Germany	30·0	52	22	34	12	21

"In this table are given only the five principal exporting nations. The export of electrotechnical products in these countries is indicated by mean value in millions of marks. Column one contains the absolute worth of the exports reckoned in gold marks—in the case of the dollar, which has a full gold currency, the value is taken from the par quotation; in the case of England and Switzerland, from the average of the year's value; in the case of France, from a three months' average, for greater exactness; in the case of Germany, from the monthly averages, to allow for the changes in the currency value. In 1913 Germany occupied the first position as an exporting country, and England, although a good way [illegible], America, France and Switzerland following; now the order is:—America, England, Germany, France and Switzerland. While, therefore, all the other countries have been able to see their exports rise, and even France [illegible], Germany's volume of 30,000,000 gold marks in 1913 has shrunk in 1921 to 12,000,000 gold marks monthly mean value, or, in other words, the share of Germany in the aggregate exports of the principal countries has fallen from 32 per cent. to 21 per cent. But it is not to be wondered at that Germany's electrotechnical exports should have gone back, both actually and relatively, to this extent. Middle and Eastern Europe are economically bankrupt and unable to buy. The hostile alliance withholds with all its might from importing German products, while a circle of neutral States, under the pressure excited by cheap German products, have set up a wall of import taxes and restrictions against German goods. The English Colonies forbid, for the most part, the import of German electrotechnical products. The United States have always levied high protective duties, in order to destroy all industrial competition in their home market. The rest of the world is too small to be considered, and has, moreover, suffered from the consequences of the war, so that it has no great meaning for the German electrotechnical industry."

Development of an Electricity Supply Scheme.—Messrs. Sir Chas. Bright & Partners, Ltd., have been appointed consulting engineers to the Western Electric Distributing Corporation, Ltd., which controls and operates electric supply companies in the following towns: Tewkesbury, Chippenham, Trowbridge, Melksham, Leominster, Cirencester, Abingdon, Ledbury, Ruthin, Stroud, and Warminster. We understand that Mr. A. H. Seabrook has joined the board of the company, and that financial interests in the City of London having guaranteed a large additional capital, the company's operations will immediately be extended.

French Electrical Investments.—According to the statistics of new capital investments in the first quarter of the present year, the French electrical industry was responsible for 511,000,000 fr., divided as follows:—Share capital of new companies, 11,765,000 fr.; increases of capital, 59,167,000 fr.; and bonds, 440,206,000 fr. These figures far exceed those of other branches of industry, even those of food supply, which shows the growing importance of the electrical industry and the favour its securities enjoy among the general public.

Wages in the Tramway Industry.—Sir David Shackleton presided at a meeting of the Joint Industrial Council for the Tramways Industry on September 21st. The employers submitted a modified scheme of wages reduction, involving a "cut" of 3s. per week instead of the 12s. originally put forward. They also desired that the whole question of wages and conditions should be submitted to a court of inquiry in November. A national conference of the men's delegates unanimously rejected the new proposals, resolving not to agree to any reduction in wages whatsoever. There appeared to be some difference of opinion regarding the rates to be paid to employés in the Metropolitan area and those outside it. It was felt that a settlement could be arrived at if the two classes were considered separately. On Tuesday last the National Council again met, and, after a long discussion, adjourned until the following day without having arrived at a settlement.

The Sunderland Tramways Committee, which has seceded from the Joint Industrial Council, has submitted a scale of reduced wages to its employés, who have replied that they cannot accept the scale as it stands, nor can they accept any revision of wages which will mean a greater reduction than that which is eventually accepted under the national scale. They ask for an early interview with the Committee. The Committee's scale proposes reductions of varying amounts in the pay of all classes of employés, ranging from 8s. to 13s. a week, the cuts to be made in three instalments. Under it no present employé would receive less than 51s. a week, and newcomers would get not less than 50s. a week. Ticket inspectors' wages would be reduced from 73s. 6d. to 61s., motor inspectors' from 78s. 3d. to 65s.; drivers' from 68s. 6d. to 57s., and conductors' from 62s. 9d. to 53s. The scale is based on the condition that the men agree to a reduction in the annual holiday with pay from eight days to six days.

Brown Boveri South American Branch.—The *Review of the River Plate* reports the formation of the Brown-Boveri Compañia Sudamericana de Electricidad as follows: "Domicile, city of Buenos Aires with the right to establish branches. Duration, 30 years, with the right to prolong. Object: to exploit the 'Brown-Boveri' processes and patents in South America and more particularly in Argentina, Uruguay, Paraguay, and Peru, by the importation of electrical materials, &c., manufactured in the 'Brown-Boveri' workshops. Capital, $500,000 m/n in 500 shares of $1,000 m/n each. The company has the right to issue debentures. Board of directors: Directors, Atanasio Iturbe, Antonio Chiesa, Juan Carosio, Walter Boveri and Jorge Boner. Directors-alternate: Juan Massone and Ernesto Franzoni. Syndic: William S. Bell. Syndic-alternate: J. Monteith Drysdale. Shares have been subscribed as follows: Juan Carosio, 50; Atanasio Iturbe, 50; Augustin Zamboni, 50; Luis Riva, 50; Oscar Strazzolini, 50; Octavio Cesario, 50; Sebastian L. Flores, 50; Juan Alberto Molinari Calleros, 50; Humberto Ghersa, 50; and Juan B. Rivara, 50. Total, 500 shares."

Australian Tariff Decisions. The following decisions, *inter alia*, have been approved by the Customs Department: *Scientific Instruments and Apparatus.*—Binaural instruments for the detection and location of sound. Item 174. Free under the British preferential tariff, 5 per cent. under the intermediate tariff, and 10 per cent. under the general tariff. *Electrical Appliances.*—Accumulators having plates 14⅞ in. by 13⅜ in. "for use in the production and distribution of electricity from brown coal." Item 174. Free, 5 per cent., and 10 per cent. *Machines, machinery, &c.*—Dies, wire drawing. Item 174. Free, 5 per cent., and 10 per cent.—*Reuter's Trade Service* (Melbourne).

A Chilean Experiment.—The U.S. Commercial Attaché at Santiago, in an August dispatch (*Commerce Reports*, September 4th), says that the provision of money for the payment for the electrification and the railway material purchased in the United States last year brought about discussion in Congress, which has resulted in the enforced decision of the railway administration to authorise the construction of locomotives and cars within the country. The result of the experiment of building locomotives in Chile is uncertain, and it is doubtful whether the railway administration will be able to count upon them with sufficient security to avoid purchase abroad in case the services require additional equipment within a comparatively short space of time."

Midland Electrical Notes.—Our Birmingham correspondent writes: "Engineering is making but slow progress in Birmingham and the Midlands. On the electrical side, however, there is a better inquiry for motors adapted to industrial purposes, but the accessory trade is still rather lifeless. For small lighting sets for private houses there is a much better demand. The actual number of orders received for power plants is not large, but the inquiries are more numerous, both on home and foreign account. In the coal mines electricity is having a much wider application, and a certain amount of business under this head has been received from France. The electrical section of the new technical school at Rugby has been completed. The equipment of a very up-to-date kind has been presented by the B.T.H. Co."

South African Tariff.—The South African Customs authorities have recently given a decision to the effect that "switches, dimmer for motor car lamps" are to be classified under No. 114b of the Tariff, the general duty being 3 per cent., British manufactures being admitted free.

Electricity Meters for the Sydney City Council.—With further reference to this matter (see ELEC. REV., September 15th, p. 375) the *Industrial Australian and Mining Standard* for August 10th reports as follows: "The Sydney City Council proposes that the contract already made with the Electricity Meter Manufacturing Co., Ltd., for the supply of 1,500 5-amp. 240-volt single-phase induction house-service meters, be extended to cover the supply of 500 additional meters. The price of the additional meters to be £2 each. The electricity committee considers that the council cannot afford to 'spoon-feed' any longer the meter manufacturing industry in Sydney by paying higher prices for electric meters than those ruling in the open market. It accordingly rejected a proposal by the Electricity Meter Manufacturing Co. to supply 5,000 meters at £2 each, but decided to recommend the acceptance of 500 meters at the price stated above. It is anticipated that the Sydney City Council will be calling for tenders for the supply of 5,000 electricity meters."

Works Visit.—The Electrical Society of Glasgow opened its proceedings for the session on September 19th with a visit to the works of the Falkirk Iron Co., Ltd., at Falkirk. After being entertained to lunch, the party, numbering about 90, proceeded to the works canteen, where successful demonstrations of electric cooking were given on a present-day cooker, and also on a "Model" cooker which the company has evolved. The principal feature of the "Model" cooker is that heat is induced in the bottom and sides of the cooking utensils themselves, and not in the appliance, which remains cool. The utensils are specially made, and as no flames or radiant heat impinge on them they should outlast ordinary cooking vessels. The domestic equipment on which the demonstrations were conducted consisted of one large and one small "Inducer" mounted on a standard cooker, the "Inducers" replacing the ordinary solid or radiant-type boiling plates. It is claimed that the domestic "Inducer" as demonstrated has an efficiency varying from 85 to 90 per cent. One pint of cold water can be boiled in one minute, and 16 pints can be brought to the boil on a consumption of one kWh. With larger quantities of water the "Inducer" boiler is said to be capable of as high an efficiency as 97 per cent. Not only is extremely rapid heating and cooking obtainable, but when once the food or water is brought to the boil the wide range of control permits simmering, brais ing and other slow operations to be carried out economically. The lowest loading of the smallest "Inducer" is 120 W. After the cookery demonstrations the party was conducted round the various departments of the works, the Electrical Department being of special interest.

E.D.A. Salesmanship Conferences.—The first E.D.A. Salesmanship Conference for the session 1922-23 will take place at Caxton Hall, Westminster, S.W., on Friday, October 13th, at 7.30 p.m. Mr. W. E. Bush (of the B.T.H. Co.) will open a discussion on "Salesmanship in Relation to Lighting," and Mr. Ll. B. Atkinson will take the chair.

Copper and Lead Prices.—Messrs. F. Smith & Co. report September 26th:—Copper (electrolytic) bars, £71 5s., 5s. decrease; do. do. sheets, no change; do. do. wire rods, £81 5s., 5s. decrease; do. do. h.c. wire, no change.

Messrs. James & Shakespeare report September 27th:—No change in copper bars (best selected), sheet and rod, and English pig lead.

Telephone Exports to the Dutch Indies.—The Swedish General Consul at Batavia reports that the Swedish exports of telephone apparatus to the Dutch East Indies now seem to be threatened by the United States and Japan. These two countries entered that market during the time of the war and appear to find a wide field for their manufactures. If Sweden is to maintain its position the Consul states that it will be necessary for suitable measures to be adopted to meet the competition in question.

The Electrification of Russia.—At a conference of the communist party, held in Moscow about a year ago, M. Lenin declared that the "Council Republic is communism plus electrification." Matters now appear to have somewhat changed. The *Isvestija*, the official organ of the All-Russian Executive Central Committee, recently referred to the question of electrification, and stated: "The moneys are not to be found, and consequently the works of electrification, which involve large expenditure, have been discontinued." On the other hand a telegram sent out from Moscow last week announces that the Supreme Economic Council has approved a draft of a decree to authorise the formation of a joint stock company for the financing of works of electrification, which is thought of as an organising and financial centre for these works. The constitution of the company is to take place with the participation of the State Bank and the Bank of Industry, and a foreign agency of the company, under the control of the Foreign Trade Commissariat, is to negotiate the purchase of electrical machinery and materials abroad.

For Sale.—By direction of the Disposal Board, Messrs. Geering & Colyer will sell by auction, on October 12th and the following day, at H.M. Naval Depôt, Dover, and at the Royal Army Ordnance Depôt, Shorncliffe, generating plant, machinery, cranes, machine tools, &c.—Stockport Corporation Electricity Department invites offers for surplus plant, consisting of three 500-kW Bellis generating sets, a number of motors, fan, &c.—Worcester Electricity Department has for disposal six E-type "Underfeed" stokers; Messrs. Jones and Griffiths are inviting offers for surplus generating plant now lying at the power station of the Mardy Electric Light Co., Ltd., Mardy Station, Rhondda Valley. The plant was installed in 1911 by the G. E. Co., Ltd., and is now being sold owing to the change-over from d.c. to a.c. Instructed by the Liquidator, Messrs. S. M. Wilkinson and Co., are inviting offers for the stock, fittings and fixtures of Messrs. Evans, Dewhurst & Colley, Ltd., electrical, mechancial, and motor engineers, of West Wharf, Cardiff. The Yorkshire Electrical Power Co. has for disposal two water-tube boilers, superheaters, and hand-fired furnaces, condensing plant, pumps, &c. (See our advertisement pages to-day.)

LIGHTING AND POWER NOTES.

Aberdeen.—PRICE REDUCTIONS.—The Electricity Committee has reduced the price of electricity by ½d. per kWh as from July last. The price per kWh will now be as follows:—Private lighting, 5½d.; public lighting, 3¾d.; heating and cooking, 1½d.; and power (lowest rate), 1¼d.

Argentina.—WATER-POWER DEVELOPMENT.—The Minister of Public Works of the Province of Mendoza has submitted to the Legislature of that province a gigantic scheme for the exploitation of the water-power which is now going to waste, and which the Minister says can be economically utilised for the generation of electrical energy and the irrigation of 625,000 acres of land. The Government proposes the construction of plant on the River Atual at a point near the town of Nihuil to generate from 40,000 to 100,000 h.p. of electrical energy. Government engineers have pointed out that from Nihuil to Mendoza, a distance of nearly 300 miles, electrical power can easily be conveyed for lighting and industrial purposes. At present the supplying of light and power involves the transport of fuel from Buenos Aires, and to produce 40,000 h.p. by Diesel engines would require a supply of 70,080 tons of crude petroleum per annum. The Minister has asked the Legislature to pass a law authorising the calling of tenders for a concession to be granted for the installation and operation of the hydro-electric plant at Nihuil, notification to be given in all foreign countries, with a term of six months for the submission of offers. Full details of the project can be obtained from the Minister of Public Works, City of Mendoza, Argentina. *Reuter's Trade Service* (Buenos Aires).

Australia. MANLY (SYDNEY).—The Council is to borrow £25,000 for extending its electric street lighting and mains. —*Reuter's Trade Service* (Melbourne).

Bangor.—ELECTRICITY SCHEME.—The Urban Council has under consideration a scheme for supplying the district with electricity. The estimated cost of carrying out the work is £38,300.

Barnes.—Proposed New Plant.—Last year a proposal to install an additional turbo-alternator, with the necessary converting plant, was deferred owing to the excessive cost. The engineer has now reported that the additions are urgently needed, and he has therefore been instructed to prepare estimates for the plant.

Bedford.—Application for Order.—The Town Council has applied to the Electricity Commissioners for a Special Order extending the area of supply to the parishes of Kempston, Wootton, Stagsden, Biddenham, Bromham, Pavenham, Oakley, Clapham, Milton Ernest, Revensden, Wilden, Renhold, Goddington, Willington, Cople, Cardington, Eastcotts, Wilshamstead, and Elstow.

Bo'ness.—Transfer of Undertaking.—At a recent meeting of the Town Council it was agreed to take over, as from July next, the control and management of the town electricity undertaking, which 20 years ago was leased to the National Electric Construction Co., Ltd. The capital expended on the works to date is £59,000, and the amount outstanding £42,000.

Canada. — Newfoundland. — According to Washington officials of the Newfoundland Business Men's Committee, the Premier (Sir Richard Squires) is now in London negotiating for British support for the 235,000 h.p. electrical plant which is to be installed on the Humber River, Newfoundland.—*Westminster Gazette.*

Cardiff.—Price Reductions.—The Electricity Committee has recommended the following reductions in the charges for electricity: Lighting, from 6½d. to 5½d. per kWh; power, from 2½d. to 2¼d. per kWh; heating and cooking 1½d. per kWh during the winter quarters, and 1¼d. per kWh for the summer quarters.

Carlisle.—Year's Working.—The report of the City electrical engineer (Mr. C. W. Salt) for the year ended March 31st, 1922, states that the total revenue of the electricity undertaking was £53,470, as compared with £54,618 in the previous year. The total working expenditure fell from £41,492 to £38,553, increasing the gross surplus from £13,126 to £14,937. Capital charges increased from £12,692 to £14,358, leaving a net profit of £579, as compared with £455 in 1920-21. The amount of energy sold decreased from 6,220,535 to 5,886,680 kWh. The capital expenditure during the year was £14,938.

Continental.—Bulgaria. *Water Power.*—A report upon the hydro-electric resources of Bulgaria by the U.S. Vice-Consul at Sofia was recently published in *Commerce Reports*. It is stated that the estimated potential water-power amounts to over a million electrical horse-power. According to projects recently planned for its utilisation only about 150,000 h.p. would be required primarily for the electrification of the railways and industries, leaving the remainder for lighting and agricultural purposes. A programme drawn up by the State proposes the construction of a number of hydro-electric stations, interconnected with transmission lines throughout the country. The State recognises the necessity for the aid of foreign construction companies in order to obtain the full benefit of their superior technical knowledge, construction methods, and equipment. To this end all work to be undertaken will be publicly advertised.

The preliminary estimate of the cost of the State project amounts to 260,000,000 leva (£1 = 700-750 leva, August 22nd).

Crieff.—Electricity Supply.—The Town Council is to transfer the scheme for the introduction of electricity to a local company to be named "The Crieff Electric Supply Co.," cancel the Special Order already obtained by the Council, and co-operate with Edmundson's Electricity Corporation, Ltd., in carrying out the scheme.

Edinburgh.—Progress of the Portobello Station.—The three 10,000-kW turbo-alternators, with their condensers, air pumps, and auxiliary plant, at the new Portobello power station, are now complete, with the exception of a small amount of pipework. Two of the boilers are practically finished, and a third will probably be ready by November. It is anticipated that this will be sufficient to meet this winter's demand.

Glasgow.—Electricity Extensions.—It is recommended that permission be granted to the Clyde Valley Electrical Power Co. to carry out the necessary mains extensions for the purpose of giving a supply of electricity to the Tollcross housing area, the nearest cable belonging to the Corporation being two miles distant.

Hereford.—Result of Inquiry. The *Bath Chronicle* states that disquieting disclosures are the result of an inquiry by a special committee of the City Council into the financial position of the Corporation's Electricity Committee. Hereford was the first municipality in this country to establish a scheme for supplying electricity to towns and villages within 20 miles, and in three years the Council has spent over £100,000. It was stated at the inquiry that of that amount £10,000 could not be accounted for, and that one firm was paid £900 commission on poles supplied by another firm.

Hove and Aldrington.—Year's Working.—The report on the working of the Hove electricity undertaking for the year ended March 31st last, shows a total revenue of £45,007, as compared with £39,703 in the previous year. Working expenses amounted to £27,107, leaving a gross profit of £18,900. After payment of capital charges there was a net profit of £6,049. In the previous year there was a surplus of £2,959. The number of kWh sold increased from 1,290,504 to 1,456,861. A total of £17,752 was spent during the year on capital account; this included machinery, £7,125; mains, £1,531; bulk supply mains, £7,320; and meters, £1,177. The Electricity Committee has recommended a reduction of 1d. per kWh in the charge for electricity for lighting purposes, beginning from the September quarter's readings.

The working of the Aldrington electricity undertaking for the past year shows a total income of £4,170. Working expenses absorbed £2,611, leaving a gross profit of £1,459. After meeting capital charges, &c., there was a net profit of £339, as compared with £34 in the previous year. The number of kWh sold rose from 112,784 to 129,913 .

Keith (N.B.).—Electricity Scheme Abandoned.—The Town Council has decided not to proceed with the institution of an electricity supply for the district, and the special committee formed for the purpose has been discharged. Messrs. Edmundson's Electricity Corporation, Ltd., had offered to form a company, provided that £5,000 or more was subscribed by residents.

New Zealand.—Devonport.—The Borough Council has under consideration the raising of a loan of £40,000 in connection with the supplying of electricity to the town. The amount would be expended in the following manner: Purchase of present installation, £25,000; alterations to existing mains, £3,000; alterations to plant at pumping station, £2,000; installation of new plant, £10,000. A report prepared by the Council's consulting engineer states that a profit of £5,000 per annum could be expected without any increase of existing rates.

Ashburton.—The poll in connection with a loan of £296,500 to provide for the installation of electric light and power in the district has resulted in a large majority favourable to the proposal.—*Reuter's Trade Service* (Melbourne).

South-East Lancashire District.—Electricity Advisory Board.—The South-East Lancashire Electricity Board, at a meeting on September 19th, approved proposed contracts for bulk supplies from the Lancashire Electric Power Co. to Radcliffe Urban District Council and Rochdale Corporation, and from the Manchester Corporation to the Lancashire Electric Power Co.; and also the construction of certain mains in connection with such supplies. The Board is in operation in all respects as though the Order had been approved by Parliament, and has prescribed forms in order to standardise procedure in relation to the submission of material facts by constituent authorities in connection with their proposals. The Board has also instructed the Engineering Advisory Committee to consider and report upon the adjustment of running hours of the generating stations in such manner as to effect the maximum economy in the production of electricity; and the principles which should govern the charges to be made for reciprocal stand-by and bulk supplies. The Board has recommended the Electricity Commissioners to amend the Order so as to provide for the addition to the Engineering Advisory Committee of a member representing the distributing authorities, and in anticipation of this amendment the distributing authorities have appointed Mr. H. C. Busbridge, the engineer to the Swinton and Pendlebury Urban District Council.

Winchester. — Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. L. Ayton) for the year 1921-22 show a total revenue of £30,458, as compared with £33,563 in the previous year. The working expenditure totalled £22,497, as against £25,147, leaving a gross balance of £7,961 (£8,416). After payment of interest, sinking fund, and other charges, a balance of £1,047 was carried forward; this was slightly greater than the equivalent figure in the previous year—£1,022. The expenditure on capital account during the year was £12,759, the principal item being £10,314 for machinery. The total energy sold increased from 1,407,814 to 1,493,161 kWh. The report states that the new turbo-generator set was not delivered until September last, and consequently was only in service from November onwards. The two Belliss-Parker sets were sold for £1,250, which was £250 above their estimated value.

Wolverhampton.—Year's Working. The report of the Electricity Committee upon the undertaking (engineer: Mr. S. T. Allen) for the year 1921-22, records a total revenue from all sources of £164,552, as compared with £193,369 in the previous year. Working expenses amounted to £94,777, as against £119,932, leaving a gross profit of £69,775 (£73,437). Against this was charged an amount of £55,973, including £5,000 transferred to the Improvement Fund, giving a net profit of £13,941, the whole of which was transferred to the Reserve Fund. Last year there was a profit of £27,064. The Reserve Fund now stands at £63,929. The capital account shows an expenditure of £41,105 during the year, the principal items being £31,765 expended upon mains and services, and £8,619 for transformers. The amount of energy sold underwent a serious decrease, *viz.*, from 21,559,351 to 16,208,656 kWh, providing yet another proof of the bad state of industry during the year.

Scheme for Unemployed.—In order to provide work for the unemployed during the winter a scheme has been submitted to the Unemployed Grants Committee for laying mains, &c., at a cost of £8,700

St. Helens.—Year's Working.—The total revenue of the electricity undertaking for the year ended March 31st last was £87,629, as compared with £121,515 in 1920-21. Working expenses were £62,579, as against £100,233, leaving a gross profit of £25,050 (£21,282). After the payment of capital charges and the crediting of various amounts, including £3,862 brought forward from the previous year, the sum of £4,888 was carried forward. During the year the sum of £50,506 was spent on capital account; this included £16,560 for machinery, £15,081 for sub-station buildings and equipment, and £12,614 for mains and services. A total of 13,187,606 kWh of energy was sold, a decline of over 8,000,000 on the previous year's figure.

Warrington.—Year's Working.—The accounts of the Corporation electricity supply undertaking (engineer: Mr. F. V. L. Mathias) show that the income during the year ended March 31st last amounted to £103,054, as compared with £123,365 in the preceding period. The total amount of working expenses was £65,239, as against £92,211; this reduction was due mainly to a fall in generation costs from £63,520 to £41,765. The gross surplus was thus £37,815, as compared with £31,153 in 1920-21. After crediting interest on investments and deducting capital charges, a net profit of £11,215 remained; this compared with £12,037 in the previous year. The capital expenditure during the year was £49,490, "machinery, tools, &c.," accounting for £30,428, and mains and services for £10,525. In common with the majority of undertakings there was a decline in the amount of energy sold—from 9,681,226 to 8,019,814 kWh. The capacity of the plant remained at 7,750 kW.

York.—New Hydro-Electric Station.—It is stated in the Yorkshire Press that the hydro-electric station at Linton Lock is expected to be in operation before next Christmas. The installation will consist of three turbines, two of 560 b.h.p. and one of 410 b.h.p., driving 6,000-V alternators through gearing. The power will be transmitted a distance of 10 miles to a sub-station at Lendal Bridge, York, at the generated voltage; it will there be transformed and converted into d.c. at 230 V. The total cost of the scheme will be between sixty and seventy thousand pounds, and it is estimated that a saving of 4,000 tons of coal per annum will be effected.

TRAMWAY AND RAILWAY NOTES.

Australia.—New South Wales.—The Sydney *Sun* states that while it has been decided that the Bankstown line shall be the first to be electrified, even this is a long way off. There seems little prospect at present of the Treasury providing the money for the work. The electrification of the North Shore line lies in the still remoter distance. The Commissioners have long been urging the electrification of the Newcastle steam tramways, which are losing £40,000 a year through the competition of the 'buses. No money, however, can be found for this work, though it is claimed that it would be highly remunerative.

Birmingham.—Proposed New Route.—The City Council has under consideration a number of winter relief schemes for providing work for the unemployed. It is proposed to spend £776,000; this amount will include £187,700 for the construction of a tramway track to Rubery and Rednal, villages on the Worcestershire side of the city.

Bradford.—Year's Working.—The report of the general manager of the Corporation tramways (Mr. R. H. Wilkinson) for the year ended March 31st, 1922, shows a total combined revenue (general, railless, and parcels) of £721,547, as compared with £718,539 in the previous year. The working expenses totalled £588,803, as against £653,903, leaving a gross surplus of £132,744 (£64,636). This was made up of a surplus on general account of £143,388 and deficits of £8,068 upon the railless traction account, and of £2,576 upon the parcels account. Capital charges, &c., absorbed £76,128, giving a final result of £56,616 profit, as compared with a net deficit of £16,434 in 1920-21. The increased revenue was due to the higher scale of fares, with a 2d. minimum, put into operation in October, 1920. The receipts per car-mile were 28.440d., as compared with 27.292d. in the previous year. The working expenses were reduced from 23.493d. to 22.088d. per car-mile. The car-mileage was 6,132,403, a decrease of 215,001. The route mileage of the tramways operated by the Corporation is now 59 miles, or 109 miles of single track. The railless trolley routes have a total length of 9½ miles, and further extensions are contemplated in the near future.

Continental.—Spain.—A concession for the construction and working of an electric tramway in Pontevedra has been granted to Don Teodosio Dominguez.

The Sociedad Anonima Ferrocarril Metropolitano de Barcelona (Barcelona Underground Railway) has concluded an agreement with the Town Council to accord the latter a share in its profits, to pay a yearly fee and satisfy all the requirements of the municipality. The network of this second underground company in Barcelona will cross the city from north to south, and the company undertakes to build an [illegible] line starting from Bollblanch and ending at San Andrés [illegible], this line a branch will be made to the grounds of the electrical exhibition, which is to be held in 1924. The Collblanch-San Andrés line will be completed in 18 months, and the total cost is estimated at 50,000,000 pesetas. To further the [illegible] of the Exhibition of Electrical Industries the Town Council has sanctioned the borrowing of 70,000,000 pesetas.

Active progress is being made with the equipment of Madrid with an underground electric railway service. By 1924 the Compania Metropolitano Alfonso XIII. will have completed the Sol to Ventas line, which will give 4 km. of extensions, with eight new stations. Other extensions are under way or in contemplation. Foreseeing that the supply of current from existing sources may not cover its future needs, the company has begun the erection of a large steam-driven generating station in the Calle Pacifico, which is expected to be working by the summer of 1923.

According to the *Westminster Gazette*, a scheme for the electrification of 10,000 kilometres of Spanish railways by utilising waterfalls, at a cost of 1,400,000,000 pesetas, is under discussion.

Italy.—The Società Anonima delle Ferrovie Economidre de Bruxelles has secured authorisation to electrify the Biello to Mongrando railway. The line is 8,185 km. in length.

Edinburgh.—New Route.—The Corporation is to extend the tramways from Murrayfield terminus to Corstorphine at a cost of £43,000.

Glasgow.—Purchase of Paisley Undertaking.—In connection with the proposed acquisition by the Corporation of the Paisley tramways, the Town Council has agreed that £18,000 be paid to Paisley Corporation as compensation for the loss of revenue from electric energy supplied to the tramways.

India.—Railway Electrification.—The *Railway Gazette* states that the Indian Government has now sanctioned the electrification of a large portion of the Bombay suburban lines of the Great Indian Peninsula Railway and tenders for the necessary plant will be called for at an early date. The portion to be electrified includes the Great Indian Peninsula local lines from Victoria terminus to Thana and the harbour branch which runs through Sewri to join the main line at Kurla. It also includes the Mahim Chord branch connecting up to Mahim on the Bombay, Baroda & Central India Railway. The latter branch will enable passengers from the residential districts around Bandra to travel direct to Victoria terminus. The next step of the Government in this direction will no doubt be to sanction the similar electrification which is proposed on the Bombay, Baroda & Central India suburban line. The overcrowding to be seen at present on the suburban trains of this railway is evidence that the fast and frequent service which electrification would provide is much overdue. It is hoped that the first portion of the new electrified service on the Great Indian Peninsula Railway will be in operation before the end of 1923. The total expenditure will probably reach two millions sterling apart from the electrification of the ghâts line, which will probably be carried out subsequently.

Bombay.—The employés of the tramway undertaking are on strike. It is stated that the strike was due to the non-recognition of their union.

London.—Forecast of Reduced Fares.—The *Westminster Gazette* stated last week that reductions in the fares charged by the "Underground" companies are imminent, as the Railway Rates Advisory Committee has the matter in hand. The same journal also stated that "the main-line companies are to reduce ordinary passenger fares shortly by 25 per cent. on present rates."

Electric Railway Extension.—*Modern Transport* states that tenders will shortly be invited for the extension of the Metropolitan and Great Central Joint Railway from Rickmansworth to Watford. It is the intention ultimately to electrify the line throughout from Harrow to Watford; the present express services of the Metropolitan Railway will then be extended to afford through fast trains to the City *via* the Inner Circle line.

Report on Collision.—The report of Col. J. W. Pringle to the Minister of Transport, upon the collision on July 12th between an electric train and a buffer stop at the Ealing Broadway (G.W.R.) station, has been published. The train, which weighed about 119 tons, was fitted throughout with a Westinghouse air brake; the single buffer stop had a 17-in.-diameter piston with an 8-ft. stroke, and was calculated to offer resistance sufficient to withstand the thrust of a 200-ton train moving at a speed of 10 m.p.h. In this instance the hydraulic (oil) ram was pushed in 5 ft. 9 in. Two qualified drivers were in the motor cab, and the continuity of the brake had been tested and found satisfactory; the brake had been employed in pulling up the train at the previous station. The driver stated that he cut off the current at the proper place when the train was travelling at about 30 m.p.h. When the speed had fallen to 20 m.p.h. he applied the brake, and he thought—although he was not certain—that the too-rapid deceleration made him release the brake. When he recognised it the brake did not give the expected effect, and so he made a third application while passing the station platform. He then made an emergency application of the brake, which

caused the train to skid and collide with the buffer stop. The driver admitted that the accident was due to his bad manipulation of the brake.

Underground Extensions.—*The Times* states that it is hoped to be able to run through trains from Edgware to Moorgate by October 1st next year, but that the through service from Edgware to Clapham Common is not expected to be commenced for at least two years. The enlarging of the City and South London tube is causing surprisingly little inconvenience to passengers. The extension of the Hampstead line from Golder's Green to Edgware is well advanced, and it is hoped that this section will be open to traffic by October 1st, 1923.

Newcastle-on-Tyne.—Year's Working.—The annual report of Mr. Ernest Hatton, engineer and general manager of the Corporation's electricity and transport undertaking, shows that while the year ended March 31st last finished with a debit balance of £2,667, the reserve fund had also been practically wiped out, the balance remaining being only £946. Mr. Hatton draws attention to the fact that the stoppage in the mining industry had materially affected the undertaking, involving considerable expense in providing oil fuel plant, as well as the oil fuel itself. The strike of the tram-workers on the 48-hours' question in February and March also cost the department some £13,000. The financial statement in the report shows a total revenue of £546,818, compared with £580,268 in the previous year. Working expenses were £467,735, against 498,966 in the previous year. The gross profit was £79,083, to which was added interest on investments £2,810, making a total of £81,893 available. Of this sum £28,431 was absorbed by interest on capital, and £42,555 for redemption of debt; other smaller items reduced the balance to £7,253; income tax required £9,920, causing a deficit of £2,667. The gross capital expenditure on the undertaking has reached £1,611,921. The traffic revenue per car-mile was 22.65d., and the total operating costs per car-mile 19.508d.

Reading.—Extension of Time.—The Minister of Transport has extended the time of the Corporation Act for the completion of the tramways until July, 1924.

South Shields.—Year's Working.—The annual report on the working of the tramway undertaking for the past year shows a total revenue of £89,533 as compared with £102,085 in the previous year. Working expenses amounted to £84,581 (£98,707) leaving a gross profit of £4,952. After deducting capital charges there was a deficit of £8,686. The number of passengers carried decreased from 18,115,530 to 15,195,139, and the total number of car-miles run rose from 1,140,137 to 1,142,131. This is the first year in which the receipts have shown a decrease.

Warrington.—Proposed Track Renewals.—The Town Council has under consideration a proposal to expend £16,000 for the reconstruction of the tramway track in Liverpool Road, and the relaying of the section between Pickmere Street and Atherton's Quay.

Wolverhampton.—Track Renewals. It is proposed, in order to provide work for the unemployed, to relay certain portions of the tramway track at a cost of £56,685.

TELEGRAPH AND TELEPHONE NOTES.

Austria.—Marconi Concession Ratified. The Reparations Commission, having ratified the Austrian Government's concession to Marconi's Wireless Telegraph Co., the final documents relating to that concession have been signed and are now in London. By this concession the Marconi Co. is given the sole right to erect, and to work for 30 years, wireless stations for public traffic between Austria and all other countries.

Brazil.—Telephone Concession.—The Brazilian Traction, Light & Power Co. has been granted a concession in connection with telephone services in the Federal district by the Rio de Janeiro Municipal Council. Among the improvements embodied in the contract is permission to vary charges in accordance with the rate of sterling exchange. Revisions may be made at intervals of four years.

China.—Proposed Agreement.—It is proposed to come to an agreement with the Chinese Government as to the disposition of the radio stations at Tsingtau and Tsinan and to arrange for the continued operation of the submarine cables between Tsingtau and Sasebo. These two units were part of the communication system developed and administered by the Germans and taken over by the Japanese during the war.—*T. & T. Agc.*

Germany.—"Broadcasting" Service.—A public "broadcasting" service has been instituted by the State for the dissemination of market reports and other commercial news. It is considered that this will relieve the congestion on the telephone and telegraph services to a great extent. The receiving apparatus is installed and maintained at an annual fee. It is proposed to inaugurate a lecture, concert, &c., "broadcasting" scheme shortly.

Italy.—New Cables.—The Ministry of Posts and Telegraphs is undertaking some extensive repairs in telegraphic communications between Sicily and the mainland. In addition, two new submarine cables are to be laid between Messina and Catania, and between Catania and Syracuse.—*Commerce Reports.*

Sweden.—New Radio Station.—Competing with the English, French, and Germans, the Americans were successful, according to a message received on August 22nd from E. F. W. Alexanderson, chief engineer of the Radio Corporation of America, in securing a contract with the Swedish Government for furnishing apparatus for a high-power radio station to handle direct wireless communications between the United States and Sweden. The total cost of the station erected will probably be over $2,000,000. *T. & T. Agc.*

The Telegraph Service.—Anglo-Irish Cables Cut.—On September 22nd the cables between Dublin and England were cut at the Dublin end, but were restored by September 25th.

The Telephone Service.—The work of placing the London-Glasgow telephone line underground is proceeding rapidly. Over 150 miles of roadway north of Leeds has been opened up and 50 miles has been relaid. "Spur" cables from Edinburgh, Leicester, Leeds, Newcastle, and Derby are in course of installation to connect up with the main system.

New Exchanges.—Two new exchanges were put into commission on September 23rd. The first, at Wallington, is a 480-line exchange, and 174 lines have been transferred to it from Sutton and Croydon. The other exchange, at Aldershot Post Office, is a c.b. system taking the place of the old magneto equipment. The exchange has 40 per cent. greater capacity than the equipment it replaces, and it is to be considerably extended.

Extension of the "Toll" System.—A wide extension of the "toll" system of dealing with calls from London to outer districts is about to be put into operation. The extended area embraces a further 89 towns, including Brighton, Guildford, Chelmsford, and Tonbridge.

United States.—Wireless Agreement.—The circumstances affecting two of the large land line companies in the United States, which tended to limit direct radio service from America to points on the Atlantic seaboard, have now been rectified by the conclusion of a contract between the Radio Corporation and the land wire system, by which the corporation's radio service to and from America is made available to every city, town and village in the United States.—*Reuter.*

Uruguay.—Montevideo.—The Montevideo correspondent of *The Times* states that the services of the Montevideo Telephone Co. are being interrupted by a strike. The Municipal Council by three votes to two has decreed that the company must cease operations, alleging lack of concessionary rights. The National Administrative Council considers this decision illegal, and has suspended the enforcement of the municipal decree. Congress will be asked to decide the dispute.

Wireless Telegraphy.—The Postmaster-General has suspended the issue of licences for wireless receiving sets pending the settlement of arrangements between the companies which are to carry out "broadcasting" and the Postmaster-General. The latter denies that the companies will be given a monopoly of the sale of apparatus, but it is certain that the companies will have to recoup the large expenditure which they are making on the broadcasting stations, new plant, &c.

The Marconi Experimental Station at Towyn (Merionethshire) was flooded on September 23rd owing to the washing away of the river bank. The operators were forced to carry out their duties by the use of boats.

Wireless Telephony.—The Radio Communication Co., Ltd., recently applied to the Barnes Council for permission to erect a lattice-girder wireless mast 100 ft. in height upon land in front of its works, but, upon the recommendation of its Highways Committee, the Council refused to sanction this.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—January 31st. Victorian Electricity Commissioners. Back-pressure steam turbine, driving a 1,500-kW turbo-alternator (Spec. 308), four water-tube boilers and accessories (Spec. 317). (September 22nd.)

Perth (W.A.).—November 15th. Postmaster-General's Department. 1,490 galvanised tubular poles.*

Queensland (Mackay).—January 31st, 1923. Boiler and generating plant, switchboard, and transformers. Messrs. Frew & Bridger, Queen Street, Brisbane, are the consulting engineers.—*Reuter's Trade Service* (Melbourne).

Barton-upon-Irwell.—October 3rd. Board of Guardians. Electric lift at the Union infirmary, Green Lane, Patricroft. Mr. P. Howard, architect, 88, Mosley Street, Manchester.

Belgium.—Schaerbeek, Brussels.—October 5th. Municipal authorities. Supply of 525 electricity meters. Service de l'Electricité, Hotel Communal, Schaerbeek.

Bure, Namur.—October 28th. Municipal authorities. Installation of a system of electric lighting and power supply in the town.

Birkenhead.—October 6th. Mersey Railway Co. Electrical sundries. Mr. J. Shaw, general manager and secretary, Central Station, Birkenhead.

Brazil.—Cachoeira, Rio Grande do Sul.—October 24th. Municipal Council. Six centrifugal pumps, with electric motors, piping, &c.*

Edinburgh.—October 17th. Tramways Department. 80 trucks, electrical equipment of cars, &c. Forms from manager.

Egypt.—November 15th. Installation work in connection with a power station and distribution system at Manfalout. Director of Technical Service, Section of Municipalities and Local Commissions, Savoy House, Cairo.

Hawarden.—October 4th. Board of Guardians. Supply and erection of an electric generating set, and also for wiring for electric lighting the Institution at Broughton. (September 22nd.)

Latvia.—Riga.—October 6th. Ministry of Communications. Telephone material, including commutators, portable field telephones, Leclanché cells, and accessories.*

New Zealand.—Auckland.—Twelve 5-ton (and alternatively 3-ton) electric quay cranes. Four 5-ton (and alternatively 3-ton) electric roof cranes. Six 1-ton electric mono-rail cranes. Specifications from Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, E.C.

Invercargill.—December 15th. Southland Electric Power Board. Turbines and valves, generators, exciters, and battery equipment, steel penstocks and valves, switchboards, switchgear and cables, for the Monswai hydro-electric development scheme. Mr. W. Hinchey, chairman, Southland Electric Power Board, P.O. Box 121, Invercargill, N.Z.

Wellington.—November 21st. Public Works Department. Mangahao scheme. Electrical storage battery and accessories, including a motor-booster and one single-phase testing transformer.*

November 28th. Outdoor and indoor sub-station switchgear in connection with the Mangahao power scheme.*

January 9th, 1923. One electric travelling crane (capacity 27 tons) for the Waikato power scheme.*

Carterton.—November 25th. Wairarara Power Board. Hydro-generating plant and steel pipe line.—*Reuter's Trade Service* (Melbourne).

Nottingham.—October 27th. Electricity Department. Two 650-kVA, 3-phase static transformers, two 900-kVA, 6-phase do., one 150 kVA, single-phase do., three steam-driven turbine boiler-feed pumps, four gravity bucket coal conveyors with crushers, accumulators, &c. (See this issue.)

Portsmouth.—Electricity Supply Department. One 4,000-kW turbo-alternator, with condensing plant, one water-tube boiler (30,000 lb. per hour capacity), with steel bunker and [illegible]. (See this issue.)

Rosslynlee, Midlothian, and Peebles District Asylum.—Electric fittings, &c., for six months. The clerk, 19, Heriot Row, Edinburgh.

Uruguay.—Monte Video.—November 11th. State Electricity Department. One 10,000-kW turbo-generator. State Electricity Department, Calle Julio Herrera, 1458, Monte Video.*

October 3rd. 10,000 metres 3 mm² rubber insulated cable. October 4th. 80,000 metres 10 mm², 30,000 metres 20 mm², 25,000 metres 25 mm² paper-insulated cable.*

October 6th. 15,000 metres 2 x .75 mm² rubber-insulated cords for interior use.*

October 9th. 18,600 metres v.i.r lead-covered cable, various sizes.*

October 31st. Switchgear for 15 transformer sub-stations.*

November 21st. 15,000 metres 3 x 32 mm², 36,000 metres 3 x 64 mm², 15,000 metres 3 x 80 mm², 3-ph., h.p. cable; 450 junction boxes; 350 vertical end boxes.*

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Aylesbury.—Town Council. Accepted:—
Illuminated signs, £4 [illegible] Edison Swan Electric Co., Ltd.
Wiring, &c., [illegible] £164 G. C. Gower.

Brazil.—Central Railway Electrification Award.—According to *The Times*, the Brazilian Minister of Transport has advised the director of the Central of Brazil State Railway that the best terms, having regard to price and technical advantages, for the electrification of the Central Railway, are offered by the General Electric Co. (America), and authorising the execution of a formal contract. The total value of the contract is about £2,000,000. Offers were received from the General Electric Co. (American), the Metropolitan-Vickers Electrical Co. (British), and the Westinghouse Co. (American).

France.—Paris.—According to *Reuter*, forty-five tenders have been received for the installation of moving platforms in the Paris underground stations, including quotations from Great Britain, the United States, and Belgium.

Dundee.—Electricity Committee. Accepted: 750 yd. 1-p. cable (£668), Union Cable Co., Ltd. The lowest foreign tender received was £689 from a Danish firm.

Glasgow.—Tramways Committee. Accepted:—
Trolley wire.—Thos. Bolton & Sons, Ltd.
Mast plates for welding.—Steel Co. of Scotland, Ltd.
Insulated bolts.—Fleming, Birkby & Goodall, Ltd.
V.I.r. cable.—Johnson & Phillips, Ltd.
Lead-covered cable.—Western Electric Co., Ltd.
Iron castings (section pillars).—McDowall, Steven & Co., Ltd.

Government Contracts.—The following Government contracts were placed during August, 1922:—

Admiralty Contract and Purchase Department.
L.p. cable.—Johnson & Phillips, Ltd.
Electric overhead travelling cranes.—Cowans, Sheldon & Co., Ltd.
Electric light and power installation.—G. E. Taylor & Co.
Generating sets.—A. G. Mumford, Ltd.
Porcelain insulators.—Bullers, Ltd.; Electric & Ordnance Accessories Co., Ltd.; Taylor, Tunnicliffe & Co., Ltd.

War Office.
Secondary batteries.—Chloride Electrical Co., Ltd.

Air Ministry. Contracts Department.
Electrical fittings (term contract).—General Electric Co., Ltd.; Cable Accessories Co., Ltd.
Electric lamps (term contract).—Notable Electric Co., Ltd.; Crysalco, Ltd.; Edison Swan Electric Co., Ltd.
Thompson Bennett magnetos and spares.—Lucas Electrical Co., Ltd.
W.T. transformers.—Ferranti, Ltd.
W.T. valves.—General Electric Co., Ltd.; Mullard Radio Valve Co., Ltd.

Crown Agents for the Colonies.
Auto-transformer kiosks.—British Insulated & Helsby Cables, Ltd.
Aerial telephone cable.—Callender's Cable & Construction Co., Ltd.
Lighting supplies.—J. Stone & Co., Ltd.
Electricity meters.—Ferranti, Ltd.
Waterworks pumping equipment.—General Electric Co., Ltd.

General Post Office.
Testing and protective equipment.—British L.M. Ericsson Manufacturing Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd. (Peel-Conner Telephone Works); Phœnix Telephone and Electric Works, Ltd.
Telegraph and telephone cable.—Enfield Eclaswan Cable Co., Ltd.; Hackbridge Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Compound.—Dussek Bros. & Co., Ltd.
Switchboard cords.—Phœnix Telephone & Electric Works, Ltd.; British Insulated & Helsby Cables, Ltd.
Joint box covers.—United Steel Companies, Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Firebrick Co., Ltd.; Doulton & Co., Ltd.; Stanley Bros., Ltd.; Sutton & Co. (Overseal), Ltd.; J. Woodward, Ltd.
H.d. copper wire.—R. Johnson, Clapham & Morris, Ltd.
Manufacture, drawing-in, and jointing cable.—Coventry-Leicester: Johnson & Phillips, Ltd.
Laying conduits.—A large number of contracts for this service have been placed during the month.
Telephone exchange equipment.—Marton: Automatic Telephone Manufacturing Co., Ltd.; sub-contractors for batteries, Chloride Electric Co., Ltd. L.C.C. County Hall: Automatic Telegraph Manufacturing Co., Ltd.; sub-contractors for batteries, Tudor Accumulator Co., Ltd. Walton (Liverpool): Western Electric Co., Ltd.; sub-contractors for batteries, Tudor Accumulator Co., Ltd.; for charging machines, Electric Construction Co., Ltd.

H.M. Office of Works.
Engineering services. Electric wiring Natural History Museum.—Apex Manufacturing Co., Ltd.

Holmfirth. Urban Council. Accepted:
Alterations to the plant at the electricity works (£3,160).—Johnson and Phillips, Ltd.

London.—Hackney. Works and Open Spaces Committee.

Electric vehicles for dust collection:—	Per Vehicle.
Clayton Wagons, Ltd.—Battery—Chloride IMV 10, 44 cells, 323 amp. hours	£770
Flite Electric Vehicles, Ltd.—Battery—Tudor 80 cells, 250 amp. hours	£[illegible]
Electromobile, Ltd.—Battery—Chloride IMV 10	£68
Electricars, Ltd., Seymour Place, W.1.—Battery—Edison A.8, 60 cells, 70 volts, 300 amp. hours	£[illegible]
Battery—Edison, 60 cells, 375 amp. hours	£[illegible]
Garrett & Sons, Ltd.—Battery Chloride, IMV 9, 44 cells, 293 amp. hours recommended	£50
Battery—D.P. lead acid, 44 cells, 400 amp. hours	£[illegible]
Battery—Ni. Fe. nickel iron, 60 cells, 380 amp. hours	£[illegible]
Battery—Edison, 60 cells, 375 amp. hours	£[illegible]
Ransomes, Sims & Jefferies, Ltd.—Battery—Chloride, IMV 9, 40 cells, 290 amp. hours	£[illegible]
Battery—Ni. Fe., 60 cells	£[illegible]
Battery—Edison, 60 cells A10, 375 amp. hours	£[illegible]
Newton Bros. (Derby), Ltd.—Battery—Chloride, 44 cells, 290 amp. hours	£[illegible]
General Vehicle Co., Ltd.—Battery—G.V. 10, 44 cells, 300 amp. hours	£[illegible]
General Electro-Motives, Ltd.—Battery—Chloride, IMV 10, 42 cells, 325 imp. hours	£[illegible]

The Committee recommends that, subject to the L.C.C. sanctioning the necessary loan, the tender of Messrs. Garrett & Sons, Ltd., be accepted

for 20 [illegible] Crompton batteries at £750 each, [illegible] for the vehicles, if required [illegible] have to be [illegible] the date the order [illegible]

Bath.—Electricity Undertaking Committee. Recommended [illegible] No. 2 [illegible] £964. Messrs. A. C. [illegible]

The [illegible] is to be renewed for six months [illegible] Contracting Co., Ltd. [illegible] & Hookham, Ltd., and Ferranti, Ltd.

Electrolytic meters.—Reason Manufacturing Co., Ltd.

Engine room stores.—Pryke & Palmer, Ltd.

St. Marylebone.—Electric Supply Committee. Recommended:—Renewal of contracts for house service meters for 12 months, with Chamberlain & Hookham, Ltd., and Ferranti, Ltd.

Lanark.—Messrs. Martin & McGregor, Wishaw, have secured the contract for electric tubing in connection with new offices for the County Council at Lanark.

FORTHCOMING EVENTS.

Society of Engineers. Monday, October 2nd. At Burlington House, Piccadilly, W. At 5.30 p.m. Paper on "The Economics of Arterial Land Development," by Mr. C. H. L. Cleaver.

Housing and Health Exhibition.—October 2nd to 21st. At the Kelvin Hall, Glasgow.

Swansea Electrical Exhibition.—October 2nd to 14th. At the Drill Hall, Swansea.

Institute of Transport.—Monday, October 2nd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Annual general meeting, presidential address by Sir Sam Fay.

Institution of Railway Signal Engineers.—Wednesday October 4th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 3 p.m. Paper on "Welwyn Automatic Signal System on the Belgian State Railways," by Mr. T. S. Lascelles.

Chemical Society.—Thursday, October 5th. At Burlington House, W. At 8 p.m. Ordinary scientific meeting.

Chief Technical Assistants' Association.—Thursday, October 5th. At the Engineers' Club, W. At 6.30 p.m. Discussion on "Electric Vehicles," [illegible] by Mr. J. D. Spark.

Brighton Electrical Exhibition. [illegible] Brighton.

Electricity Supply Commercial Association. [illegible] October 6th. At Anderton's Hotel, Fleet Street, E.C. At 7.45 p.m. Final Reunion conference.

Junior Institution of Engineers.—Friday, October 6th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Engineering in Bacon Factories," by Mr. W. A. Tookey.

Electrical Power Engineers' Association.—Friday, October 6th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Boiler Efficiency under Test and Working Conditions," by Mr. D. Wilson, O.B.E.

(Kent Section).—Saturday, October 7th. At the Church Institute, Union Street, Maidstone. At 3 p.m. General meeting at 6 p.m., lecture on "Transformer Breakdowns," by Mr. S. Austin Stigant.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:—

The Lungen buzzer.

The [illegible] for windows, used with the Birka lamp.

Daylite lighting lamps.

Simplex electric [illegible] American names of British [illegible] wanted.

NOTES.

Silver Solder for Rotor Bars.—Writing to the *Electrical World*, Mr. J. E. Housley says that it is practically useless to use [illegible] solder on rotors, as any severe overload will cause the rotor bars to heat and throw out the ordinary solder. It is comparatively easy to silver-solder rotor bars if the copper section is large enough to prevent melting of the copper under oxy-acetylene flame. The copper must be absolutely clean before soldering. In one case the cleaning was accomplished by suspending the rotor by means of a crane over [illegible] half of a chemical cleaning compound which was kept boiling by means of a gas heater. The rotor was revolved in this cleaner and all dirt, grease and foreign matter was quickly removed, after which the rotor was silver-soldered.

Appointments Vacant.—Assistant lecturer and demonstrator (temporary) in electrical engineering, for the Northampton Polytechnic Institute; switchboard attendants (£5), for the Edinburgh Corporation electricity supply department. [illegible] page today.

Pre-cast Busbar Ducts.—In the construction of masonry bus structures the building of the horizontal bus compartments has always been the most difficult part of the work. The cost of construction is high, and it is difficult to build a structure which is sufficiently rigid to withstand the short-circuit stresses met in practice [illegible]

To overcome these objections the New York & Queens Electric Light & Power Co. has adopted a simple form of bus construction. Rectangular ducts are pre-cast and erected in three horizontal rows, one above the other, the units being staggered so that the openings for bus taps occur at the proper place in each row. The duct walls are 2 in. thick, and for a 2,300/4,000-volt bus the inside dimensions are 12 in. x 13 in. The length is 3 ft. 5¼ in., which is equal to the width of two single-phase compartments. The units are cast in steel forms and reinforced with wire mesh, which is open on one side to prevent possible eddy currents. Each unit weighs approximately 400 lb. Inserts are provided on the top of each unit for the insulator on the bus above. This form of construction provides additional clearance at the supporting insulators where it is needed on account of clamps and bolts.

The cost of this type of construction is considerably less than that of others, and it results in a much more rigid structure.—W. C. Blackwood, in the *Electrical World*.

The Provincial Electric Supply Committee.—The annual meeting of the Committee was held on Tuesday last, under the chairmanship of Sir Harry Renwick, K.B.E. A report will appear in our next issue.

The Electro-Harmonic Society. The 1922-23 Season of the Society commences on October 11th with a smoking concert. This season the concerts are to be held in the Caxton Hall, Westminster, and the series consists of six concerts, two of which will be open to members' lady friends. Mr. Leo Stormont has been appointed to act jointly with Mr. Bernard Flanders, A.R.A.M., in the musical direction of the concerts.

The Status of Electrical Contractors.

The stinging words, and phrases tense
Of Taunton's censure, deep and strong,
Must surely pierce, however dense,
The brain pans of the E.C. throng.
Wake up! the E.C.A. and strive
To clear your ranks of side-line duds.
In other words: spring-clean your hive
And keep reserved for bluest bloods.

"Nala."

Brighter "Underground" Cars.—The latest improvements in the rolling stock of the District Railway are mainly æsthetic, proving that amidst the rush of modern affairs the ideals of William Morris have not been forgotten. The idea has been to get rid of the "all-steel" atmosphere which pervades the new "all-steel" cars. Mr. Hall Thorpe, the well-known artist, has been called in and has produced a number of novel and pleasing colour schemes. In addition to this the vertical rods which took the place of straps are to be abandoned in favour of the earlier method of accommodating surplus passengers; a kind of foot-rest is to be installed; and the noise-eliminating system devised by Professor A. M. Low is to be incorporated in the new design.

National Association of Supervising Electricians.—The following meetings, to be held at the St. Bride's Institute, Bride Lane, Ludgate Circus, E.C.4, have been arranged, and the chair will be taken on each occasion by Mr. W. E. Highfield, M.I.E.E., President of the Association, at 6.45 p.m.:—October 10th, "Single-phase Commutator Motors; their progress, and reasons why they demand the attention of power engineers," by Mr. F. Creedy, A.M.I.E.E.; November 14th, lecture on "broadcasting," and demonstration by a representative of Marconi's Wireless Telegraph Co., Ltd.; December 12th, "The High Cost of Installations: with special reference to the effect of rings, and bad organisation, on prices," by Messrs. W. J. Rexell and F. T. Aldread.

The "Passimeter" System. The success of the "Passimeter" system of booking passengers, installed a short time ago at the Kilburn Park Station, has led the "Underground" companies to extend it to many other stations, with a consequent speeding-up of traffic through the gates. Another improvement recently introduced is a change-giving machine. It is estimated that 70 per cent. of the passengers do not tender the exact amount of their fares, a circumstance which causes a great deal of delay. With the new machine appears a list of fares from the station at which it is installed, and the apparatus is capable of giving change for all the silver currency (except five-shilling pieces, which are rarely seen nowadays). By this means it is expected to increase the rate of booking from 12 tickets per minute to 20.

A Father's Sacrifice.—The following paragraph, received from our correspondent at the Cape, will remind some of our readers of the days gone by when the employment of councillors' sons in the municipal electric light stations, in the control of which their fathers were interested, formed one of the grounds for the grievances of those who wanted such jobs and could not get them. The case at Oudtshoorn is different from those which arose here years ago, for the son being already apprenticed to the electric light station the district is deprived of his father's services as a councillor: "The candidature of Mr. J. Crosoer for the Oudtshoorn, Cape Province, municipal election was challenged by another candidate on the ground that he was a party to a municipal contract, as his son is apprenticed to the electric light undertaking. Mr Crosoer has withdrawn.".

High-pressure Rectifiers.—Most usually, pressures of 1,500—3,000 V have been chosen for the electrification schemes of main-line railways with direct current. Rotary converters and rectifiers have so far been employed for converting a.c. into d.c. when the contact-wire pressure does not exceed 1,500 V, whereas, for higher pressures, motor-generators have to be used. The latter are not only considerably more expensive, but have a lower efficiency than the former machines. This accounts for the preference accorded to direct current at pressures not greater than 1,500 V in Europe, where only a few lines are operated with higher d.c. pressures, amongst which several railways equipped by Brown, Boveri & Co. may be mentioned, such as the Turin-Lanzo-Ceres Railway (4,000 V), the Rome-Ostia Railway (2,400 V) and the Coire-Arosa Railway (2,000 V). Some months ago, however, Brown, Boveri & Co. designed a new type of rectifier suitable for high d.c. pressures, and this has successfully undergone trials on the test bed. Direct current was supplied continuously at different pressures: first of all, the pressure was 2,500 V and the output 450 A (1,125 kW) per cylinder; the pressure was subsequently raised to 3,500 V with an output of 350 A (1,225 kW), and finally to 5,400 V and 300 A (1,620 kW). During each series of tests, the rectifier remained uninterruptedly on load day and night for a considerable time, without the slightest disturbance occurring while switching, overload, and short-circuit tests were carried out. The output of the rectifier was dissipated by water resistances. The neutral point of the transformer was earthed, and the rectifier and vacuum pump set were insulated—an arrangement which is usually adopted by the firm for plants of this description. These tests show for the first time that mercury arc rectifiers can not only be built for d.c. pressures of over 5,000 V, but also, that they are technically suitable for such high pressures, as was shown by switching overload and short-circuit tests. Rectifiers are well adapted for completely automatic sub-stations, and several plants of this description equipped by the firm will be placed in service this year. Since d.c. traction motors can now be built for terminal pressures greater than 2,000 V—as has been proved by the motors for the Turin-Lanzo-Ceres Railway—and the construction of switches, controllers, &c., for pressures of 4,000 V and over no longer offers any difficulties, all obstacles which prevented the advantages of electrification of main-line railways with high-pressure direct current from being utilised, have now been removed.—*Brown, Boveri Review.*

A Standard Source of Sound.—In a letter addressed to *Nature* of September 16th, Mr. E. T. Paris, of the Signals Experimental Establishment, Woolwich, suggests the use of a hot-wire grid, as used in the Tucker microphone, for the purpose of constructing a standard source of sound. The grid would be fixed at one end of a Helmholtz resonator, and a telephone at the other end; the telephone would be actuated with current from a thermionic valve oscillator, at a frequency equal to that of the resonator, giving a pure tone of moderate intensity, and the change of resistance suffered by the microphone grid would afford a measure of the amplitude of vibration of the air-column, and therefore of the strength of the source (*sic*), which could be varied at will. If the frequency of vibration were known, the strength of the source could be found in absolute measure.

Educational.—City and Guilds of London Institute.—The Department of Technology informs us that both the Grade I and the Final Examination of the Institute in Electrical Installation Work will be held next year in England and Wales and elsewhere. Those candidates who have not already passed the examination in Grade I should be instructed to take and pass this examination before presenting themselves for the final examination in 1924. All intending candidates are advised to make application to the secretary of the nearest technical school or local education authority with a view to the formation of classes. All candidates will be required to have attended evening classes regularly in the subject of Electrical Installation Work, except in certain special cases, when application should be made before the end of February, 1923, to the Department of Technology, City and Guilds of London Institute, 29, Roland Gardens, S.W.7, for exemption.

Generating Plant in U.S.A. Central Stations.—On October 1st, 1921, there were 5,532 central generating plants in the United States with a total prime-mover rating of 19,737,361 h.p. and a total installed generator rating of 14,466,915 kW. The increase in prime-mover rating during the period from January 1st, 1920, to October 1st, 1921, was 1,170,712 h.p., or at the rate of 3·9 per cent. per annum.

The total rating of the steam motors was reported as 13,331,933 h.p., of which 86·5 per cent. was attributed to steam turbines. During the twenty-one-month period from January 1st, 1920, to October 1st, 1921, the total rating of the installed steam turbines was increased by 1,487,367 h.p., while the total rating of the installed steam engines was increased by only 31,733 h.p.

The total rating of the installed water-wheels was 6,200,245 h.p. The rating of waterwheels installed in central generating plants increased by 822,845 h.p. subsequent to January 1st, 1920, an increase of about 15.3 per cent. Internal-combustion engines were rated at 205,183 h.p.—*Electrical World.*

Explosives in Mines Committee.—The Secretary of State has appointed the following committee to carry out under the general direction of the Safety in Mines Research Board research into the causes of, and the means of preventing the ignition of firedamp and coal dust by the firing of permitted explosives:—Col. Sir F. L. Nathan, K.B.E. (chairman); Mr. W. Rintoul, O.B.E., F.I.C.; Dr. G. Rotter, O.B.E.; Mr. H. Walker, C.B.E.; and Prof. R. V. Wheeler, D.Sc. A grant has been made by the Miners' Welfare Committee out of the Miners' Welfare Fund to meet the cost of initiating the research.

The Song of the Electric Way.

(With apologies where necessary.)

When sonorous call electric,
Announces early morning,
In baths approaching hectic,
We splash before adorning.
No thought of gas or matches,
Or taps and gadgets numerous,
One trace of pleasure snatches,
Byegone ideas are humorous.
To tune the time by wireless,
As breakfast elements glimmer,
The ether pulses tireless,
While eggs and bacon simmer.
In summer fans play gently
At button's press projected,
And winter finds us potently
By radiant heat protected.
By trolley and bow contacted,
Flow energies harmonious,
Time space is counteracted,
To reach our city terminus.
Amenities electrical,
Reduce the day's distraction,
And typists cease to pall
In dictaphone's reaction.
At home the dishes glisten,
Thro' whirr of motor wash
And launderers by us hasten,
To homes not quite so "posh."
Since telegram and 'phone,
And 'type and radiograms,
Reduce the hours from home,
And foster epigrams,
By omnipotence electric,
'Fore dusk all work's long past,
Th' electric way redeems the day,
And music is broadcast.

F. A. P.

The Electrical Trades Benevolent Institution.—Annual Festival.—The Festival will be held at the Trocadero Restaurant on November 15th; Sir James Kemnal will preside, and ladies will be present.

Train Heating by Electrically-heated Boiler.—Since the electrification of the Swiss Federal Railways was partially carried through, the heating of the carriages has been effected by electric radiators, except in international trains, in which steam heating, as previously used, has been adhered to temporarily. As a result of this some source of steam has to be provided on the train itself, and this has been done by installing an electrically-heated boiler specially adapted to the requirements of the railways. For purposes of economy it was decided to use the current of the overhead line, the voltage of which is 1,500 V, without transforming it, but this gave rise to insulation difficulties. Further, it was found desirable to install the boiler on a special coach, capable of being coupled to any desired point on the train, in order to obtain uniform heating. The following is a brief description of the installation as finally designed by Messrs. Brown, Boveri & Sulzer Bros. (*Schweiz. Bauzeitung*).

Placed in a van, the boiler absorbs 800 kilowatts, and supplies steam at a pressure of 8 kg. (about 113 lb./sq. in.). The current from the overhead line is received by a pantograph provided with the usual fittings (pneumatic gear) and safety devices. The high-pressure fittings are, moreover, enclosed and inaccessible when the pantograph is raised. The boiler is fed by two injectors and fitted with a circulating pump operated by a low-pressure motor (fed from a small transformer connected to the 15,000-volt lead). The object of this pump is to equalise the steam production by constantly renewing the water round about the electrodes, so as to avoid sudden gushes of steam. There are two electrodes, which can be operated singly or together, while their effect can be regulated by sliding the insulating tubes that embrace them. Traps are provided for evacuating the steam from the roof of the coach in case of accident, and the opening of these traps automatically lowers the pantograph from the overhead line. The compressed air for these operations is taken from the main pipe of the Westinghouse automatic brake, or, if the coach is not connected up with that supply, the air is supplied by a small hand-operated pump.

It is interesting to note that the new electric locomotive described elsewhere in this issue is fitted with an electrically-heated boiler, constructed by the Bastian Electric Co., Ltd.

INSTITUTION NOTES.

Institution of Production Engineers. — Mr. Max R. Lawrence, works manager of The Sterling Telephone and Electric Co. Ltd., Dagenham, Essex, has been re-elected President of this Institution for the 1922-1923 session. Mr. W. L. Fisher, of Richmond, Surrey, and Mr. H. E. Honer, of Dartford, Kent, have been elected Vice-Presidents. For the coming session the following papers have been arranged :—

October.—Presidential address.
November.—"Standardisation," Mr. G. Hey.
December.—"The Production Engineer," Mr. H. E. Honer.
January.—"The Principles of Organisation and Management," Mr. Wallace Attwood.
February.—"Machine Moulding Methods," Mr. F. T. Hardyman, foundry manager, Messrs. Petters, Ltd., Yeovil.
March.—"Modern Gauging Systems," Mr. Axel Wickman, of Messrs. Alfred Herbert, Ltd.
April.—"Tooling for Production," Mr. L. C. Keen, consulting production engineer.

Local branches of the Institution have already been formed at Coventry and Newark-on-Trent, and it is hoped to inaugurate a local section at Glasgow during the coming session.

Rotherham Technical Engineering Society.—Mr. E. Cross, the Corporation electrical engineer, in his presidential address, enlarged upon the part which electricity was destined to play in future progress. He showed how much more efficient electric traction was than steam locomotion, and predicted that the all-electric house would be a popular institution in Rotherham before very long. Mr. Cross thanked the hon. secretary, Mr. Stansfield, for his services to the Society.

Glasgow and District Radio Club.—The Club resumed its activities with the annual general meeting, which was to be held at the new premises in Buchanan Street on September 27th. At this meeting the election of office bearers, &c., was to be carried out.

The Club has arranged for a public exhibition and demonstration of wireless reception at the McLellan Galleries Hall, Sauchiehall Street, on November 4th. The committee asks firms who wish to be represented to send full particulars of offers to the Hon. Secretary as soon as possible. Prof. G. W. O. Howe, D.Sc., M.I.E.E., has kindly consented to deliver an address, and special messages from Continental stations have been arranged.

A syllabus for the ensuing session is in the course of preparation, and the secretary asks for contributions to the winter's programme.

Bradford Engineering Society.—The winter syllabus of the Society, the president of which is Mr. C. E. Allsop, of the Bradford Corporation electricity department, includes a series of lectures on all phases of engineering. On the electrical side the president is to open on October 2nd with a lecture on "The Development of Public Electricity Supply." The Society has secured the services of a number of leading experts who will deal with various methods of securing the maximum of economy in power production. The meetings are held at the Technical College, where the hon. secretary, Mr. G. F. Charnock, is Professor of Engineering.

Institution of Railway Signal Engineers.—The programme for the remainder of the 1922-23 session is as follows :—October 4th, "Weissenbruch's Signal System on the Belgian State Railways," by T. S. Lascelles; November 1st, "A Few Remarks on Railway Accidents," by J. Holt; December 6th, "Intermediate Block Signalling," by C. Carslake; January 3rd, 1923, "Rotary Interlocking Block," by A. Wallis; and February 14th, annual general meeting.

Faraday Society.—The Faraday Society and the British Cold Storage and Ice Association will hold a joint meeting on October 16th. The meeting will be held at the Institution of Electrical Engineers, and it will be divided into three sessions. At the first session, following a general introduction by Prof. Alfred W. Porter, F.R.S., the subject to be discussed will be "Laboratory Methods of Liquefaction and Methods of Measuring Low Temperatures." The opening address will be delivered by Prof. H. Kamerlingh Onnes, and Dr. Crommelin will give a description of the equipment of the Cryogenic Laboratory at Leyden. Subsequent contributors will include Prof. C. F. Jenkin and Dr. Ezer Griffiths. The second and third sessions will be devoted to "Industrial Methods of Liquefaction and Practical Applications of Low Temperatures." The general introduction to this subject will be given by Mr. K. S. Murray, of the British Oxygen Co., Ltd., and among those who will contribute papers will be Monsieur Claude, on "The Industrial Manufacture of Hydrogen by the Partial Liquefaction of Water Gas," and Mr. E. A. Griffiths, who will deal with the subject as it touches aeronautical work. Messrs. Liquid Air, Ltd., will arrange some demonstrations during the intervals, and will also contribute information on the Heylandt system of air liquefaction and on the use of liquid oxygen in blasting. Those desirous of attending are invited to communicate with the Secretary of the Society, 10, Essex Street, W.C. 2.

Institute of Physics.—The third of the series of lectures being delivered under the auspices of the Institute of Physics on "Physics and the Physicist in Industry" will be given by Mr. Clifford C. Paterson on Wednesday, October 18th, at 6 p.m., at the Institution of Electrical Engineers, Victoria Embankment, W.C.2. Mr. Paterson will deal with the "Physicist in Electrical Engineering." Sir J. J. Thomson, O.M., president of the Institute, will take the chair.

OUR PERSONAL COLUMN

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The *Commonwealth Engineer* reports that Mr. A. W. KENDALL has resigned from the position of managing director of the Australian General Electric Co., Ltd., and at the request of the International General Electric Co. is remaining on the board of directors. Mr. Kendall, who is taking up other important interests, has been with the company for 19 years, and for the last 12 years filled the position of managing director, during which period the company's business has increased eightfold. Mr. Kendall was to relinquish control at the end of August.

MR. F. CHARLES RAPHAEL, M.I.E.E., has resigned the position of manager of the Cable and Wire Department of the Edison Swan Electric Co., Ltd. For the present, communications should be sent to his home address, 35, Chase Green Avenue, Enfield, Middlesex (telephone, Enfield 664) where he is carrying on his consulting work. He desires to receive catalogues from manufacturers of fittings and accessories for house wiring, &c.

The Faraday medal of the Institution of Electrical Engineers, the first award of which was made by the Council in the early part of the year to MR. OLIVER HEAVISIDE, F.R.S., was personally presented to him by Mr. J. S. Highfield, President of the Institution, at Torquay, on September 9th.

Councillor JOHN E. GIBBS, who was formerly with Messrs. Ferranti, Ltd., is Sheriff-elect of York. He is now head of the firm of Gibbs & Co., of York, and is vice-chairman of the Corporation Tramways and Electricity Committee.

The Edinburgh Corporation has appointed MR. J. HAGEN, of Glasgow, to be boiler-house superintendent at the new power station at Portobello, at £400 per annum. Mr. Hagen is at present at Dalmarnock electricity station. MR. W. DUNCAN, at present manager of the electrical department of the Victoria Brass Foundry Co., Leith, has been appointed sales superintendent for the Edinburgh Electricity Department, at £500 per annum.

Last week, at Dundee, MAJOR H. RICHARDSON, J.P., was presented with a dressing-case with silver and ivory fittings, as a mark of esteem from the chief officials of the Corporation on the occasion of his vacating his present position in the City. Mr. W. H. Blyth Martin, Town Clerk, supported by Lord Provost Spence, in handing over the gift, made reference to the many valuable services rendered to the city by Major Richardson, who replied in his characteristically happy manner.

MR. ARTHUR FODEN has resigned his position with the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, to take up the position of engineer-in-charge with the Eccles Corporation electricity department.

MR. A. R. HENDERSON, A.M.I.E.E. (late Lieut. R.N.V.R.), is terminating his engagement with the Admiralty as an engineer-in-charge of design in order to return to commercial engineering. He wishes to hear from pre-war business friends, and to receive manufacturers' catalogues at 53, Lawrence Road, Southsea.

Obituary.—MR. J. T. FAHY.—We regret to learn from the *Commonwealth Engineer* that Mr. J. T. Fahy, who recently retired from the position of chief electrician, New Zealand railways, after 42 years' service, died in July in Sydney at the age of 57 years. "The late Mr. Fahy was for many years in the Dominion's telegraph department. With Mr. T. Buckley (later controller of telephone services), he took part in experimental wireless telegraphy in its early stages. It is believed that these two officers were, in 1898, the first south of the equator to establish perfect ink-marked Morse signals on tape over short distances. They also designed a forked quadruplex, which, when perfected, Mr. Fahy installed at Blenheim, where it has been worked for over 20 years. In 1901, Mr. Fahy was transferred to the railway service as electrician, where he did valuable work in the erection of railway telegraph and telephone lines. Mr. Fahy was an associate member of the Institution of Electrical Engineers and an associate of the American Institute of Electrical Engineers."

Dr. Reiss.—*The Times* Paris correspondent reports that Dr. Reiss, of Metz, has died at the age of 64 from the effects of using X-rays in the treatment of patients at the Sainte Blandine Hospital.

Alderman T. P. Bird.—We regret to announce the death of Mr. Alderman T. P. Bird, J.P., the deputy-chairman of the Birmingham Electric Supply Committee, who had been a member of the committee since 1911. Alderman Bird was also an active member of the District Industrial Council for the West Midlands area, and its municipal representative on the National Council for the industry. He was also chairman of the District Joint Board and the district's representative on the National Joint Board. He devoted a considerable amount of his time to matters connected with the electric supply industry.

There was a very large attendance at the funeral, at Aston Church, on Saturday, including the Lord Mayor of Birmingham and the chairman (Mr. H. K. Beale), and members of the Birmingham Electric Supply Committee.

Mr. S. H. Fielden.—We learn with regret of the death of Mr. S. H. Fielden, who was for many years connected with Rhodes Motors, Ltd., and was for part of the time a director of that company. He subsequently went to Australia to take up an appointment with Messrs. H. V. Mackay at Sunshine, Melbourne. During the war he joined the Australian forces and saw fighting in Egypt and France. He was badly gassed and suffered from shell shock, and was appointed instructor at the camp at Christchurch. On demobilisation he rejoined Messrs. Rhodes Motors, Ltd., as their export manager in London. He had to give up work in 1921 owing to the state of his health, and he passed away on September 16th at a nursing home.

Will.—The late Mr. C. H. Shuter, of Westminster, submarine telegraph and cable engineer, left £15,279.

NEW COMPANIES REGISTERED.

Broadcast Wireless Co., Ltd. (184,466).—Private company. Registered September 20th. Capital, £500 in £1 shares. To carry on the business of manufacturers of and dealers in apparatus and component parts in connection with wireless telegraphy and telephony, &c. The first directors are: C. D. Rutter, Holly Lodge, Chestnut Grove, New Maldon, Surrey; A. S. Young, 7, Upper Hornsey Rise, N.19; G. O. Tutton, St. Olaves Lodge, 47, Wimbledon Park Road, Southfields, S.W.18. Qualification: 50 shares. Remuneration as fixed by the company. Secretary: A. S. Young. Registered office: 2, Tower Royal, Cannon Street, E.C.4.

Ajax Production Engineers, Ltd. (184,368).—Private company. Registered September 14th. Capital, £3,000 in £1 shares (1,500 ordinary and 1,500 7 per cent. cumulative preference). To adopt an agreement with Ajax Manufacturing Co. and to carry on the business of electrical, mechanical, motor and sanitary engineers, founders, smiths, machinists, ship and boat builders, manufacturers of agricultural implements and motor cars, &c. The subscribers (each with one share) are: W. C. Terry, 123, Upper Clapton Road, E.5, manufacturer; W. T. Frost, 4, Seymour Road, Church End, Finchley, N.3, manufacturer. The first directors are to be appointed by the subscribers. Qualification: £50. Remeuneration: 10s. 6d. each per meeting attended. Secretary: H. J. Bellingham. Registered office: 188-189, Strand, W.C.

Barlow & Redruth, Ltd. (184,464).—Private company. Registered September 20th. Capital, £500 in £1 shares. To acquire the business of electrical and general engineers' merchants and hardware merchants and manufacturers carried on by L. R. Incledon, S. V. Reynolds, and A. G. Stanners as "Barlow and Redruth," at Wolverhampton, Staffs. The first directors are: L. R. Incledon (permanent). "Winnats," Penn, near Wolverhampton; S. V. Reynolds, 218, Birmingham Road, Walsall; E. C. Stanners, Parkhurst, Westbourne Road, Penn, near Wolverhampton. Registered office: 2, St. John's Street, Wolverhampton.

Nicholson and Lord (Walsall), Ltd. (184,489).—Private company. Registered September 21st. Capital, £2,000 in £1 shares. To take over from A. Sherratt and R. F. Sherratt the business of organ builders and tuners, together with the tuning contracts lately acquired by them from the liquidators of Nicholson and Lord, Ltd. The permanent directors are: A. Sherratt, 2, Cambridge Crescent, Erdington, Birmingham, electrical engineer; R. F. Sherratt, 2, Cambridge Crescent, Erdington, Birmingham, electrical engineer; T. Sherratt, 3, Crooked Usage, Church End, Finchley, N.W., telephone engineer. The two first named are managers. Qualification: 50 shares. Registered office: 20, Vicarage Place, Walsall.

Cooke and Whitfield Wireless, Ltd. (184,509).—Private company. Registered September 22nd. Capital, £5,000 in £1 shares. To carry on the business of manufacturers of, and dealers in, wireless telegraphy and telephony apparatus and components, and erectors and maintainers of receiving, transmitting, and broadcasting stations, &c. The life directors are: H. S. Cooke, Broadway, St. Bernard's Road, Olton, Warwick; H. H. Whitfield, The Glen, Primrose Lane, Hall Green, Birmingham, electrical engineer. Qualification, £100. Remuneration as fixed by the company. Registered office: 34, St. Paul's Square, Birmingham.

Bann Syndicate.—Registered on September 22nd as a private company with a nominal capital of £10,000 in £1 shares. The objects are:—To promote or assist in promoting a bill or bills in the Parliament of Northern Ireland or any other seat of parliament (1) granting permission and making provisions for the supply of electrical energy, (2) sanctioning the erection, purchase and maintenance of works, generating and electrical power supply stations for the production and supply of electricity, (3) giving directions and granting permission to construct, acquire, install, and maintain machinery, &c., connected with generation, distribution, supply, accumulation and employment of electricity, (4) giving permission and directions to sink wells and shafts, and to buy, build, maintain, or pull down reservoirs, waterworks, aqueducts, electric and hydraulic engines, and other works and appliances which may seem conducive to the production and supply of electricity, and (5) giving authority and directions to promote and assist in promoting and/or operating railways, tramways, hydraulic works, electric and other lighting works, or any of them, and the business of supply connected therewith, &c. The subscribers (each with one share) are: R. C. Howley, 17, Throgmorton Avenue, E.C., clerk; W. H. Morgan, Broxash, Marguerite Drive, Leigh-on-Sea, clerk. The subscribers are to appoint the first directors. Remuneration as fixed by the company. Solicitors: Ashurst, Morris, Crisp and Co., 17, Throgmorton Avenue, E.C. No notice of situation of registered office was filed at the time of registration. The file number is 184,506.

Hayner Engineering Co., Ltd. (184,455).—Private company. Registered September 21st. Capital, £200 in £1 shares. To carry on the business of manufacturers of and dealers in all kinds of electrical, mechanical, engineering apparatus, &c. The first directors are: H. J. Watson, 7, Road, N.W., electrical engineer; H. F. Hayward, 42, Church Road, N.W.10, electrical engineer. Qualification: 20 shares. Registered office: 7, den Road, Willesden Green, N.W.10.

Clarence R. Foster, Ltd. (184,522).—Private company. Registered September 22nd. Capital, £10,000 in £1 shares, 3,000 cumulative preference and 7,000 ordinary. To take over the electrical and motor engineer carried on by C. R. Foster at 170, Cardigan Road, Leeds. The first directors are: C. R. Foster, Glenholme, Victoria Gardens, Horsforth, Leeds; G. F. Storey, 15, Ashleigh Road, West Park, Leeds (director of Storey Evans & Co., Ltd.). C. R. Foster may retain office while holding 3,500 of the shares to be allotted to him under purchase agreement. Qualification of other directors £100. Registered office: 170, Cardigan Road, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Marston Billington, Ltd.—Particulars filed of £14,000 debentures authorised June 16th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; the whole amount being now issued.

Luminor Signs (British), Ltd.—Particulars filed of £500 debentures authorised June 22nd, 1922, charged on the company's property, present and future, including uncalled capital; the whole amount being now issued.

V. P. Webb & Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital dated September 7th, 1922, to secure £3,800. Holder: Mrs. A. B. B. Webb, Clent House, Clent, Worcestershire.

Mikro, Ltd.—Particulars filed of £500 debentures authorised June 23rd, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; the amount of the present issue being £450.

CITY NOTES.

French Cable Company.

The report of the Compagnie Francaise des Cables Télégraphiques states that the decrease of 3,000,000 fr. in the receipts in 1921 as compared with the preceding year was due to the contraction in general business and the increased use of codes in cable messages. The diminution has continued in 1922, but on the other hand, cable charges have been increased and also further raised since May 16th, 1922. Good results were obtained from the company's participation in the Société de Télégraphie sans Fil and in the Société Radio France. Works in connection with the modernisation of working were carried out during the year, particularly with regard to relay stations. The net profits amount to 10,097,000 fr., and a dividend has been declared at the rate of 37.69 fr. gross per ordinary share.

Halifax and Bermudas Cable Co., Ltd.—The net result of the year ended June, 1922, is a credit balance of £6,878, as compared with £18,465 for the previous year; the balance brought forward from last year was £61,557, making a total of £68,434. £1,992 has been expended on repairs. A total dividend of 6 per cent., free of tax, for the year absorbs £3,000, leaving to be carried forward £63,442, subject to corporation profits tax. The decrease of £11,588 in the net result of the year's working is accounted for by a reduction of £8,558 in the receipts, principally due to the reduction of rates and wireless competition at Bermuda, an increase of £2,776 in income tax, E.P.D., and corporation profits tax, and an increase of £253 in the general expenses. Mr. G. Clapperton has been elected to the board in place of the late Mr. G. G. Ward.

Radio Corporation of America.—According to a daily paper the operations of the company for 1921 resulted in a profit of $426,799, which has been applied to "Reserve for Patents." No dividends were earned on either the preferred or the common stock, and the amount set aside for patents is stated to be quite inadequate for writing-down purposes. The year's record of business done, however, is very satisfactory; gross revenue from trans-oceanic communications increased 137 per cent. over the previous twelve months, and sales increased by 184 per cent.

Dundee, Broughty Ferry and District Tramways Co.—Profit for year ended July 31st (including £474 brought in), £5,517. Interest on debenture stock and interim dividend paid on preference shares for half-year, less tax, absorbed £2,234. Dividend on ordinary shares at 7 per cent. per annum, less tax; reserve £500; carried forward £241.

Lancashire Electric Light and Power Co., Ltd.—A dividend of 3½ per cent. for the half-year ending September 30th on the cumulative participating preference shares is announced.

German Company.—The Electricity Supply Co., of Hamburg, reports net profits of 252,000 marks and a dividend at the rate of 15 per cent. for 1921-22, these figures comparing with 116,000 marks and 10 per cent. in the previous year.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend for the half-year ended June at the rate of 5 per cent. per annum, free of tax, on the ordinary shares.

Direct West India Cable Co., Ltd.—Net result of working during year ended June, 1922, a credit balance of £15,965, as compared with £14,601. Balance forward £96,051, making a total of £112,016. £25 expended on repairs; dividend, 6 per cent. free of tax; carrying forward £108,391, subject to corporation profits tax. The company's cables have worked efficiently during the year. The insulation of the Bermuda-Turks Island section remains very low. Mr. G. Clapperton has been elected to the board in place of the late Mr. G. G. Ward.

Stock Exchange Notice.—The undermentioned has been ordered to be officially quoted :—

[illegible] £4,000,000 5½ per cent. sterling bonds of 1922 (bearer) Nos. A1 to A4,000, £100 and 1S1 to 1S00, £500, guaranteed by Danish Government), in lieu of scrip now quoted.

Midland Electric Corporation for Power Distribution.—Interim dividend on the ordinary shares at the rate of 8 per cent. per annum for the six months ended June 30th last.

Shanghai Electric Construction Co.—First interim dividend at rate of 6 per cent. actual (12s. per share), less tax, in respect of year 1922.

STOCKS AND SHARES.

Tuesday Evening.

With the removal of the war-cloud which hung over the Near East, a greater measure of assurance returned to the Stock Exchange markets, bringing with it a revival of business in certain directions. Keen interest centres at the moment around the daily-expected terms of the grouping arrangements in connection with the Southern railway companies. Already, the Isle of Wight Central proprietors have received notices of the offers which are to be made to them, and speculation fastens upon what may happen in the case of the popular trio, South-Eastern & Chatham, Brighton, and South-Western companies in the same connection. It is considered likely in the market that all three companies, which are known to have extensive electrification programmes, are probably waiting for the grouping arrangements to be crystallised before they, the companies, take steps in the direction of starting upon the important work that lies in front of them in connection with electrification.

Electrical railway stocks are inclined to be better, with Metropolitans a good spot at 57. Underground £10 shares touched 3¼, and at 3 show a net rise of 5s. Central Londons are marking time, and Districts remain firm at 42.

The agitation which has arisen in some of the Metropolitan boroughs for reduction of the price of electric current to consumers, in those districts, is being watched closely by proprietors of shares in the electricity companies. The recent newspaper campaign against gas charges has had its effect upon certain stocks and shares in the gas market. The electricity companies are not, of course, in the same position, and, having regard to the profitable nature of the present year's working, there is not likely to be any particular effect felt upon shares in this section even if the companies should make any alteration in the manner of their charges. As is generally known, big schemes are afoot for extension of supply of energy, and this factor operates in the direction of continually contributing to reduction of costs, while it increases the business handled by the companies.

Metropolitan ordinary shares at 6 are ½ down, South Londons at 4 are unchanged, but are ex the dividend of 2s. recently deducted. County ordinary and preference are both 6d. lower, and the new shares at 3s. and 1s. 10½d. premium, for ordinary and preference respectively, are both a trifle under the best.

The market for cable stocks and shares shows a hesitating tendency. Indo-European have fallen £1 to 34½. Great Northerns are 15s. down at 28⅜. Eastern Extensions at 18⅝ shed 2s. 6d. and Anglo-American preferred shows a loss of 1½ at 102¼. The Marconi market is quiet, prices remaining fairly steady, although Radio Corporations continue heavy, the ordinary falling to 20s.; the preferred are 13s. 9d. Canadian Marconis incline to sag, the present price being 10s. 3d. Holders of Marconi shares are disappointed at the delay which has occurred in carrying-out the broadcasting programme boldly outlined by the Postmaster-General a couple of months ago, a programme which raised natural expectations that the present wireless concerns would stand to benefit substantially by what was expected to be the immediate extension of the new service. What stands in the way of prompt developments it is difficult to understand; in the meantime, the shares of the various companies likely to be affected by the additional business, are attracting little attention.

In this connection, it may be as well to sound a note of warning with regard to schemes that are being put forward in certain directions, through which investors are invited to apply for shares in broadcasting companies that are to make, according to the glowing prophecies of the circulators, a fortune for the present investors. Some, at any rate, of these companies have little more to recommend them than the rosiate estimates set out on cheap paper. Possibly these will appeal to the unwary, who may be warned by readers of this paper that if they want to get rid of their money, the hospitals are likely to make better use of it than share touts with certificates to sell.

Brazilian Tractions have again receded to 49, making a fall of 4 points within a fortnight, and the market in most Brazilian issues remains depressed, owing to the unhappy plight of the milreis. The Mexican group has not moved. British Columbia Electric Railway deferred is 1 down. On the other hand, Anglo-Argentine Tramways 5 per cent. debenture stock recovered 2 points to 80½, upon attention being directed to the fact of its undue weakness, having regard to the nature of the security offered.

Amongst manufacturing shares, Siemens ordinary show a fall of 1s. 9d. at 25s. 9d. For this, the market assigns no particular reason. Probably if the decline continues, we shall hear doubts as to whether the company can maintain the 10 per cent. tax-free dividend which it has paid hitherto. The 4½ per cent. debentures keep steady at 90, and the 10 per cent. preference shares at 31s. 3d. General Electric preference gave way to 21s. 3d. English Electrics at 15s. 6d., and Edison-Swans at 3s. are both a little easier. British Insulated retain their substantial rise at 45.

Babcock & Wilcox are dullish at 58s. 9d., in consequence of the depression produced in the iron and steel market by the closing-down of the giant Ebbw Vale works in South Wales. This, however, has not affected the armament list, where Vickers and Armstrongs hold their prices. Rubber shares continue to show a little animation, the slight rise in price of the raw product affording ground for the perennial hope that the time is at hand when steady upward progress may be expected.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Sept. 26, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	8	—	£7 10 0
Charing Cross Ordinary	8	9	7⅞	—	5 17 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	—	4 16 0
City of London	14	14	2½	—	6 11 9
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	12	—6d.	5 16 8
do. do. 6 per cent. Pref.	6	6	12	—6d.	5 4 4
Kensington Ordinary	9	10	7⅜	—	6 13 4
London Electric	2½	4	9⅜	+ ⅛	4 11 5
do. do. 6 per cent. Pref.	6	6	6	—	5 17 1
Metropolitan	7	7	6	— ½	5 16 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9		6 13 4
South London	7	7	4xd		7 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅞	—	6 11 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	102½	—1⅛	5 17 1
do. Def.	1½	84/6	23⅜	—	7 8 6
Chile Telephone	⅝	⅝	6	—	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 9 8
Eastern Extension	10	10	18⅝	— ⅛	5 7 5
Eastern Tel. Ord.	10	10	186½	—	5 7 3
Globe Tel. and T. Ord.	10	10	18⅝xd	— ⅛	5 6 8
do. do. Pref.	6	6	114xd	—	5 4 8
Great Northern Tel.	24	22	28⅜	— ¾	7 13 0
Indo-European	10	10	34½	—1	7 5 0
Marconi	12	15	2⅜	—	6 6 4
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	⅝	⅝	6⅜	—	*5 18 8
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18½xd	— ½	*5 8 1
Home Rails.					
Central London Ord. Assented	4	4	87	—	5 19 5
Metropolitan	1½	2½	57	+1	3 19 0
do. District	Nil	1	42	—	2 6 6
Underground Electric Ordinary	Nil	Nil	⅜	+ ½	Nil
do. do. "A"	Nil	Nil	8/-	+6d.	Nil
do. do. Income	2	4	86½xd	+1	*4 12 6
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	3⅞	—	8 0 8
do. do. 2nd Pref.	Nil	5½	9⅛	—	7 0 9
do. 5 per cent. Deb.	5	5	80½	+2	6 4 3
Brazil Tractions	Nil	Nil	49	—1	8 0 0
British Columbia Elec. Rly. Pcs.	5	5	76½	—	6 9 9
do. do. Preferred	5	98/-	66	—	*7 1 8
do. do. Deferred	8	124/-	71½	—1	*8 12 6
do. do. Deb.	4⅛	4⅛	75xd	—	5 13 4
Mexico Trams. 5 per cent. Bonds	Nil	Nil	70¼	—	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	41½	—	Nil
Mexican Light Common	Nil	Nil	Nil	—	Nil
do. Pref.	Nil	Nil	48½	—	Nil
do. 1st Bonds	Nil	5	64½	—	7 14 6
Manufacturing Companies					
Babcock & Wilcox	16	16	21⅛	—	5 12 3
British Aluminium Ord.	10	5	17½xd	—	5 12 8
English Insulated Ord.	15	15	32	—	6 13 4
Callenders	15	15	2⅞	—	6 17 0
6½ Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 18 4
Edison-Swan	10	Nil	8/-	—3d.	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1⅜	—	8 0 0
English Electric	8	6	15/6	—6d.	7 7 0
do. do. Pref.	6	6	1	—	6 0 0
Gen. Elec. Pref.	6½	6½	21/8	—9d.	6 2 4
do. Ord.	10	5	19/-	—	5 5 8
Henley	15	15	2⅜	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1⅜	—	—
Met.-Vickers Pref.	8	8	2⅜	—	6 8 0
Siemens Ord.	10	10	25/9	—1/9	*7 15 4
Telegraph Con.	20	20	25⅞	—	*4 13 6

* Dividends paid free of Income Tax.

DYNAMOS AND MOTORS OF COMPARATIVELY SMALL OUTPUTS.

By J. W. BURLEIGH, A.M.I.E.E.

(*Concluded from page 407.*)

The writer does not wish to imply that it is a relatively easy matter to compare costs and facility of production for different constructions and to put it in terms of pounds, shillings, and pence. It often requires a simultaneous consideration of many factors to arrive at a true comparison, and only the experienced engineer can hope to do this readily.

A reference to figs. 4 and 5 will clearly show the new construction. The magnet system is characterised by each pole being divided into two parts or limbs, which are so disposed that the angle between their axes is large, permitting of very effective ventilating apertures

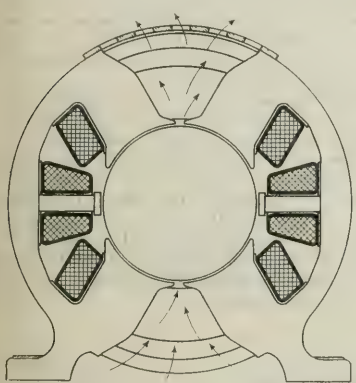


Fig. 4.

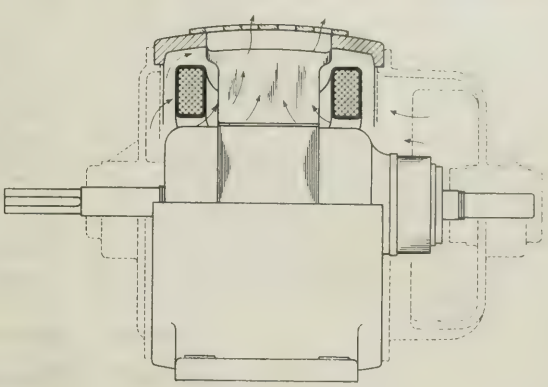


Fig. 5.

at the top and bottom of the frame. Further, it will be seen in fig. 4 that, although pole tips are cast with the poles, the design is such that the field coils lie close to the limbs when passing through the space between the poles.

Each pole is excited by a single coil, slightly arched. Fig. 6 is a development of the pole, showing preferred form of field coil.

It may be interesting to note that patent No. 5,602, dated March 8th, 1906, granted to the writer, describes a somewhat similar magnet construction. The excitation of each pole of this magnet system is effected by two coils, one coil being mounted on each part or limb.

Divided poles are, of course, well known. It is doubtful if a single dynamo designer, past or present, has not, at some period, constructed machines having a division in the main poles transverse to the armature laminations. Many interesting patent specifications have been based on this principle.

The large ventilating space between the two parts of each pole is of very real importance. It forms, in effect, an excellent ventilating shaft—all the heat-generating members being practically within the cooling air circuit, which extends vertically through the machine. Very effective natural ventilation is thus provided without having recourse to forced ventilation by means of a fan.

The field coils are preferably spread at the sides of the magnets, as shown in figs. 5 and 6. By so disposing the coils, free passages are provided between the poles and coils which allow the cooling air to more readily flow through the machine. Secondly, it admits of the coil having an elliptical (and therefore easily wound) shape.

One might think at first sight that the field coils are not removable owing to the pole tips. This idea will be dispelled by a consideration of fig. 7, which shows that the field coils can be placed on or withdrawn directly and with a straight-line motion.

A magnet system designed on the lines indicated has preferably the yoke, poles, and pole tips cast in one member. It has the great advantage that the main field magnet material may be of cast iron only.

The magnets are comparatively light in weight (approximately equal to half the total weight of the machine) by reason of the advantages arising from the particular disposition of the materials.

It is interesting to note that with an average density of 6,500 lines per sq. cm. in the magnets (neglecting the leakage flux) the ampere turns required for the total iron paths are only about 160 for a three-quarters brake horse-power motor at 1,600 r.p.m., and about 220 ampere turns for a two brake horse-power motor at 1,500 r.p.m. These figures show great economy, and result in a low weight of copper being required for the field coils.

For the three-quarters brake horse-power motor referred to, the total weight of wire, including the covering, is not over 2 lb. per pole. The two brake horse-

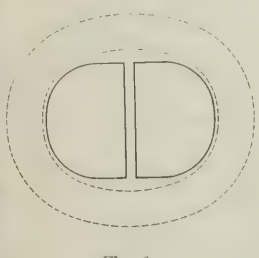


Fig. 6.

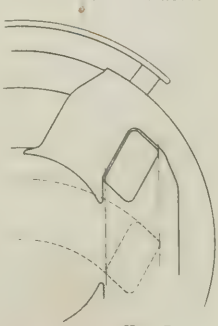


Fig. 7.

power motor at 1,500 r.p.m. only requires about 5 lb. of wire per pole.

Machines constructed with the cast-iron magnet system described are found to be nearly as light as with a two-pole construction having cast-steel yoke and poles and fitted with a fan.

They are certainly as light as a four-pole construction having a cast-iron yoke and steel poles, even when refinements are embodied.

In comparing the weights of dynamo machines, both large and small, it is interesting to find that the law, or formula, laid down by Fischer-Hinnen a great many years ago applies at the present time. In his book, "Continuous-Current Dynamos," dated 1899, he states that the weight in lb. $= Wr^{\frac{2}{3}} \times C$. Wr = watts per revolution, which in motors $= 746 \times$ b.h.p. / revs. per min. C = 387.

We all know that the weight has decreased since the above formula was proposed. The weights, however, for a line of machines designed on the same lines still vary as the two-third power of the Wr.

With present-day machines having cast-iron yokes, the factor C=190 approximately. For four-pole machines having steel yokes the figure varies from 150 to 170.

In the line of machines having the simplified cast-iron construction, as described, the weight factor is about 175. The curve for weights for a Wr up to 4 was shown in fig. 3.

By introducing one or two of the refinements indicated, and by increasing the ratio of copper to iron, the weight constant can no doubt be reduced to 150 or less, with a very moderate temperature rise.

Although the observations in this article have been mainly confined to machines up to about 6 b.h.p., or a specific output of 4 watts per r.p.m., it must not be thought that this output forms a limitation for this type of magnet structure. It is possible to build, with economy, machines up to many times this output.

Certain modifications may be desirable in the larger outputs. For instance, each of the field coils should be made in two sections. It will be wise to follow this course even in the very small machines of high voltage.

Possibly, too, in the larger machines with two-pole armature windings, a modified form of end winding may be found of service. It is found that with the ordinary barrel winding the armature is not unduly long, as with the big distance between the pole tips in a two-pole design, chord windings can, with great advantage, be used. In several small armatures already made the end windings have only required approximately the same space as in the case of four-pole construction.

When using interpoles it is advisable to advance the armature winding pitch, but not necessarily to the full pitch. It may be mentioned that one interpole only may be used by suitably arranging the main poles so that a larger space for the interpole is provided on one side.

Before concluding, there are a few points to which reference will be made. Instead of fixing a perforated cover on the magnet frame over the ventilating aperture, a plain cover may be used having distance pieces as shown in the fragmentary view (fig. 7). It is possible to keep the ventilating apertures horizontal instead of vertical. The temperature rise even then is not excessive. It would naturally be expected that the temperature rise under this condition would be in excess of that obtained with the vertical openings.

A fan can be used, too, if desired; then, of course, the ventilating apertures could be closed.

A probable application of the type of magnet frame described will be for constant-voltage dynamo construction by what is known as the third-brush method.

It will be seen that the poles can easily be cut away between the two limbs, so that trouble due to parasitic currents could be minimised. For different positions of the third brush, two opposite limbs might easily have wide gaps "cored" in them for a similar purpose.

This magnet system, when fitted with the third brush arrangement, might be utilised for a three-wire system where a small unit is required.

THE BRITISH ASSOCIATION.—IV.

Electrical Ignition Apparatus for Internal-combustion Engines.

By E. O. Turner, D.Sc., A.M.I.E.E. (*Abstract.*)

Section G.—Engineering.

One of the reasons for the increase of interest in magneto design has been the recent introduction of a cobalt-steel alloy from which an energy per unit magnet volume of from three to four times as much as the best hitherto obtainable may be developed; the full effect of this remarkable discovery may not be felt for some years to come.

The method adopted in the paper is first to consider induction coils and the magneto is then treated as a special type of induction coil.

It is the opinion of those who have studied the subject of spark ignition that if a spark actually occurs in an explosive mixture ignition will follow, and however much the spark energy be varied, no variation in the power developed will follow. If the spark fails to ignite the mixture, no increase in the energy of the spark will cause an explosion. Assuming, then, that it is necessary merely to cause a spark without any regard to its character, the requirements to be fulfilled by an ignition generator may be stated as follows: (1) The spark must take place at a cylinder compression, varying, according to the type of engine and the conditions of working, between 30 and 160 lb. per sq. in. The voltage required to break down the gas between these limits of pressure may be taken roughly as being from 5,000 to 25,000 volts. (2) Sparking must be regular between limits of low and high speeds. (3) The functioning of the generator should be as far as possible unaffected by variations in the external circuit. As regards the first condition, it has been demonstrated that in [illegible] the compression at the moment of explosion may be at high speed actually less than half the maximum cylinder speed compression. With regard to condition (2), it would be better if there were no lower speed limit, but as a magneto must be turned at a certain speed in order to begin sparking, care must be taken that this speed is rather less than at which the engine can be turned by whatever starting method is [illegible]. The third requirement refers to variations in the external circuit. The two factors which affect the sparking most are the presence of capacity in series with the plug electrodes and the joint resistance of the leakage paths in parallel with them. As a general rule the first may be ignored, but leakage resistance paths may seriously affect the sparking. It is impossible to prevent the formation of a number of these branch circuits. Some of them consist of paths of surface leakage across the insulation, both at the generator and at the plug terminals; others are formed through the body of the plug, and their resistances vary according to the temperature of the plug, the amount of carbon deposited upon it, &c. In comparing ignition generators with other electrical machinery a "figure of merit" is proposed. In the case of induction coils this figure would be obtained by dividing the "utility" (equivalent to the output of other classes of electrical machinery) by the product of the least sparking voltage and the supply current. The figure of merit for a magneto would then be the "utility" divided by the product of the least sparking speed and the magnet energy. This closely resembles the output coefficient of electrical machinery, which may be expressed as output/(least speed of operation × rotor volume). For the contact breakers either platinum-iridium alloy or tungsten may be used. The first has the drawbacks of expense and transfer of metal from positive to negative; the second is comparatively cheap and very hard, but the resistance rises to a high value under certain conditions. The form of contact breaker usually adopted is such that the contacts are opened by means of a cam operating a lever against the pressure of a spring, the latter being relied upon to close the contacts. Extreme care is necessary in design and manufacture to ensure satisfactory operation at the high speeds which are now required in multi-cylinder automobile engines. Some engine makers call for considerable accuracy in the intervals between successive explosions; for example, it may be stipulated that the difference between the actual and theoretical firing angles shall not exceed 1 deg.—measured on the crankshaft. To meet this requirement it is necessary that the opening shall take place comparatively abruptly. This tends to produce "flinging," *i.e.*, a lagging of the lever behind the cam, at very high speeds, which prolongs the "break" period and shortens the "make." This is not important in magnetos, but with coil ignition it is imperative that there should be no "flinging."

Most induction coils are built with only a core of magnetic material, the circuit being completed through an air path. Unless the outer diameter of the coil is small compared with the core length the linkage of flux with the outer layers of the winding will be incomplete. As the object of design is the transference of as much energy as possible from the primary to the secondary circuit, rather than the establishment of a high peak voltage, this partial linkage is to be

avoided as far as possible. For this reason laminated steel cheeks, of a diameter preferably exceeding that of the coil, fitted so as to closely embrace the core, are sometimes added. When these are fitted the field due to the primary is partly screened, and does not stray over so large a space, and the coil is less likely to be influenced by neighbouring masses of metal. Considerable care is required in deciding the number of primary and secondary turns. Under high-speed conditions it will be found that if very few primary turns are employed the m.m.f. and flux will be correspondingly low; if too many are chosen the current will only have risen to a small proportion of its maximum value when it is cut off and the m.m.f. will still be low; there is thus a definite number of turns which will establish the greatest core flux. Since at high speed, that is, with primary current considerably below the maximum, the flux density in the iron will be low, the inductance of the primary winding may be expressed in the form $a\,n^2$, where a is a constant depending solely on the shape of the magnetic circuit. By this means, and the equation for the rise of current in an inductive circuit, the best value for n_1 may be found. At speeds below the maximum, if the iron ampere-turns are appreciable, the inductance is not constant for a given number of turns, and it must, therefore, be expressed in terms of the magnetisation curve of the coil. If the equation for the rise of current is transformed into the form—

$$t = \frac{\Phi_1 n_1}{10^8 R_1 i_1} \log \frac{i_1}{i_1 - i_1}$$

by tabulating assumed values of i_1 the corresponding value of the primary m.m.f. $n_1 i_1$ and the flux Φ may be found and values of t worked out and plotted against i_1. This procedure is necessary, since the magnetisation curve of the coil cannot readily be expressed in the form of an equation.

The number of secondary turns should be as small as is consistent with satisfactory performance at reduced voltage. If more turns are employed than are necessary to establish the breakdown voltage the secondary current flowing in these unnecessary turns will represent a considerable voltage consumption. Tests have been carried out showing that there is a well-defined maximum utility at about 16,000 turns. A very large number of secondary turns ensures a spark being produced at a very low voltage, but only at the expense of the utility.

During the first part of the cycle of spark production the secondary winding may be ignored and the magneto may be considered as an alternator, of which the primary circuit constitutes its armature winding, working on short circuit. As regards the second part of the cycle, the "spark flux" can be expressed in terms of the armature m.m.f. and the

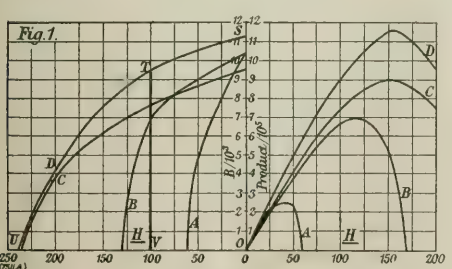


Fig. 1.—Comparison of Various Magnet Steels.

joint permeance of the branch circuits. As soon as the spark flux is found, the problem of the magneto becomes a common one with that of the induction coil. The greatest drawback of the magneto is the inherent weakness of the spark at low-speed, when the utility should be greatest. The best that can be done is to increase the product $i_1 n_1$ at low speed by employing as large a total cross-sectional area as is compatible with leaving room for the secondary winding.

There are a number of drawbacks associated with magnetos, from which, hitherto, there has been no means of escaping. The lamination of the armature core, for example, is necessarily very imperfect. The actual laminations employed form only about a half or less of the total core length, and they are not only supported by large solid-steel cheeks carrying flux but the effective lamination is also reduced by a number of rivets right through the structure, while the necessity for a considerable portion of the flux to cross the remaining laminations transversely is a still further source of loss. Other drawbacks involved, such as rotating windings, rotating contact breakers, and the very large number of carefully insulated parts which form a kind of high-pressure transmission line from armature to plug, reflect more on the reliability of the magneto than on its utility or its figure of merit. The recent introduction, however, of cobalt steel for magnets offers the means of overcoming a number of the difficulties alluded to, and it is likely that in a short while the use of tungsten magnet steel, at all events so far as magnetos are concerned, will be entirely superseded. In fig. 1 are shown portions of the hysteresis loops and also the products of B and H plotted as a function of H for different magnet steels. From this it will be noted that the maximum BH product obtainable from a good tungsten steel magnet, curve T, is about 300,000. The earliest samples of cobalt steel gave a curve similar to B, having a maximum product of about 700,000. To-day curve D, with a product of 900,000, is an average sample, and results as shown in curve D are by no means uncommon. It will be noted that the flux density at which the maximum product occurs is approximately the same both for tungsten and for cobalt steel; thus, to establish a given flux, the same area of cross section is required for both, but whereas the value of H available for the external circuit with the former material is about 35, for the latter it is about 150, so that the cobalt steel magnet need be only about one-quarter of the length of the tungsten steel magnet it replaces. Merely shortening the magnet is of itself no great improvement and would not appreciably affect the utility or the figure of merit of the magneto. The substitution of a much shorter magnet, however, makes other forms of construction possible which do not possess the drawbacks referred to in the rotating armature machine. It is as yet too soon to discuss the various arrangements which recently published patent specifications indicate are in course of development, but there is little doubt that the chief advantages which may be looked for in the near future will consist of a more compact structure, a shorter magnetic circuit, and a more thorough lamination of the armature flux path, ensuring a more efficient use of the magnet energy.

In conclusion, the author acknowledges his indebtedness to the British Lighting & Ignition Co., Ltd., and Messrs. Vickers, Ltd., from whom information was obtained.

Discussion.

Prof. G. W. O. Howe said that although it had been proved that the energy obtainable from an explosion was independent of the nature of the spark used to give that explosion, he was afraid that this fact would be very slow in making headway among motorists. So long as the spark was sufficient to ignite the mixture the energy obtainable from the explosion was the same, and all the elaborate system of blue and white sparks, fat and thin sparks, was largely a myth. The interesting question, he said, was as to what constituted the great superiority of certain brands of magneto. A great deal of research work had been done in this country, and magneto manufacture had been brought to a high state of perfection as a result of the war. Even so, he suspected that even now many English motorists preferred Bosch magnetos. He believed he was right in saying that the world-wide reputation of the Bosch magneto was not due to any difference in principle or in design, but merely to the careful manufacture of small details, which prevented the thousand and one accidents which could happen in a magneto. With regard to the use of cobalt steel, he referred to a magneto exhibited at a recent meeting of the Institution of Electrical Engineers, made with a magnet of cobalt steel, and the difference in size as between magnetos with tungsten and with cobalt steel magnets was striking. He believed, however, that at present it was not an economical proposition to use cobalt steel.

Prof. Sir J. B. Henderson asked for a further explanation of the term "utility." As to the indifference of the power of an internal combustion engine to the method of producing the spark, he expressed the opinion that this was due to the turbulence of the gases. Turbulence was so enormous if the ignition took place during the first compression that two or three sparks made practically no difference to the ignition, but if the piston was allowed to reciprocate several times, and the valves were kept closed several times before igniting, there was an enormous difference, because the turbulence was allowed to die down. He asked Dr. Turner if, in the introduction of induction coils, a closed magnetic circuit had ever been used.

Dr. Turner, in reply, did not accept Prof. Howe's contention that British magnetos were not as good as German. It might have been so in the past, but it was not true now, certainly not in design, because in many ways the British magnetos showed considerable superiority over the German. Undoubtedly the Bosch magneto owed its supremacy chiefly to its excellent workmanship. As to cobalt steel, with magnetos as they had been made in the past it was not a commercial proposition. If we only replaced a horse-shoe magnet by a shorter magnet it was an economic proposition, but other possibilities were opened up, which made it, not only a question of the alteration of the magnet length, but a question of rendering possible other forms of construction in which far more energy might be obtained in the magneto for a given weight than before. In future cobalt steel would be used almost to the exclusion of tungsten steel, provided changes in design of magnetos took place. In reply to Sir J. B. Henderson, he said that the utility merely referred to the conductance in parallel of the plug circuit, and not of the whole. In reply to the question as to the closed magnetic circuit, the question was largely one of rated decay of the flux. If the circuit was closed, as in a transformer, it was found, in the first place, that the flux would decay much more slowly; and secondly, that the flux would not die away to zero. In order to make the flux fall nearly to zero it was

necessary to leave air gaps. He believed that Sir J. B. Henderson had got at the root of a spot where much progress would be made in the future. Undoubtedly gaps would have to be left in the circuit in order to ensure efficient [illegible]

Fuel Economy Committee's Report. (*Abstract.*)

Section B.—Chemistry.

The fifth report of the Committee upon Fuel Economy was presented to Section B on September 12th.

The report opened with a reference to the effects of last year's coal dispute upon production, and consequently upon the iron and steel industries.

During the year the Committee had under consideration the question of oil supplies, and particulars were compiled of imports into the United Kingdom for the five years from 1917 to 1921 inclusive. The figures showed that the maximum import of fuel oil occurred in 1918, when the total was 3,515,020 tons. The lowest total was that of 1919—1,105,855 tons; in 1921 the figure was 2,255,822 tons. The bulk of the last year's importation was from Mexico, with the United States second. A total of 85,185 tons came from the British West Indies. The Committee considered that our dependence upon foreign sources of supply was dangerous, and in this connection reported the present state of the low-temperature carbonisation of coal in this country. It referred to the experimental plant at Barugh, near Barnsley*, the conference on the subject held this year at Cardiff under the auspices of the South Wales Institute of Engineers; the paper read in April last by Messrs Sutcliffe and Evans before the Society of Chemical Industry; and the Fuel Research Board's report, published recently. The Committee was in general agreement with the last-named report that, although we had not yet reached the stage when it could be decided whether or not a new industry could be established to deal with the carbonisation of the coal which was at present being consumed in the raw state, yet, as the result of the pioneering work carried out by various organisations, such knowledge and experience as had been gained afforded some ground for the expectation that we were approaching a conditional solution of the matter. The future seemed to depend upon the acceptance by the public of a smokeless fuel; the price of this should be reasonable and its appearance should be attractive. If such an industry were established the amount of carbonised fuel required for domestic consumption would be at least 40 million tons per annum. The by-products from this quantity of coal would possibly be 100 million gallons (or about 350,000 tons) of motor spirit, and 600 million gallons (2,750,000 tons) of anhydrous tars (fuel oils). Oil-fuel burners for boilers had been considerably improved, and so had the injection of oil in internal combustion engines, making it possible to use successfully the heavier oils. Work in connection with the adaptation of heavy oils to low-compression i.c. engines was now proceeding.

Part III of the report dealt at some length with the progress made in research upon the chemistry of coal.

Part IV treated of the possibilities of developing brown coal and lignite as fuels, but it was recognised that this was of small importance to Great Britain itself, although it was of some moment to several of the Dominions. Some particulars were given of the celebrated Morwell (Victoria) brown coal deposits. It was stated that the official estimate of the cost of producing the raw material was about 2s. 6d. per ton; that the cost of electrical energy generated by its agency would not exceed £2 17s. 6d. per horse-power per annum; and that this energy could be profitably sold at an average price of £4 8s. per horse-power per annum. Prof. Bone, in his investigations into the Morwell brown coal and other deposits, established that there was a definite temperature limit for each type up to which it might be heated (in the dry state) so as to effect a considerable chemical condensation in its cellulosic or humic constituents, with simultaneous expulsion therefrom of steam and CO_2; that by means of such condensation substantially the whole of the potential energy of the fuel might be correspondingly concentrated by suitable heat treatment, and the fuel value would thereby be improved.

The [illegible] domestic heating and cooking appliances dealt almost exclusively with means of improving the ordinary coal range. The question of the efficiency of gas and electric cookers was deferred as requiring further investigation. In Part VI the Committee called attention to the need for more systematic effort on the part of steam users to improve the present very low rate of boiler practice throughout the country, especially in the direction of educational provision for the better training of stokers and power-station superintendents. It was averred that if scientific methods were universally applied the present relief thermal efficiency of the average boiler plant could be improved from the present 60 per cent. to 75 per cent., with consequent [illegible] It was said to be the fact that unnecessarily large volumes of air were drawn through the [illegible] due to sheer neglect of the most obvious precautions. With good management it should be possible by careful damper regulation and maintaining a correct depth of fire, to burn completely an average quality of steam coal with no greater excess of air than would give about 12 per cent. of CO_2 (without appreciable quantities of CO) in the chimney gases. While the more general use of indicating and recording apparatus might be recommended as the best automatic aids to good management, yet unless these were supplemented by intelligence and watchfulness on the part of both stokers and boiler-house superintendents, they would not avail much, and might actually be misleading. Large boiler installations should be in the hands of specially-trained technologists. Local educational authorities could help fuel economy by instituting in technical schools properly organised classes of instruction for stokers and the lower grades of boiler-house attendants. In larger centres more advanced courses should be arranged for the higher officials.

The Committee pointed out that the Electricity Commissioners would render a great national service if, in their annual returns, they would publish such financial and detailed technical data as would show the actual fuel consumption and the production cost per unit of output in the various individual power stations throughout the country.

With regard to smoke abatement, the Committee mentioned the report of the Departmental Committee appointed by the Ministry of Health to deal with the subject. Although it was calculated that domestic chimneys were responsible for the discharge into the atmosphere of 2½ million tons of potential fuel in the form of soot, as against 500,000 tons from factory chimneys, it was considered impracticable to introduce legislation to counteract this waste. It was recommended, however, that the central housing authority should have certain supervisory powers with regard to heating methods in housing schemes submitted by local authorities, and that the latter be empowered to make by-laws requiring the provision of smokeless heating apparatus in new buildings other than private dwelling houses. With regard to industrial smoke, it was recommended by the Departmental Committee that the Ministry of Health should be given more definite power to compel local authorities to properly administer the laws dealing with smoke abatement; that a legal obligation should be imposed on all manufacturers to employ the best possible means for avoiding the pollution of the air by grit or smoke; that the same law should apply to Government establishments and to road and rail vehicles; that the Ministry of Health should be empowered to fix smoke standards from time to time; that the administration of the smoke abatement laws should be transferred to county authorities; and that advisory officers should be appointed by the Ministry of Health to assist local authorities and manufacturers in the matter. In conclusion, the Committee gave it as its opinion that the Ministry of Health should institute a Smoke Inspectorate upon the lines of the existing Alkali Inspectorate, which had admittedly worked well and with beneficial results to the industry concerned.

An appendix to the report gave data as to methods of determining the efficiency of cooking appliances. It was stated that the true determination of efficiency could only be made by raising the apparatus to, and maintaining it in a steady state, during which period valid observations on running efficiency could be made. Fairly complete investigations had been made of solid fuel and gas cookers, but the electrical series was still in progress at the date of the report, and could not be spoken of with the same degree of confidence as in the other two cases. Particulars of results only, therefore, included figures obtained with the use of solid fuel and gas appliances.

* Electrical Review, November 18th, 1921, p. 664.

The Origin of Magnetism.

Section A.—Mathematics and Physics.

In opening a discussion upon the above subject, Prof. P. Weiss said that Langevin had considered a body each molecule of which had a constant magnetic moment and complete freedom of orientation (a paramagnetic gas or a dilute solution containing a paramagnetic salt). By applying to such a substance the principles of statistical mechanics he had found its law of magnetisation in terms of the external field and the temperature, and had thus explained the paramagnetic phenomena. Van der Waals had explained the great density of liquids on the basis of the kinetic theory by adding to the external pressure an internal pressure which expressed the attraction exerted by the molecules on one another. The speaker had shown, similarly, that the intense magnetisation of ferromagnetic bodies might be deduced from the laws of paramagnetism by adding to the external field a molecular field which represented the mutual actions of the magnetic molecules in relation to orientation. He assumed that the [illegible] was proportional to the intensity of magnetisation and in the same direction. This hypothesis had enabled the variation of the magnetic saturation of ferromagnetic substances to be calculated for the first time as a function of the temperature. The law thus found had been verified by new experiments with magnetite. The same hypothesis had given, in addition, the following results: Above the temperature at which strong magnetism disappeared—or the "Curie point"—the coefficient of magnetisation was inversely proportional to the excess of temperature over the "Curie point." This law was

in accordance with experience. At the "Curie point" the true specific heat of a ferromagnetic substance fell abruptly to a smaller value. The magnitude of the discontinuity calculated from the magnetic data had been found to agree with the value obtained by thermal measurements. The theory of the molecular field permitted us to anticipate a reversible phenomenon, namely, that a substance became hotter when magnetised and cooler when demagnetised. This phenomenon had been observed and found to be in accordance with the theory. By supposing that in a crystal the molecular field had three different values in the directions of three rectangular axes, it had been possible to explain the remarkable anisotropic properties which had been discovered in the crystal of pyrrhotine. The molecular field theory, in conjunction with Langevin's kinetic theory, had provided means of calculating, on the basis of experimental data, a great number of atomic moments. All these moments possessed a remarkable property: they were integral multiples of the same elementary moment which the speaker called the "magneton." But the same atom did not always possess the same number of magnetons. For example, metallic nickel had three magnetons in the neighbourhood of absolute zero. After a region of transition, it held [illegible] magnetons.

[illegible] regard to iron and the other ferromagnetic metals. The discontinuous [illegible] striking evident by the discovery of ferro-cobalt (Fe_2CO), which [illegible] magnetons for each of its three atoms, whilst iron and cobalt under the same conditions only had 11 and nine magnetons respectively.

It might be concluded that magnetic atoms were the seats of characteristic moments which varied in a discontinuous manner according to the state of the body, and which were integral multiples of a single definite elementary moment—the magneton. Intense magnetism—or ferromagnetism—was the result of the existence of the mutual orientation effects of the magnetic molecules, which were expressed by the molecular field.

MUNICIPAL TRAMWAYS ASSOCIATION (INC.)—III.

ANNUAL CONFERENCE.

Tramway Rolling Stock.

ON September 14th the paper by Mr. E. S. RAYNER on "Tramway Rolling Stock," which was abstracted in our issue of September 15th, was read. Opening the discussion,

Mr. R. S. PILCHER (Edinburgh) agreed with Mr. Rayner that it would be beneficial if weights could be reduced. Edinburgh had recently reduced the height of the cars by 6½ inches, whilst the cantilever platform had been dispensed with, and there was a continuous frame from end to end of the car. The appearance of the car was enhanced, and the centre of gravity was lower. A light motor had also been introduced. The weight of the car had been reduced from 11 to 9½ tons, the carrying capacity had been increased from 54 to 60 per car, and the weight per passenger had been reduced from 456 to 354 lb. The speed had been increased, and the Ministry of Transport had sanctioned 20 miles per hour on certain routes. They had tried roller bearings, but had not so far found any reduction in energy consumption. He understood that ball bearings cost £100 per truck, and for that money manufacturers must be able to show some return in a reduction of costs. The question of renewals was a very important matter—Newcastle had almost absorbed its reserve in meeting charges of that character—and the speaker advocated weight reduction as far as possible, without reducing strength.

Mr. W. M. MILNES (Wigan) said that tests that had been conducted were in every case favourable to ball bearings. In actual working over the last nine months the roller bearings had shown a saving of energy as high as 16 per cent., as compared with other cars, and as low as zero. The average saving of energy on roller bearings was 3.5 per cent. over the period named. There was as yet no sign of wear on the bearings, and the lubricant was clean. The cost of converting a single truck was at present about £175. On a 3.5 per cent. saving of energy it would be a long time before the cost was made up. Wigan, therefore, was going no further in converting cars in its present financial position, but if he were ordering new cars, he would specify ball bearings.

Mr. C. W. SILVERS (Wolverhampton) thought more efficient results could be obtained with the chain drive, than with the—in his opinion—merely fashionable worm drive. He advocated a single-deck type of car, with a high centre of gravity, and considered that with trailers attached such a type of car was hard to beat. A great deal of wear on the track was due to grit and mud rather than to car construction.

Mr. C. J. SPENCER (London) said that as cheaper fares were desirable, those responsible for the tramways must set about lowering their costs by adopting new methods. He suggested the setting-up of a Research Committee representative of the Association, to meet and confer with manufacturers. Officials of the Tramways and Light Railways Association would always co-operate with such a committee.

Mr. B. HALL (Halifax) advocated a combination of the lightening process with the use of lighter alloys.

Mr. P. PRIESTLEY (Liverpool) observed that in his own town they had adopted a heavy track, and he suggested that the question be considered along those lines, instead of lightening the cars.

Alderman T. COBBY (Huddersfield) said they had had a very costly experience with a differential gear, and were not inclined to repeat the experiment.

Mr. A. R. FEARNLEY (Sheffield) contended that the efficiency of the present-day tramcar was considerably higher than that of the motor vehicle. In 21 months' experience of ball bearings, he had found no advantage. He deprecated the suggestion that tramcars were not keeping ahead of the times, and said innumerable improvements had been introduced with regard to details and efficiency.

The PRESIDENT thought the time was not quite ripe for the appointment of the suggested committee, and the matter was left in abeyance until next year's conference.

"Highways" Costs Borne by "Tramways."

By H. MATTINSON, A.M.Inst.C.E.,
General Manager, Manchester City Tramways.

(*Abstract.*)

UNDER the Tramways Act, 1870, we are:—To provide the "Highway" formation for the width of our tramway and 1 ft. 6 in. beyond; to maintain such "Highway" formation so long as the tramway exists; and to reinstate the roadway, in the event of the tramway being abandoned.

These conditions, imposed when all tramways were horse-hauled, were just and reasonable. It is the introduction of electric traction which has altered the circumstances and which renders a reconsideration of the obligations necessary, and it is the use of this "Highway" provided by the "Tramways," by irresponsible motor 'bus competitors that aggravates the injustice. Our object, therefore, is to claim relief from those obligations that are in common equity and fairness chargeable against highways authorities.

The tramways require a rail, held by tie-bars and supported by an adequate foundation. Generally speaking, a stringer 1 ft. 6 in. in width and 6 in. thick has proved adequate—the rail, packed on this and held by tie-bars, constitutes our "structure." All the rest is "Highways." I consider, therefore, that where the concrete and paving extend in common the full width of the road, the whole cost of such "Highway" construction should be debited against the Highway Authority in so far as it is saved such cost.

In the event of the roadway in question not requiring concrete foundations or paving for the general traffic thereon, it is obvious that, in common fairness, the local authority cannot be charged with the cost of a type of construction called for by the laying of the tramway. If in course of time the local authority should reconstruct the sides of the road, a contribution should then be made towards the cost of the original tramway area based on the cost of such reconstruction.

As regards maintenance, I do not see that we can escape this, nor ought we to attempt to do so. The obligation is ours under Section 25, to keep the surface of the roadway level with the rail, and, furthermore, it must be admitted that we do [illegible] paving more than ordinary traffic does if we do not wear it; also it is to our interest that we do this work, to enable us to maintain our rail in adequate condition. The utmost claim we might fairly make [illegible] an allowance toward the cost of the work, based on that incurred by the Highways Authority on the [illegible] of the road, together with any grant from the Ministry of Transport in respect thereof.

References have been made to the [illegible] rates, in respect of the permanent way, but [illegible] ascertain the facts, any alteration in the [illegible] charges relating to the repair of the [illegible]

materially affect the rates payable by the tramways. The repair and renewal of the paving or any portion thereof has no bearing whatever on the liability of tramway undertakings for payment of rates.

Tramways are, or should be, rated on the rent a hypothetical tenant would pay, and the first factor in arriving at this rent is the gross earnings which arise out of the user of the tramway. The repair and renewal of the tramway is a statutable deduction to be made from the gross estimated rents. Even if the liability to repair and renew the paving or any part thereof was taken away from tramway operators, it would appear to follow that the paving would no longer form part of the hereditament for rating purposes, and no such deduction would then arise. In this event the statutable deductions would be reduced by the elimination of the cost of the repair and renewal of the paving, and the net rateable value on which rates are paid would be correspondingly increased.

One could recite instances of the injustices of our highway liabilities indefinitely. In Manchester we have an instance of a reserve line that practically has had no cars over it—probably not 100 all told—yet has been completely worn out and relaid, consequent on the vehicular traffic.

The obligation is a statutory one and only Parliament can modify it. The departmental attitude towards this proposal is, I believe, not at all sympathetic, in which case there would appear to be no alternative but that of a private Bill.

Discussion.

Mr. J. B. Hamilton, C.B.E., general manager of the Leeds Tramways, opened the discussion. He stated that Mr. Mattinson's subject had been dealt with twice previously at other conferences. That, he contended, was an indication of its importance. The whole question had entirely shifted from the time when the Tramways Act was passed, putting the maintenance of the track upon the tramways. The horse cars had gone, and on the other hand there was heavy tractor and vehicle traffic on the roads, which was responsible for a good deal of depreciation. It had been urged in a previous discussion at that conference—and he held rightly—that the tramcar passenger should pay for his ride. In respect of the question of road maintenance they might consider whether or not the passenger was having to pay for the maintenance of something, the cost of which should be borne by the ratepayer generally. What was wanted was a private Bill to bring antiquated laws up-to-date, and he suggested that municipal authorities should be approached and asked to say that road charges should be apportioned to the proper accounts.

Mr. E. Hatton (Newcastle) said he entirely disagreed with Mr. Hamilton's views and contended that if tramway undertakings took up the best street positions they should pay for that privilege.

Alderman W. C. Fenton (Sheffield) expressed astonishment at Mr. Hatton's views, because those remarks were diametrically opposed to Mr. Hatton's earlier plea for cheaper fares. If road charges were properly apportioned, fares could be materially reduced. It was high time a proper adjustment was made.

Mr. E. S. Rayner (Hull) said he supported the view that every road user should pay a fair and proper proportion of the cost of road upkeep. It was a fallacy to state that tramways monopolised the road, since they only used that portion of the road on which they happened to be running. Neither tramways nor ratepayers should be called upon to bear road costs. Tramways should maintain rails and foundations, and obtain a rebate from the roads authorities, the road costs being fairly apportioned to road users. Under such circumstance the penny fares would soon be an accomplished fact.

Alderman T. Hey (Halifax) supported the general opinion expressed in the debate.

Capt. L. C. F. Bellamy (St. Helens) suggested that consideration should be given to the proposals of the Ministry of Transport for payment on a seating basis.

Mr. J. Beckett, general secretary, pointed out the difficulties that arose in relation to privately owned concerns, by reason of the existence of the Road Fund.

A resolution on the lines suggested by Mr. Hamilton was adopted by the conference, the only dissentient being Mr. Hatton.

Traffic Regulation.

At the request of the London County Council, the Conference gave some consideration to the regulation of traffic at tramway stopping places. That body asked for consideration with a view to taking steps to promote legislation to deal with the matter.

Mr. Beckett placed before the Conference certain correspondence that had passed with the Minister of Transport, drawing the attention of the Ministry to the danger to people alighting from tramcars by reason of vehicular traffic passing on the near side of the car. The Minister had replied that he could not see his way to take any steps in the matter, and drew attention to the provisions of the Motor Car Act. That Act, said Mr. Beckett, was not sufficient to meet the danger. He quoted from a report which stated that more than 25 per cent. of the accidents to persons alighting from or boarding tramcars were caused by horse-drawn vehicles or bicycles.

Councillor G. R. Davey (Ilford) said the necessity for action was patent, and the only reason something had not been done was that the authorities failed to realise the urgency of the question.

Mr. T. B. Goodyer (Croydon) stated he had been in correspondence with the coroners of the country, and they were in favour of some regulation being passed to prevent vehicles passing between the kerb and standing tramcars.

Mr. J. Dalrymple (Glasgow) said there had been a by-law in that city for at least ten years, prohibiting vehicles endangering tramcar passengers alighting or boarding, and it had had beneficial effects. There had been some difficulty in working it at first, indeed, there had been some prosecutions, but now it was fully observed.

Mr. J. Barnard (Bolton) supported the general plea for regulations.

Mr. A. L. C. Fell (London County Council) suggested that the whole matter should be referred to the Executive Council, with a view to action being taken, and this was agreed to.

This ended the business of the second day.

Dinner.

The delegates were entertained to dinner by the Newcastle Transport and Electricity Committee on Thursday, September 14th, Alderman R. Mayne presiding, and in addition to the delegates there were present the Lord Mayor and Lady Mayoress, Sir A. Munro Sutherland, Bart., and many other leading citizens.

Sir A. M. Sutherland proposed the toast of the evening: "The Municipal Tramways Association." He said from small beginnings the Association had risen to great proportions. Now they had £62,000,000 capital. He hoped the members would not shut the doors of their cars to the man who had only a penny. But if they wanted to reduce their fares they must reduce the expenses all round; and if they wanted to increase their income they must reduce their fares. The tramway workers in Newcastle were a splendid body of men, but he failed to see why a man working for a municipality should be paid more than he would get in any other industry. They had to pull together in order to live with the times.

Alderman Mayne, in responding, said it was a day of anniversaries. The Association had reached its majority at the same time as the Hull Corporation tramways had reached the 21st year of municipalisation. During the past two days they had conferred together at one of the best gatherings they had known. Whilst he believed in municipalisation, in practice it raised all sorts of difficulties, and they were feeling those difficulties now. If they thought the municipalisation of public services a sound proposition they must prove it sound. Fortunately, they were seeing their way through. They had pooled their experiences, and learnt from each others' successes and failures.

Mr. Ernest Hatton (of Newcastle) also responded. He said that personally he would rather like to go back to the standard of living in 1914, with the same freedom and cheapness in cost. It was time to reduce working expenses considerably by sound common-sense methods.

The Chairman presented Mr. J. M. McElroy, who had recently retired from the general managership of the Manchester Tramways, and also from the executive council of the Association, with two handsome timepieces, and referred to Mr. McElroy's connection with the Association.

Mr. McElroy, in accepting the gifts, said he had not known a better set of men than those he had met in the work of the Association. They had been tolerant and kindly in all circumstances.

The health of the Chairman was toasted on the proposition of Mr. Dalrymple, of Glasgow.

Report.

The report of the Executive Council shows that the membership comprises 95 local authorities, four honorary members, 96 general managers, and 19 associate members. Seven local authorities are not in membership. Endeavours have been made to induce the Minister of Transport to make permanent the provisions of the Tramways (Temporary Increase of Charges) Act, 1920, and its period has been extended to March 31st, 1924. The Minister has refused to initiate legislation to prevent vehicles from passing stationary tramcars on the near side at stopping-places. Mr. Harry Allcock's proposal that the value of the penny shall be raised to one-tenth of a shilling has been approved by the Council. Attempts to secure the abolition of maximum speed limits have been unsuccessful, but the Minister of Transport has stated that he is willing to authorise speeds up to 20 m.p.h. where the conditions warrant it. The expenditure of the Association for 1921-22 was £3,631, and the receipts were £3,410; the balance sheet shows a surplus of £20s.

Returns of the member undertakings for the last financial

year are given in an appendix, from which it appears that the aggregate results is as follows:—

Amount required for renewals at 2d. per car-mile		£2,298,319
Less aggregate amount of surpluses, without any provision for renewals	£1,792,091	
Deduct aggregate amount of deficits ...	334,544	
Net aggregate surpluses		1,457,547
Net aggregate deficits for the year ...		£840,772

The total capital invested was £62,292,756, and the total revenue was £27,222,962.

The total amount charged upon rates was £261,222. Deducting the amount estimated to be contributed to rate aid, £37,465, the net charge was £223,757.

CANADIAN ELECTRICAL NOTES.

The following notes upon developments and conditions in Canada were derived from the September 1st issue of the *Electrical News* (Toronto), a journal which gives very extensive reviews of happenings in the Canadian electrical world.

The coal situation, which is acute in Central Canada, is considered to provide a valuable opportunity for extending the use of electricity. It will have a great moral effect if electricity can demonstrate its value at such a critical time, and dispel, to a great extent, the feeling that electricity in the home is merely a luxury.

One way of spreading the "electrical idea," adopted by at least one Transatlantic undertaking, is house-to-house canvassing. Although decried as being too closely allied to "peddling," many dealers look upon it favourably and consider that if the right kind of man is appointed to do the work the results will be beneficial.

The Murray report criticising the working of the Hydro-Electric Power Commission of Ontario, and the Commission's reply thereto, has once again roused the two camps of those who are in favour of public ownership and those who are not. The Commission asserts that Mr. Murray has distorted figures and inflated estimates of the working costs. The real figure, it appears, is $7,200,000 per annum, whereas Mr. Murray gives a total of $12,310,000—showing a considerable difference. The Commission claims to have justified its very caustic comments upon the report which were issued when the report first appeared.

The contractor-dealers of the Province of Quebec do not intend the recent Act providing for the licensing of contractors and wiremen, and the inspection of installations, to fall into desuetude. They claim that, under the terms of the Act, 60 per cent. of the present *soi-disant* electrical contractors will disappear from the industry. The purpose of the Act is being extensively advertised, and the fruits of this are already beginning to be seen. At least two contracts which were recently awarded to non-licensed contractors have been cancelled, the parties concerned evidently fearing that the underwriters would refuse to grant an inspection certificate, or that the work would be stopped by Government officials.

A description of a "modern electrical home" which was to have been opened in Montreal during the present month indicates it to be a well-organised scheme. The arrangements are in the hands of a large committee divided into sections dealing respectively with finance, illumination, appliances, advertising and publicity, and installation. The organisers include representatives of power companies, manufacturers, contractors, and dealers; the home should prove a great attraction.

An important industry, that of cement production, realises the value of electricity. Recent statistics show that 1,146 electric motors with an aggregate of 60,375 h.p. are working in cement factories throughout the Dominion. One large works has an installation of 14,080 h.p. in motors chiefly of the squirrel-cage type.

The British Columbia Electric Railway Co. is proceeding with the extension of its Stave Lake plant. The existing dam is being raised and a fourth generator of 13,000 h.p. capacity is being installed; this will bring the installed plant up to 52,000 h.p.

The North Canada Power Co. recently issued its first public financial statement, showing a net profit of $84,431 upon a revenue of $344,483, during the year 1921.

The Hydro-Electric Power Commission of Ontario is proceeding with the extension of its lines into rural areas, and eleven more townships are being connected up to the system. The total mileage of transmission lines erected and acquired by the Commission was 3,001 up to October 31st, 1921.

The chief developments in Winnipeg are in the direction of telephones and cooking appliances. The Fort Rouge exchange is expected to be in operation on the automatic system in January next. When this exchange with its 7,000 lines, and the 13,000-line Garry exchange have been converted, two-thirds of the Winnipeg system will be automatic. The Winnipeg Hydro reports that the sale of electric cooking ranges averages 70 a month, and the demand for [illegible] is exceeding anticipations.

The "broadcasting" fever has firmly taken hold of Canadians. One feature of the National Exhibition at Toronto was a radio section, in which a continuous eight-hour programme of a varied nature was given daily. It is authoritatively stated that in Toronto alone, the number of valve receiving sets in operation is between three and four thousand.

Recent contracts for electrical equipment secured by English firms or their Canadian representatives include an order given by the Ontario Commission to the Ferranti Meter & Transformer Manufacturing Co., for 179 transformers for rural distribution schemes, in sizes of 5, 7½, and 10 kVA; and one placed by the Commission with Messrs. Ferguson, Pailin and Co., for 19 oil circuit-breakers, with a rupturing capacity of 400,000 kVA.

STANDARD BRUSH-HOLDERS.

It was recently decided by a number of electrical manufacturers that the time had come when the standardisation of brush-holders and brush gear would be of great benefit to the industry generally, and, with this end in view, the designers of several of the interested manufacturers met to consider the question.

The advantages to be gained by the users of electrical machinery by such standardisation may be summarised briefly as follows:—

The universal adoption of a standard brush holder will allow the user, even if machines of different manufacture are in his service, to carry only one make of brush-gear spares. Further, the bulk production of a standard holder would enable a considerable reduction in cost to be made.

A list of conditions to be aimed at in designing a standard brush-holder was drawn up, the chief points of which were:—

(1) That each brush-holder should be a self-contained unit and independently renewable, with a view to the ultimate reduction of the quantities of spare parts to be carried.
(2) That the brush-holder should be of the "box" type, suitable for brushes of the dimensions given in the British Standard Specification No. 96.
(3) That the tensioning device should be such that the greatest uniformity of pressure should be maintained throughout the life of the brush, and that independent adjustment of the pressure should be provided for.
(4) That the brush-holder should be readily removable from the carrier.
(5) That all parts should be suitably locked so that there would be no loose parts to become detached.
(6) That means should be provided for accurate alignment of the brush gear, and adjustment for any wear of the commutator.

Simplicity of construction was considered an essential feature, and after examining a number of designs the brush-holder described below was evolved as fulfilling most completely the requirements stated and, at the same time, being suitable for quantity production.

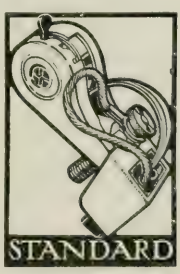


Fig. 1.—The "Standard" Brush-holder.

The brush-holder carriers are of special triangular-section drawn steel, simply cut off to the length required and necessitating no further machining apart from drilling.

Insulation of the carriers from the bracket is of the simplest possible form, and consists of a suitable insulating sleeve moulded round one end of the carrier and projecting beyond the clamp for a sufficient distance on each side to provide ample creepage surface. The carrier is clamped in the machined jaws of the brush bracket by means of a simple cover plate and two or four screws, compensation for any wear of the commutator being provided for by suitable packing pieces under the brush carrier.

The triangular section of the brush carrier ensures that, when clamped up in the brush bracket, it presses hard against one side of the accurately machined jaw, thus en

suring its exact pitch and alignment. Also the brush-holder boxes themselves are pulled up against one side of the brush carrier by means of the clamping screws, which are set at an angle for the purpose.

The method of attaching the brush holders to the carrier is such that any holder in a line may be removed when desired without disturbing the remainder, and when replaced it will be accurately located so that the angle which it makes with the commutator surface will be the same as previously, and consequently the brushes will not require rebedding.

A substantial terminal or binding post is provided to which the brush pigtail may be attached, and is so arranged that the current is carried direct from the pigtail terminal through the binding post into the brush carrier, so that by this means efficient contact is made whether the surface of the carrier is clean or not. Should it be thought desirable on heavy-current machines, &c., a copper strip can be clamped between the carrier and the brush-holders, the end of the copper strip being arranged to form a brush carrier terminal and thus conduct the current from the brush-holders without its passing through the steel carrier.

The method of constructing the brush-holders produces a substantial box which is capable of standing up under the severe vibration which is sometimes present, and in addition to mechanical strength, extreme accuracy of brush-box dimensions is ensured.

The springs are of the "clock" type, made of phosphor bronze, so that they are free from liability to rust. It is a well-known fact that the clock spring, extended and arched to form a pressure finger, gives the most uniform pressure of any known form throughout the life of a brush. In addition to this advantage the resiliency is greater and the weight of finger less than that obtained with any other form. Adjustment of tension is easily accomplished with one hand by moving the adjusting lever into a different notch in the holder.

The metal at the back portion of the holder is brought round the spring to form a shroud and completely enclose it. This is done with the object of protecting the vital part from damage by flash-over.

The design of the mechanism is such that it can readily be dismantled, and springs or other parts can be replaced in a short time. In addition to this advantage, the gear is locked in a simple and efficient manner, so that parts cannot shake loose while the machine is in operation.

Arrangements have been made to manufacture the "Standard" brush-holder in bulk quantities, so that prompt deliveries from stock can be secured. It is stated that the prices for the large range of sizes turned out are very reasonable, and compare favourably with the prices of any other type of brush-holder on the market.

The patents for this brush-holder are held by the Standard Carbon Brush Holder Co., Ltd., London, to which all inquiries as to sizes, prices, &c., should be addressed.

THE GAS TURBINE.

A New Design.

Since the end of the war experimental work on the gas turbine has again been taken up in Germany, and according to the accounts which have been published in the Continental technical Press substantial headway has been made. It is rather surprising to find that so little interest is taken in the subject in Great Britain, and that the problem is so generally regarded as a hopeless one.

Mr. W. A. D. Forbes gives a brief elementary account in the *Motor Ship*, from which the following details are abstracted, of what has already been done, and indicates a proposed new line of development which is based upon a new theory of nozzle action, and involves the use of a novel type of pump known as a "kinetic compressor."

To become a commercial success it will not be essential that the gas turbine should have an efficiency superior to the Diesel engine, but it will be necessary to obtain an efficiency greater than that of the steam turbine, while, in addition, there should be considerable gains in weight and space.

The gas turbine consists essentially of:—

(1) A combustion chamber in which heat is given to the working fluid.

(2) [illegible] from which useful work is obtained by the expansion of the working fluid.

(3) A cooler in which heat is abstracted from the working fluid; frequently the atmosphere is allowed to act as the cooler.

(4) A pump which compresses the working fluid from the cooler pressure to the combustion chamber pressure. It is necessary that there should exist a pressure difference between these two components.

The combustion may take place at a superatmospheric pressure, while the cooler is at atmospheric pressure, or the combustion chamber may be kept at atmospheric pressure while the cooler is maintained at a sub-atmospheric pressure. The latter case is known as a sub-atmospheric cycle, and the pump will have to act as an exhauster unless the vacuum is maintained by other means. The work done by the expansion of the working fluid from the combustion chamber pressure to the cooler pressure is known as the "positive work," while the work absorbed by the pump is known as the "negative work" of the cycle.

The gas turbine may be operated upon three different types of cycle. Heat may be taken in at constant pressure, or at constant volume, or under thermodynamic conditions which vary between these states. Gas turbines have actually been built and operated on each of these three cycles.

In the constant-pressure cycle fuel is burned in a combustion chamber under steady conditions, and the p.v. diagram of the cycle is similar to that used in the Diesel engine, except that in the latter the toe of the diagram is cut off, as the reciprocating mechanism is not suitable for utilising large specific volumes. This type of turbine is divided into two classes: (*a*) Single-fluid turbines, in which the working substance is air; and (*b*) mixed-fluid turbines, in which the working substance is air and steam.

The constant-volume cycle is analogous to the Otto cycle, except that the toe of the diagram is utilised. The unburnt charge enters the combustion chamber, the exit from which is closed by a valve which remains shut until the explosion pressure reaches its maximum value; it then opens, and the pressure in the combustion chamber falls as the products of combustion are discharged through nozzles on to the turbine wheels.

The expansion curve of either type of cycle is usually adiabatic or a close approximation thereto. The compression curve may (in theory) be either isothermal or adiabatic, but in practice, in order to obtain a high overall efficiency, it is necessary to approximate as far as possible to isothermal conditions, and thus reduce the negative work of the cycle.

The constant volume cycle may be operated without precompression, but, as is the case with piston engines, an increased efficiency is obtained by first compressing the charge.

In the proposed new Hepburn-Forbes system of operation the sub-atmospheric, single-fluid constant-pressure cycle has been adopted, as it is considered that this type of cycle yields the most promising line of development. Attention has been directed towards the utilisation of the kinetic energy remaining in the gases after leaving the moving turbine blades. To attain this end, the gases on leaving the turbine are passed through a cooler, as far as possible without substantial reduction in velocity, and then into a "kinetic compressor;" in which their velocity energy is converted into pressure energy. This new type of compressor displaces the mechanically-driven rotary compressor generally used for maintaining the vacuum, which has, therefore, to be produced by other means. The vacuum throughout the system is maintained by the expansion, through a nozzle system, of high-pressure operating air, in which fuel has been burned, thus enabling a further supply of air, in which fuel has been burned at atmospheric pressure, to be induced to pass through the turbine and do work. Both supplies of air then pass through the cooler and kinetic compressor, and are discharged at atmospheric pressure. The supply of high-pressure operating air is maintained by a separate mechanically-driven compressor, and can induce from four to five times its own weight of air to expand down from atmospheric pressure to the vacuum pressure, and pass through the turbine. The whole mechanism is exceedingly simple, as, apart from the auxiliaries, the only moving parts are the turbine wheels.

Operating on the Hepburn-Forbes system, the calculations in which reasonable allowances have been made for losses, show that an overall efficiency approximating to that of the Diesel engine should be obtained, and there is, therefore, a wide margin for unforeseen contingencies between this value and the efficiency of the very best steam turbine.

THE CORROSION RESEARCH COMMITTEE.

Summary of Sixth Report.

The sixth report of the Corrosion Research Committee of the Institute of Metals on the nature of corrosive action and the function of colloids in corrosion, a summary of which was presented by Messrs. Guy D. Bengough, D.Sc., and J. M. Stuart, M.A., at the annual autumn meeting of the Institute, held in Swansea on September 20th, 1922, attempts to present a general discussion of corrosion phenomena, based on the study of several different metals, and to examine how far the electrochemical theory of corrosion (usually called the electrolytic theory) can account for the observed phenomena. The difficulties encountered by this theory are indicated, and it is shown that it gives a satisfactory account of the facts only under certain conditions, while many facts can only be explained by recognising the important part played by colloids in corrosion. A theory of the mechanism of colloid action is put forward, and some experimental results are reviewed in the light of this theory. Corrosion is defined in its widest sense as the oxidation of a substance which may be produced by chemical or electrochemical means. Chemical reactions

may occur when the reacting bodies are in contact: electrochemical reactions when the reacting bodies are spatially separated. In the latter case the reacting substances must be capable of ionisation, and a portion of the energy of the system appears as electrical energy. Two cases of corrosion are considered, both of which can be carried out chemically or electrochemically. Pure electrochemical action may in certain cases be relatively unimportant. Thus the cathode of a cell of high voltage may be more rapidly attacked than the anode, while an anode at a high voltage tending to force it into solution may be very little corroded, owing to scale formation.

Further facts which are difficult to explain on a purely electrochemical theory are the following:—

1. Certain depolarisers do not increase corrosion, but actually inhibit it.
2. The conductivity of electrolytes is not directly connected with the amount of corrosion.
3. Lambert's pure iron (probably the purest metal ever produced) was found to be readily attacked by sodium chloride solution and dilute acids.
4. According to the electrochemical theory the presence of ions of the corroding metal should decrease the corrosion of most of the common metals. There are, however, numerous exceptions, and in some cases the presence of such ions actually increases corrosion.

The order of corrodibility of metals in distilled water, certain salt solutions, and non-electrolytes, is different from their order in the electrochemical list, which suggests that there are factors interfering with the electrochemical action. Such a factor is scale formation, and a main factor in determining the amount of corrosion by water and salt solutions is the nature and distribution of the products of corrosion. This may be far more important than any hypothetical distribution of cathodes and anodes in the metal.

The effects of strain and impurity in the metal are considered from the electrochemical view to be of fundamental importance, and Lambert's pure iron and lead were prepared with a view to eliminating both these factors. Neither metal was incorrodible in certain conditions. However, potential differences between strained and unstrained portions of the same metal are usually very small, and unstrained (annealed) metal may corrode more rapidly than strained metal; in fact, the effect of strain is a minor and ephemeral factor in corrosion in neutral solutions.

As regards the effect of impurities on the corrosion of metals, a trace of impurity appears to assist local corrosion, but the amount of corrosion is not proportional to the amount of impurity. Even the presence of graphite does not appreciably stimulate the rate of corrosion of iron. The effect of a trace of impurity is probably a trigger action.

Local action at metallic surfaces may be produced in a variety of ways at any selected points by modifying the conditions external to the surfaces, and is not mainly determined by the presence of anodic areas on the metal. Minute pores in a metal may, however, give rise to local action, as has been shown by Seligman and Williams.

The electrochemical theory considers that the action of oxygen is that of a depolariser. It can be shown, however, that atmospheric oxygen has very little depolarising power at ordinary temperatures. The main function of oxygen in corrosion is to oxidise directly the metal, and also in some cases the products of corrosion.

A theory is developed regarding the part played by colloids in corrosion, which may be briefly outlined as follows:—

A metal immersed in water sends positively-charged metal ions into the liquid, and becomes itself negatively charged. In the case of ordinary commercial metals the metal also becomes superficially oxidised if dissolved oxygen is present. The hydroxide produced by this oxidation can take up the ions given off by the metal, and the hydroxide thereby passes into the state of a positively-charged colloid. Some of this colloid will diffuse away, permitting further reaction between the oxygen and the metal surface, and thereby reforming the hydroxide film over the latter. Oxidation is then stopped till this hydroxide can pass into the colloidal state by acquiring positively-charged metal ions. This, in general, does not take place till the colloid initially formed has diffused into the presence of the electrolyte, when it is precipitated by the anion of the dissolved salt, the anion neutralising the charge on the metal corresponding to that on the colloid. This allows the metal to send more ions into solution, and the uncharged hydroxide thereby acquires a charge. If the colloid so produced can diffuse away the process can continue and corrosion develop.

For steady corrosion, therefore, the colloid must be produced under conditions which allow it to diffuse some distance from the metal before precipitation. If it precipitates directly on the corroding surface it will, in general, adhere to the latter and stop corrosion. In the case of a corrosion pit the first condition is fulfilled, since no precipitation occurs inside the pit. It is only when the colloid diffuses through an aperture (generally very small) in the gel-deposits at the mouth of the pit, that it meets electrolyte and is then precipitated. Such precipitation merely thickens the external gel-deposits. These gel-deposits adhere directly to and protect the metal surrounding the pit, and thereby emphasise the local nature of the corrosion.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

[Report of Committee.]

The report for the year 1921-22 of the Committee for Scientific and Industrial Research has been published.*

As mentioned in [illegible] for economy has [illegible] nevertheless much useful [illegible]

The report states that the expenditure of the National Physical Laboratory has been [illegible] tions, and during the year under review amounted to £190,024. Of this £92,965 was [illegible] contributions from the fighting services. The expenditure upon the Fuel Research Station amounted to £43,266; this was partly offset by receipts of £1,883 [illegible] The Low Temperature Research Station, which the Committee's grants have enabled the University of Cambridge to erect and equip for the work of the Food Investigation Board, has been completed. The Board's expenditure during the year was £17,750. The co-ordinating boards and committees, referred to in the previous report, have made steady progress; their expenditure was £21,464, plus £5,381 incurred for work done for them at the N.P.L. The Department has carried out work on nine other research programmes during 1921-22, involving an expenditure of £5,985.

The number of industrial research associations licensed by the Board of Trade is now 24, and 22 of these are in actual operation. Grants to these bodies during the year absorbed £86,355. The balance of the "million fund" remaining unexpended was £816,850. Part of this will be devoted to grants to those industrial research associations already established, while further grants will be made to new associations as they are formed. The balances of other funds held in trust for the Department's use totalled about £7,375. Scientific investigations by other bodies were aided to the extent of £8,287; a list of these given in an appendix shows that grants were made, *inter alia*, for research upon domestic heating, scientific instruments, and low-temperature carbonisation. Allowances were made to 205 students for training in research work; to 55 research workers to undertake independent research or to act as assistants; and 20 grants were made to scientific workers to enable them to employ assistants or purchase equipment. These grants amounted to £47,005 (estimated). Headquarters administration cost £37,560, making the total expenditure for the year £525,585, which was provided from the following sources: Exchequer, £273,194; interest upon million fund, £65,358; from the capital of the fund, £86,355; and from fees from outside bodies, £100,678. Engineer Vice-Admiral Sir George Goodwin, K.C.B., and Dr. J. C. Irvine, C.B.E., have been appointed to the committee in the place of Sir Charles Parsons, K.C.B., and Prof. J. F. Thorpe, C.B.E.

The first part of the report of the Advisory Council is devoted to a survey of activities which was made in order to ascertain whether any part of the work could be curtailed as a measure of economy. The result was a negative one, proving that the Department must be regarded as a national asset, although the value of its work cannot possibly be accurately gauged. As the Council justly states:—"The cost of supporting research cannot indeed be justified by comparing it with the prime cost of production—especially when demands are falling off—but by the consideration that it is the means of improving and cheapening production and, in consequence, of increasing the demand. Research . . . . is a cost of the same category as insurance. It is an insurance against the effects of ignorance with the certainty, if it is wisely undertaken, of large and continuous bonuses."

The British Portland Cement Research Association has by research improvements devised means of reducing the coal consumption in rotary kilns by 4 or 5 per cent. The Scientific Instruments Research Association has produced a rouge and an abrasive of very superior qualities for preparing lenses, prisms, &c. Much conservation of effort has been effected by the co-operation of bodies working upon allied researches, and a number of examples are given in the report, *e.g.*, the British Scientific Instruments, and the Electrical and Allied Research Associations.

The Engineering Research Board suffered the loss of Sir Charles Parsons, its chairman, who was compelled by pressure of other duties to resign. Sir Joseph Petavel, K.B.E., Director of the N.P.L., has been appointed in his stead. Sir John Dewrance, K.B.E., and Mr. S. B. Donkin have joined the Board.

The work of the Physics Co-ordinating Research Board has included position finding by wireless, and the X-ray examination of materials. Among the researches which have occupied the attention of the Chemistry Co-ordinating Research Board is the improvement of accumulators. The Radio Research Board has investigated the laws of the propagation, &c., of electro-magnetic waves, atmospherics, and direction finding. A paper embodying the results of the last investigation is to be read before the Institution of Electrical Engineers during the present session. The National Physical Laboratory has carried out work on standards of measurement, on wireless problems, and in many other directions. The Fuel Research Board's work is reviewed in the report, indicating how valuable it is in making the most of our national resources.

* H.M. Stationery Office, price 3s. net. (Cmd. 1715.)

by low-temperature carbonisation, steaming coal in vertical gas retorts, pulverisation, and other methods. The Committee on Gauging River and Tidal Currents has done a little preliminary work, including the study of various types of current meters.

The remainder of the report gives details of works published by the Department, particulars of grants to various research bodies and to individuals, and regulations regarding patents dealt with by Government departments.

The appendixes contain details of *personnel*, statistics of grants, a list of aided researches, a list of publications by individuals in receipt of grants, the position of research organisation in the oversea dominions, &c.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

24,492. "Variable condensers for wireless telegraphy, &c." U. Beaton and W. Gummer. September 9th.

24,504. "Thermionic valves, attachments thereto, and valve holders." N. Lea and Radio Communication Co., Ltd., and J. Ree. September 9th.

24,505. "Calibration of electrical apparatus." N. Lea and Radio Communication Co., Ltd. September 9th.

24,506. "Motor-car head lights, &c." T. Hunter. September 11th.

24,515. "Electric heaters, cookers, &c." J. Krauer. September 11th.

24,516. "Electric plug and socket connectors." E. E. Bramall. September 11th.

24,519. "Magnetic or electro-magnetic separating devices." H. G. Richardson. September 11th.

24,520. "Magnetic or electro-magnetic separating devices." H. G. Richardson. September 11th.

24,537. "Automatic electric switch." R. Marr. September 11th.

24,570. "Masking device for telephone receivers." G. Black. September 11th.

24,589. "Electrically-operated vehicles." Metropolitan-Vickers Electrical Co., Ltd. September 11th. (United States, September 23rd, 1921.)

24,597. "Electric controlling devices." Sullivan Machinery Co. September 11th. (United States, November 25th, 1921.)

24,614. "Combined lamps and current generators therefor." O. Pletscher. September 11th. (Switzerland, September 11th, 1921.)

24,619. "Electrically-driven periodically-moving mechanisms." C. D. J. Jamin. September 11th. (Holland, October 4th, 1921.)

24,622. "Thermionic valves, &c." W. J. Polyblank. September 11th.

24,633. "Electric rectifiers and methods of operating same." G. Holst and Naamlooze Vennootschap Philips Gloeilampen Fabrieken. September 11th.

24,636. "Thermo electric contact." W. E. Beabey. September 12th.

24,661. "Audible signalling device." C. Baxter and J. Mellor. September 12th.

24,680. "Wireless tuning-coil holder with series-parallel device." H. J. Pugh. September 12th.

24,686. "Wireless apparatus." H. V. Andrew and G. Betjemann & Sons, Ltd. September 12th.

24,706. "Sparking plugs." A. H. Price. September 12th.

24,713. "Electric time switches." C. B. Pinkerton. September 12th.

24,719. "Electric light fittings." M. J. Railing and F. Winstanley. September 12th.

24,722. "Telephone receivers." M. R. Lawrence and Sterling Telephone and Electric Co., Ltd. September 12th.

24,724. "Colliery trams, &c." D. Llewellyn, H. Rees, and S. Rees. September 12th.

24,726. "Power-generating systems." B. W. H. Pratt. September 12th.

24,769. "Safety device for street-car trolley poles, &c." J. King. September 13th.

24,772. "Magnetiser for permanent magnets." Stentophone Motor Accessories (1921), Ltd. September 13th.

24,776. "Electric accumulators." E. W. Teale and W. Whitehead. September 13th.

24,777. "Piano, &c., electric lamps." H. Bray and A. D. Keay. September 13th.

24,778. "Magnetic clutches." C. F. Shanks. September 13th.

24,783. "Rectifying devices, &c." A. R. Angus. September 13th.

24,809. "Electric alarms." L. J. Dabos. September 13th. (France, September 14th, 1921.)

24,810. "Electric ignition devices for liquid-fuel furnaces." W. A. White. September 13th.

24,821. "Locking devices for electrical apparatus, &c." British Thomson-Houston Co., Ltd., and J. Sugden. September 13th.

24,823. "Alternating-current dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). September 13th.

24,828. "Dynamo-electric machines." W. D. Horsley, Sir C. A. Parsons, and J. Rowan. September 13th.

24,837. "Apparatus for electrically heating liquids." D. Thomson. September 13th.

24,857. "Track brakes for tramways." J. V. Payne. September 13th.

24,869. "Thermionic valves, &c., for wireless signalling, &c., installations." W. T. B. Roberts. September 14th.

24,883. "Incandescent vapour lamps." A. G. Weleter. September 14th.

24,884. "Electric lighting sets." C. C. Garrard, A. H. Railing, and W. W[illegible]. September 14th.

24,908. "Electrolytic anti-corrosion systems." A. S. Gush. September 14th.

24,910. "Variable electric condensers." H. Jackson. September 14th.

24,915. "Electric fuses." W. Clark. September 14th.

24,921. "Field magnet frames for dynamo-electric machines." J. Thum. September 14th. (Switzerland, October 22nd, 1921.)

24,948. "[illegible] & Holtzke Akt. Ges. September 14th.

24,952. "[illegible]" G. Motte. September 14th.

24,972. "Automatic, &c., telephone systems." D. A. Christian and Siemens Bros. & Co., Ltd. September 14th.

24,998. "Manufacture of grid resistances." L. Satchwell. September 15th.

24,999. "Electricity meters for alternating currents." W. G. Dewsbury, F. W. Jones, Russell Electrical Appliances Co., Ltd., and L. T. C. Russell. September 15th.

25,024. "Transmitters for hand signalling." W. Prior and C. E. Riley. September 15th.

25,027. "Aerial for wireless apparatus." H. W. Parker. September 15th.

25,029. "Electric water heater." W. Colebrook. September 15th.

25,035. "Sparking plug." G. F. Sleath and M. S. Stevenson. September 15th.

25,040. "Telephone [illegible]." D. [illegible]. September 15th.

25,041. "Electric insulators." D. Mackenzie. September 15th.

25,042. "Signalling systems." Western Electric Co., Ltd. September 15th. (United States, September 20th, 1921.)

25,051. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. September 15th. (United States, September 17th, 1921.)

25,052. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. September 15th. (United States, September 17th, 1921.)

25,053. "Sparking plugs." A. Bicheno and L. Bicheno. September 15th.

25,063. "Apparatus for regulating electric generators." J. Thum. September 15th. (Switzerland, October 22nd, 1921.)

25,073. "Head lamps for motor vehicles, &c." F. Charie. September 16th.

25,078. "Apparatus for automatically operating electric switches of pumps." E. W. Buckley and Mather & Platt, Ltd. September 16th.

25,102. "Rectifying devices." A. R. Angus. September 16th.

25,105. "Electrically-heated kettles, &c." A. Hague and Hague and MacKenzie, Ltd. September 16th.

25,107. "Electric gramophones." A. B. Campbell and R. D. Fleming. September 16th.

25,114. "Electric switches." F. N. Linstow, J. Murrey, and A. Reyrolle and Co., Ltd. September 16th.

25,123. "Electric control systems." British Thomson-Houston Co., Ltd., R. D. Given, and W. C. Hiddiard. September 16th.

25,141. "Electric apparatus for recording and reproducing sound." A. F. Sykes. September 16th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

5,456. "Wireless and other signalling systems, particularly for the limiting of signals." J. Scott-Taggart and Radio Communication Co., Ltd. February 17th, 1921. (185,133.)

6,011. "Electric furnaces." A. F. Reid. February 22nd, 1921. (185,136.)

9,024. "Manufacture of storage batteries." H. Wade (Hazelett Storage Battery Co.). March 23rd, 1921. (185,148.)

9,494. "Storage batteries." H. E. Smith. March 31st, 1920. (160,821.)

11,706. "Lamps for road vehicles and the like." Naamlooze Vennootschap Philips Gloeilampen Fabrieken. May 1st, 1920.

13,932. "Tell-tale indicator for electric circuits." J. Atkins and A. S. Powell. May 18th, 1921. (185,168.)

14,063. "Amplifying systems employing electron discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). May 19th, 1921. (185,167.)

14,135. "Anchoring clamp for overhead electric lines." I. Prinetti. May 20th, 1921. (185,168.)

14,252. "Means for producing a perforated tape by electric current impulses." C. J. J. Rosendahl. May 21st, 1921. (185,170.)

14,330. "Electric coding machine." E. H. Hebern. May 23rd, 1921. (185,171.)

14,453. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). May 24th, 1921. (185,178.)

14,518. "Standardised and interchangeable component parts for construction of wireless apparatus." G. H. Moody. May 25th, 1921. (185,180.)

14,778. "Ignition magnetos for internal-combustion engines." British Lighting and Ignition Co., Ltd., and E. O. Turner. May 27th, 1921. (185,192.)

14,801. "Windings of alternating-current dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. May 27th, 1921. (185,195.)

14,849. "Electrical connections or couplings." O. T. Banks. May 28th, 1921. (185,200.)

15,447. "Electric arc lamps." R. Rigby. June 3rd, 1921. (185,232.)

15,503. "Cable clamps." C. W. Kemper and J. T. Kemper. June 4th, 1921. (185,235.)

16,036. "Liquid electric motor starter." R. F. Baerlocher. June 10th, 1921. (185,243.)

16,718. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). June 17th, 1921. (185,252.)

17,585. "Electro magnets." J. Neale and J. A. Manners Smith. June 28th, 1921. (185,265.)

17,618. "Electric bell." E. Magerle. June 28th, 1920. (165,730.)

17,785. "Electrically-operated switches and the like." L. H. Wadsworth. June 30th, 1921. (185,267.)

17,936. "Dynamo-electric machines." T. S. Jones. July 1st, 1921. (185,269.)

17,998. "Electrical switchgear." C. W. Kay and Callender's Cable and Construction Co., Ltd. July 2nd, 1921. (185,271.)

18,701. "Electro magnets." H. R. Jones, C. E. Wood, and W. E. Lawton. July 11th, 1921. (185,280.)

18,738. "Metallic vapour lamp." Dr. P. Eversheim. July 10th, 1920. (160,144.)

18,755. "Electric bell or light press switches." J. H. Gath. July 12th, 1921. (185,281.)

19,067. "Electric massage and heating apparatus." K. Horiguchi. July 14th, 1921. (185,284.)

19,433. "Electric relays." Metropolitan-Vickers Electrical Co., Ltd. August 6th, 1920. (167,468.)

19,637. "Electric switch boxes." A. L. Davis. July 21st, 1921. (185,289.)

19,908. "Sound transmitters." F. A. Watkins. July 25th, 1921. (185,294.)

20,096. "'Ironclad' electrical switches." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. July 27th, 1921. (Cognate application 26,852/21.) (185,299.)

20,271. "Electric heating devices." H. J. W. Hamers, M. Buiskool, and W. J. Silman. July 28th, 1921. (185,300.)

20,699. "Electro magnetic switches." British Thomson-Houston Co., Ltd. (General Electric Co.). August 3rd, 1921. (185,305.)

20,720. "Method of attaching or fastening pieces of old tramway or other rails to act as anchors to existing or new tramway rails and the like." H. W. A. Brown. August 4th, 1921. (185,306.)

21,872. "Electrical precipitation." Lodge Fume Co., Ltd. (International Precipitation Co.). August 17th, 1921. (185,315.)

25,896. "Collectors or commutators for electric dynamos and the like." H. Herrmann. November 5th, 1920. (Addition to 159,848.) (171,083.))

25,921. "Rotary electric switches." G. J. Sutton. September 30th, 1921. (185,338.)

26,780. "Electrical entertainment devices." C. Dinnebier. October 9th, 1920. (170,010.)

29,117. "Electric furnaces." I. J. Moltke Hansen. November 3rd, 1920. (171,096.)

34,170. "Storage batteries." Soc. de l'Accumulateur Tudor. December 18th, 1920. (172,989.)

1922.

858. "Dynamo-electric generators." R. Bosch Akt. Ges. February 14th, 1921. (175,607.)

4,334. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. February 26th, 1921. (175,969.)

6,827. "Waterproof electric blasting cap." A. L. Oliver. March 8th, 1922. (185,376.)

8,371. "Lock for electrically-operated lifts." H. F. Thomas and G. Newbury. March 22nd, 1922. (185,372.)

THE

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THE SPIRIT OF THE ELECTRICITY SUPPLY ACTS.

THE Electricity Supply Acts, 1919 and 1922, are based on certain presuppositions, and are so framed as to carry out a particular line of policy. They presuppose that there is a general good of the industry which is not automatically achieved by each undertaking doing what is right in its own eyes, and they empower the Electricity Commissioners to override local authority in the interests of this general good. Obviously, therefore, the Acts cannot be carried out without occasionally treading on someone's toes. The essence of the Acts indeed is a kind of benevolent compulsion. Legislators realised that for 30 years the undertakings had existed under a voluntary system, each going its own way independent of all the others and regardless of any welfare except its own immediate gain, and they saw that this would naturally continue unless some measure of coercion was devised.

This modicum of coercion is designedly provided in the pair of Acts now on the Statute Book. It is therefore no argument against this or that action of the Electricity Commissioners taken under these Acts to protest that it interferes with the rights of a particular undertaking, meaning by this the right to pursue an individual policy when the same is not conducive to the general good of the district and of the public. Roughly, we may say that the good to the industry thus finally worked out will almost be in proportion to the amount of coercion thus exercised, since experience, if it shows anything, shows most clearly that the ultimate good of the industry will never be evolved by each undertaking pursuing its own course irrespective of all its fellows. All this may sound as so many truisms, but now that the Acts are being put into force we hear occasional complaints that someone or other is not allowed to do just what he likes, and that any undertaking ought to be allowed to consider merely its own immediate good irrespective of any broader issues. It needs, therefore, to be pointed out that it is useless at this late hour to try to put the clock back and to say that individual undertakings ought not to be interfered with. The principle is a *fait accompli* in the Acts, and the Electricity Commissioners have no option but to exercise such coercion as is provided in the Acts. They are merely machinery to carry out the policy of the Acts—yet directly they do so there is a pseudo-righteous outcry at "unwarrantable interference." This was the gist of the Ealing Corporation's protest in its recent difference with the Electricity Commissioners, when it even went so far as to try to "get the law on them." But in this case we are pleased to note that the law was not so much of an ass as reputation supposes. The Electricity Commissioners are to be congratulated on pursuing what they believe to be the policy laid down in the Acts irrespective of what opposition they may awaken.

Another case, too, where there seemed to be a tacit attitude of this kind was in the recent hearing of the South-Eastern Railway Co. on its application for con-

sent to erect a new generating station for its own purposes. The 1919 Act says indisputably that if electricity can be supplied from an outside source as cheaply as the Railway Companies can themselves generate, then they should take such supply and not build another station. But this, judging from the evidence, was just the one thing that the South-Eastern Company seemed by no means willing to accept. One indication in this direction was the not wholly admissible procedure of raising quasi-political issues in the witness box, as when Mr. Thomas gave evidence as a member of Parliament representing Labour, and the Town Clerk of Woolwich spoke as representing municipal feeling.

But in this case also the Commissioners are to be commended on carrying out the duty laid on them by the Acts. In the statement which they issued in August, the South-Eastern Railway Co. was told to confer with the undertakers who were willing to give a supply, with a view to giving effect to the purpose of the Act, namely, taking a supply instead of building a station. This particular question can easily be brought into the sphere of politics, and, in fact, something of a political atmosphere seemed to be threatening during the hearing, as we have already indicated. But the Electricity Commission is not a Government department of the kind readily susceptible to political influence—its very constitution is designed to make the Commissioners politics-proof.

In the decision which they have now issued, the Commissioners, after the most exhaustive deliberations, have unequivocally stated their conclusion, namely, that the traction supply to the South-Eastern Railway shall be given by one of the existing undertakers, seeing that such supply can be given on terms favourable to the railway company, and will save the railway company a capital expenditure of over £1,000,000. The conclusion thus reached by the Commissioners is in precise accord with the anticipations of the various Government Committees on Electricity Supply, which throughout urged that "the economy of a combination of all requirements, power, traction, lighting, and heating, is fundamental." The Commissioners' decision thus fits in exactly with the presuppositions on which the Electricity (Supply) Act, 1919, was based, and puts into concrete realisation the spirit of the Act. Incidentally, too, it gives a further and salient instance of the increasing good which the supervision of the Electricity Commissioners is effecting in the electricity supply industry. And this brings us back to our thesis, that the work of the Commissioners must be judged by the criterion of the general and final good of the industry and of the nation, and not by the question whether this or that individual is allowed to follow his own sweet will.

The Electrical Contractors' Association.

That only good can come to the electrical contracting industry from a strengthening of its representative organisation—the Electrical Contractors' Association Incorporated—is obvious to everybody who has followed the recent discussion of the matter in the pages of the Electrical Review. A certain amount of criticism is good for all of us at times, and we hope that as the outcome of the present controversy and of the efforts that are simultaneously being made by the E.C.A. through its monthly organ, there will be a substantial addition to the membership. We well remember the campaign that took place in different parts of the country some years ago when the contracting trade was "out" to safeguard its interests against certain encroachments or opposition. The energy of its leaders brought considerable success as the result, and its achievements in Parliament and in the Law Courts have been substantial. We have every reason to believe that the present president, Mr. Marryat, and Mr. Tate, the secretary, will be able to accomplish great things by their current development proposals if they receive real live co-operation from the various districts in convincing the large number of non-member contracting firms of the advantages of membership. The *Electrical Contractor* for October is a special "Development" number (of which the editor has very courteously sent us an advance proof), by means of which it is hoped to get into touch with genuine firms of contractors who are still non-members, and we recommend such firms after reading these lines to secure a copy of the issue and consider the points advanced and how they stand in relation to the Association, its objects, and its work. The opening article is entitled "A Sound Business Proposition—a Word to the Non-member." It disclaims on the part of the Association any desire to boost the E.C.A. organisations simply as organisations, and says, among other things: "Our object is to consolidate our trade, to improve our trade, and the conditions under which it is carried on, and to protect our trade from each and every harmful influence that operates against it to-day or that may come into operation to-morrow. We *know* that these results are to be obtained *through* the E.C.A. organisations. We *know* that if these organisations thrive, the sound business objects for which they have been formed will be attained. And the trade will benefit: *everybody will benefit.*" A number of communications are published from prominent members holding out "the hand of friendship and goodwill to the reputable, non-member, installation engineer." As we turn over the proof pages of the "Development" number we notice that among other Electrical Review matters that are honoured with mention are Mr. H. R. Taunton's recent criticisms, together with Mr. Marryat's reply which appeared in our last issue. We have no desire to intervene in that controversy—we always consider that the writers of contributed articles to the Electrical Review are able to look after themselves—but we cannot help owning to certain feelings of regret that our esteemed contemporary had gone to press before Mr. Taunton's reply was available. That is the fault neither of the author nor of the Association, though the former's reply was at our printer's two days after the latter's communication was received.

We will conclude these notes by wishing Messrs. Marryat and Tate and their Association every success in their present efforts to add to the membership. Our best desire with regard to the organisation is that it shall become large and fully representative and a power in the industry for the good of the whole country—ideals which inspired us as we presided over the operations which gave it ingress to the electrical world.

Conference of American and British Trade Journals.

Just before the end of the war the British technical and trade journals availed themselves of a favourable opportunity of entertaining, and meeting briefly in conference, a number of qualified representatives of American publications of the same class who were then on a flying visit to London. The visit followed a tour of the war zone across the Channel and of the British industrial districts. Fraternising of this kind, however brief, between those whose specialised duty it is to chronicle and study the course of important trades and industries is much to be desired, and British technical journalists expressed the hope that it might be possible at some time or other for them to meet their American confrères across the Atlantic. Trade and technical journals everywhere and those responsible for their production and distribution have much in common, and an exchange of views may do something to promote good relations between America and Britain and possibly to improve some publications. It may also go to show the real value of superficial criticism which is sometimes offered by those

who are unable to see that while all have a similarity of outlook and conceptions, there are "differences imposed by conditions of nationality" (to quote Lord Burnham). These differences dictate certain dissimilarities between British and American newspapers as well as trade journals. Our expert journalists and trade journal business men are not less alert in the organisation of their service because there is not uniformity in the output on the two sides of the Atlantic.

The desired return visit takes place next week, when representatives of the trade papers connected with the Weekly Newspaper and Periodical Proprietors' Association, Ltd., of London (of which the Electrical Review and many other leading technical journals are members) and the British Association of Trade and Technical Journals, meet at the Hôtel Astor, New York, by invitation of the Associated Business Papers of America, for a three-days' conference. The delegation conveys messages of cordial greeting from statesmen and newspaper men of eminence on this side, and we may perhaps be permitted to take advantage of this reference to the event to pass on our own greetings and good wishes to our confrères who are spending their lives in maintaining a high standard for the electrical and allied Press of New York, Chicago, and San Francisco, as we and others have long sought to do for similar organs in London.

A Successful Undertaking.

The success of the Hackney municipal electricity undertaking, reported in our "Lighting and Power Notes" this week, is principally due to the remarkably low generating costs obtaining there. The figure of 1.14d. per kWh compares very favourably with the average cost in the electricity undertakings of this country, so far as can be judged. When the cost varies between such wide limits as .9118d. and 1.26d. per kWh, the calculation of a satisfactory standard of comparison is very difficult.

At a time when practically every undertaking has had to record a decrease in the amount of energy sold, a decline of only .07 per cent. in sales is a matter for congratulation. We have no doubt that the excellent result is due to the progressive policy which the Hackney Electricity Department pursues. Two examples of this have recently been recorded in our pages—the institution of an attractive "free" wiring system and the organisation of a model exhibition (Elec. Rev., June 23rd, p. 897, and April 28th, p. 593). To this policy may be ascribed the credit of an increase of 15.66 per cent. in the electricity supplied for domestic purposes, which compensated for a decrease of 9.38 per cent. in the power supplies—due no doubt to the depressed state of trade. Another point may be emphasised while studying Hackney's electricity accounts. We feel that the great majority of the people of this country still retain the illusion that electricity is a "rich man's" luxury. It cannot be said that the bulk of the inhabitants of Hackney are over-burdened with wealth to squander on mere luxuries, and yet they use electricity in increasing quantities—surely the inference is plain enough.

A scale of reduced tariffs was instituted at the beginning of the new working year, and we hope that this further step in the right direction will be abundantly justified by the results.

Electrical Salesmen in Conference.

By no means the least interesting notice to reach us announcing the opening of the 1922-1923 session of Institutions and Associations, is that relating to the series of E.D.A. Salesmanship Conferences that are to be held in the London area during the next six months. Last year the meetings were started in a tentative sort of way, but as the winter months passed by there was no doubt about their success and general usefulness. The programme printed in our "Business Notes" to-day suggests that the tentative stage is very definitely past, and that the inaugural conference which takes place next Friday will be the beginning of a series of gatherings which will so prove their value as to render their continuance indispensable. While referring our readers to the notice elsewhere for the details of the arrangements, there is one point that we wish to lay stress upon here. We recognise that amongst our readers there are many men and women who are gaining their livelihood in the electrical trade but are not members of any of the institutions or associations connected with it. Among them there are those who are more or less expert with regard to the commercial side of the trade, and are able, given an opportunity, to contribute from their specialised experience valuable practical suggestions. The charm of these E.D.A. Salesmanship Conferences is that they afford a platform for such when they have anything useful to say, while they afford them also an opportunity of improving their own knowledge by listening to the observations of others. But it is not only the "experts" who are wanted; the would-be learner in the trade is wanted too, and the educational opportunity offered is the "chance of a lifetime." We hope that many of our readers will find in the open doorway to these conferences an entrance into the growing circle of those who see in more efficient electrical salesmanship a means of securing the best results for the trade in what Sir Harry Renwick has called the Golden Age of Electricity.

Swiss Railway Working.

The General Administration of the Swiss Federal Railways has issued a report on the results of the adoption of electric traction. The report states that from the technical point of view the use of electric traction on the lines has hitherto been fully successful, and in various respects has surpassed expectations. The inconveniences in working the trains are fewer than in the case of steam working; passengers and *personnel* appreciate the suppression of smoke; the maintenance of the rolling stock has been rendered easier, and the use of steel along the line (bridges, stations, &c.) has been materially reduced; and the efficiency of the workmen engaged on the maintenance of the lines in the tunnels has largely increased, which is particularly advantageous in the case of the St. Gothard railway. Moreover, the scope of vision of the drivers is greater, the visibility of the signals is better, and the acceleration of the speed permits of better time-table results. For instance, the fastest direct train now covers the journey between Lucerne and Chiasso in 4 hours and 5 minutes, as compared with 4 hours 42 minutes in the case of steam locomotion, while the time occupied in covering the same distance by an "omnibus train," which was 7 hours and 10 minutes with steam, has been reduced to 6 hours and 20 minutes. As to the economic side of the problem, the report states that when the price of coal delivered at the frontier is 60 fr. per ton, the cost of working by steam locomotion is the same as with electric traction; with coal at a higher price, the electrical working is more economical. It is estimated that 85 electric locomotives will be able to render the same services as 100 steam locomotives, and that the cost of maintaining the former will not exceed 75 per cent. of that of the latter per locomotive mile. So far, the calculations made show that electric traction on the St. Gothard railway has not yielded such favourable financial results as in the case of the other lines which have been converted to electric locomotion, because the works on the former were executed during the period when the cost of construction was greater. In conclusion, the report states that it will now be necessary to think about the construction of new generating stations for future years and the conversion of further lines, and that it will be very interesting to verify the anticipation that the extension of electric traction to a vaster network will bring about real and prompt economic advantages.

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THE ELECTRICITY (SUPPLY) ACTS, 1919 & 1922.

By HENRY M. SAYERS.

The Electricity (Supply) Bill, 1922, went into the House of Commons Committee stage with 26 clauses, and received the Royal Assent as an Act of 31 sections; proof that it was considerably altered in its final stages. Comments and expositions on the Bill may therefore require to be revised, and as the Act came into force immediately upon receiving the Royal Assent, it seems timely to point out its most important provisions and their effects, as these can be deduced from the authentic text.

The main object of the 1922 Act is to complete the 1919 Act, which aimed at the better organisation of electricity supply, but which in the shearing process that the Government found necessary to apply to secure its passage had cut away from it some of the provisions essential to the working of the new organs. The most important of the amputations performed was that of the financial powers of Joint Electricity Authorities. The Electricity Commissioners could set up these bodies, and could authorise them to do a number of things involving the expenditure of money, but could not authorise them to raise money for those purposes. That at least appears to have been the legal and official opinion, though it does not seem to have been formally stated, and to the layman is not apparent on the face of the Act. That, however, need not be discussed, as the 1922 Act expressly authorises the raising of capital by Joint Electricity Authorities.

The 1922 Act does other things. It makes some important alterations in the previously existing law of Electricity Supply, including amendments of the 1919 Act itself, which affect all authorised undertakers, as well as other parties.

Financial Powers to Joint Electricity Authorities.—The first five sections of the 1922 Act authorise J. E. A.'s to borrow money for the purposes of carrying into execution the schemes embodied in the Orders under which they are established. It is hardly necessary to set out the provisions in detail, because, in the first place, the borrowing powers will be conferred in each case by the Electricity Commissioners acting under regulations made by the Minister of Transport with the approval of the Treasury, so that the interpretation and application of these sections is primarily the business of the Commissioners; and, secondly, anyone interested in drafting a scheme for the establishment of a J. E. A. will necessarily consult the Act itself to ensure that any financial scheme proposed is consistent with it.

The general effect of the sections is to place J. E. A.'s in much the same position as municipal authorities are with respect to borrowing money, *e.g.*, for electricity supply, with one very important difference. Municipal loans have the ultimate security of the rates; J. E. A.'s will have no rating powers, and the security they can offer for both interest and principal payments will be the revenue and property of their undertakings, with possibly some indirect rate security. Certain local authorities in the area of any J. E. A. may lend money to the authority, or may guarantee the payment of interest on money borrowed or securities issued by the J. E. A. But this financial aid is voluntary, and is limited to liability for an annual amount not exceeding the product of a penny rate where the guarantor is not an authorised undertaker; or, where the guarantor is an authorised undertaker to the estimated annual amount of any capital charges from which the undertaker will be relieved by reason of taking a supply in bulk from the J. E. A.; this estimated amount to be determined by the Commissioners. Authorised undertakers other than local authorities may apparently lend or guarantee the obligations of the J. E. A. without any prescribed limit.

Joint Electricity Authorities.—Having thus no power to pledge the rates of their districts, their issues will not appeal to the classes of investors who provide the bulk of the loans to local authorities. It may be that they will consequently have to pay rather higher interest rates, at least at the beginning of their careers. This remains to be seen. The most probable result is that they will be financed at first mainly by the authorised undertakers and large consumers who have a direct interest in cheapening the supply of electricity, and who will be represented on the authority. It should make for efficiency and economy if the constituents of the managing body have to find most of the capital spent. It seems rather unfortunate that the financial assistance which local authority undertakers may afford is so limited, as the relief in direct capital charges due to taking a bulk supply may be far from a true measure of their interest in the success of the J. E. A.

There is a provision with respect to the prices to be charged for electricity by the J. E. A.'s (Section 18), which aims at securing the payments of interest and sinking-fund charges, in that those prices are to be so fixed that the income shall be sufficient to cover expenditure (including those charges) on revenue account, and that any deficiency may be met by assessing the consumers.

This is hardly to be reckoned as a security from the investor's point of view; it is rather a statutory direction as to the prudent administration of the undertakings.

The amount which a J. E. A. can borrow is to be fixed in the scheme for the establishment of the authority, which has to be approved by resolutions of each House of Parliament (Section 7, 1919 Act), and extensions of such original powers can only be authorised by the Commissioners by orders which will be "provisional only" until they are confirmed by Parliament. The procedure for the Parliamentary confirmation of these provisional orders is not set out in the Act, and it is doubtful whether such orders will be held to be "Special Orders" within the meaning of Section 26 of the 1919 Act, which have to be approved by resolutions in each House, or "Special Orders" under Section 35, which have to be laid before each House for thirty days and become effective if neither House presents an address against the order. It is rather curious that whereas the 1919 Act abolished "Provisional Orders" in respect of electricity supply, the Act of 1922 brings back the word "provisional" in respect of these orders for extended borrowing powers of J. E. A.'s only. Generally, a "Provisional Order" means that the Order has to be confirmed by an Act, and that if there is opposition the Committees have to hear counsel and witnesses for and against, a lengthy and costly procedure. It will be somewhat anomalous if the procedure for extension of financial powers is made more laborious than that for the original powers. Some comfort may be taken from the fact that the Orders are not called "Provisional" in the section. The words are "such Order shall be provisional only, and shall not come into force unless confirmed by Parliament." It remains to be seen how the Commissioners, the Ministry, and Parliament interpret the provision. Occasion will not arise for some time—not until after some J. E. A. has exhausted its original money powers, and has to ask for more.

Schemes.—Section 19 of the new Act makes an amendment to Section 5 of the 1919 Act, slight verbally, of considerable importance in its effect. It permits the Commissioners to include proposals in their schemes of reorganisation for the formation of other bodies than J. E. A.'s. The wording of Section 5, Sub-Section 2, of the 1919 Act now reads as amended:—"including proposals . . . where necessary, for the formation of

a joint electricity authority *or other body* for the district." The addition of the words italicised therefore permits of formal and statutory recognition of the Joint Committees and similar organisations which have been proposed, and in some cases provisionally approved by the Commissioners, as the agents of reorganisation in some districts. Whether such bodies can be given the same powers as J. E. A.'s depends upon the official view taken of the scope of the amendment, and ultimately upon the action of Parliament in respect of the schemes submitted for its approval. So far as such powers may be granted, they will have statutory effect, in virtue of the concluding words of Section 7, Sub-Section (2), of the 1919 Act :—" and when so approved shall have effect as if enacted in this Act." Elasticity in the form of organisation should considerably assist the Commissioners in meeting the views of those who object for one reason or another to the J. E. A. organisation, while agreeing to combine forces under some other form.

Section 20, 1922, adds to the interests which may be entitled to representation on the J. E. A.—if so provided in the scheme—those " of the persons employed in connection with the supply of electricity," and permits the inclusion in the scheme of provisions determining " the conditions of employment of persons employed by the Joint Electricity Authority." Both of these additions in the interests of labour are permissive, not mandatory.

Section 5, Sub-Section (4), 1922, permits the inclusion in a scheme constituting a J. E. A. or other body, of provisions authorising or requiring authorised undertakers and other bodies represented on the authority or body to contribute towards any administrative expenses of the authority or body. This is perhaps likely to be of most use in the cases of " other bodies " which may not require to raise capital and may have no revenue from sales; but which must have some accommodation and employés. It may also be useful in the preliminary stages of J .E. A.s' operations which will entail expenditure before either capital or revenue is available.

One of the most important provisions in the new Act, affecting many of the supply companies working under Provisional Order powers, is contained in Section 14. This section permits the Commissioners, either by an Order establishing a J. E. A. or by a " Special Order," to suspend the powers of compulsory purchase by either a J. E. A., the London County Council, or any local authority, for such period and on such terms as the Commissioners may think fit, and they may for that purpose amend the provisions of any Act or Order relating to the undertaking.

This power is subject to the proviso that the consent of the authority or authorities in whom the purchase powers are vested is given to the suspension. This opens up a prospect of relief from the incubus of Section 2 of the Electric Lighting Act, 1888, an enactment which has had a disastrous effect upon the supply industry. It should be noted that the power is not merely that of suspension, in other words, of prolongation of tenure, but of suspension on conditions, if thought fit to make conditions. Such conditions and the amendment of the original Act or Order presumably permit the Commissioners to vary the purchase terms. It is of importance that this power is not confined to districts where a J. E. A. is to be established, but covers every company working under the liability to compulsory purchase.

The reservation of the consent of the purchasing authority is not negligible, but it may be noticed that the amendment of the law gives such authorities a liberty which they did not possess. It is held by good legal authorities that under the 1888 Act a purchasing authority cannot decide whether it will or will not purchase an undertaking until the date laid down in Section 2, *i.e.*, " within six months after the expiration of a period of 12 years, or such shorter period as is specified " from the date of the passing of the Act or Order. So no purchasing authority can tie the hands of its successors by a previous agreement to postpone the exercise of its purchasing powers. Consequently no company liable to purchase can tell, until the end of its original tenure, whether it will have to sell the undertaking, and even if the purchasing authority is willing to make an arrangement for extending that tenure it cannot enter into a valid agreement. But under the new Act, the right to consent to a suspension of the purchasing powers is definitely given.

It is hardly necessary to point out the value of this amendment of the law. The London companies and the London public have suffered severely from the consequences of the liability to purchase. The London County Council during the inquiry last year said that it would be agreeable to a suspension of its purchasing powers, which accrue in 1931, and it may be expected that the Order now in hand for the London district organisation will provide for an extension of the companies' tenures which will enable them to go ahead with development work to the joint benefit of themselves and the public generally.

Another addition to the provisions which may be included in a scheme establishing a J. E. A.—or may be the subject of a subsequent Special Order—is that the powers and duties of a J. E. A. may be exercised through any authorised undertakers. This provision should be of value in districts where no additional authority seems necessary for the general improvement of the supply organisation, excepting that the powers of the existing authorised undertakers are insufficiently extensive, as to area or otherwise, to do all that is desirable in the district. It seems that this provision should suit districts where there is a feeling among the authorised undertakers that they can do everything that a J. E. A. could do, if only they have the legal powers. Section 15 is the one authorising such delegation of rights and duties.

Power Companies.—Section 14 of the 1919 Act empowered the Commissioners, on the application of a J. E. A., to exclude from the area of supply of a power company, any part of that area which at the time of the application was not being supplied by the company. This section is repealed, and replaced by Section 17 of the 1922 Act. Power is given to the Commissioners to exclude parts of the area of supply of any power company by the Order establishing a J. E. A. or afterwards by a Special Order. This power of exclusion is limited to (*a*) any part of the area where the right of the power company to supply is subject to the absolute veto of some other authorised undertaker, and where the Order provides for, or is made conditional on, the transfer to the J. E. A. of the generating station from which that part of the area is supplied; (*b*) any part of the area which is not being supplied by the company, and which the Commissioners consider can be better supplied by the J. E. A. or its deputy; and (*c*) with the consent of the power company, any other part of the area of supply. In compensation the Commissioners may give the power company powers to supply electricity for all purposes in any other part of its area which does not form part of the area of any other authorised distributor. The exercise of such powers of exclusion is not to affect the rights of the power company to lay mains through the excluded area, or to give a supply for railway, tramway, and canal traction, &c., at some point in the remaining area for use in the excluded area. If it is proposed to make an order of exclusion on the application of a J. E. A., and any one interested objects, the order may only be made by the " Special Order " procedure of Section 26, 1919, which requires approval by resolutions of both Houses of Parliament.

The intention of the section is obviously to prevent a part of the area of supply of a power company being deprived of a supply, because the power company is, for whatever reason, unable or unwilling to provide it. The compensation of general supply powers in other parts of the area should be a valuable one.

Section 16, 1922, amends Section 12, Sub-Section (1) of the 1919 Act. The effect of the section as amended is to prohibit a J. E. A. from supplying in any part of the area of a power company for any purpose for

which the company is authorised to supply, but subject to the proviso that if the power company is unable or unwilling to supply any consumer who is prepared to enter into a binding contract to take a supply, on terms which the Commissioners consider adequate, then the Commissioners may make a Special Order (Section 26, 1919, requiring Parliamentary approval) authorising the J. E. A. to supply without the consent of the company.

The principal alteration made by these amendments in the provisions of the 1919 Act, is that a power company's area cannot be curtailed, or invaded by competition from a J. E. A., without specific approval of such acts by both Houses of Parliament.

There are several provisions in the 1922 Act which should assist J. E. A.'s by giving them greater liberty of action than was granted by the 1919 Act. By Section 6 any authorised undertakers may lease to a joint authority the whole or any part of their undertaking, without prejudice to existing contracts, &c., and by Section 9 a J. E. A. may, by agreement, use any main transmission line of any authorised undertakers or other persons. It is permitted by Section 8 to pay a local authority undertaker for the transfer of its undertaking, in any form of payment mutually agreed and approved by the Commissioners. Where any station or transmission line is transferred to or acquired by a J. E. A., the J. E. A. may agree with the former owner to work and maintain the transferred property on its behalf.

Section 11 adds to the wayleaves section of the 1919 Act (Section 22) the important right to retain a line in position after the termination of a wayleave agreement pending the completion of an agreement for the continuation of the wayleave, putting the negotiations for renewal on the same basis as those for a new wayleave; it also provides that the Minister of Transport may revise the terms and conditions on which the wayleave is held, on the application of the owners of the line; and that these shall be decided on the same principles as apply to new wayleaves.

(To be concluded.)

ASPECTS OF STUDY AND SELECTION OF WATER-POWER SITES.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

One of the most important phases of a water-power project is in the selection of the sites, *i.e.*, dam, conduit, forebay, pipe line, power house, and tail race. Each site is governed to a large extent by the geological and topographical conditions. Where storage is available, its four main controlling factors, each involving many variables, are the reservoir, bottom, head, and total cost. The location, arrangement and cost of the head works are governed almost entirely by natural conditions. The best location of the forebay is usually a matter of cost, but with favourable geologic and topographic conditions, the most effective combination of forebay-regulating basins can be built at relatively low cost. The location of the pipe line requires good hill side, good slope, and relatively cheap and ample means for supports and anchorage, &c. The location of a conduit (non-pressure type) depends essentially on local conditions. Power-house location demands good foundation and the best use of head to give maximum power and efficiency at all stages of the river.

As the economical development of any water power depends upon the continuous available power in the river and upon the market for power, it follows that two of the main conditions to be determined as accurately as possible to bring about the desired economic results are, first, a reliable analysis of the hydrographic conditions, and secondly, a reliable estimate of the load factor and character of the load.

As regards the present status of water powers, with particular reference to studies, records, the collating and analysis of hydrographic data and conditions, one is not very wide of the mark in saying that even at this stage of the art the engineer is indeed fortunate if he can secure reliable run-off records for a long and continuous series of years, or if he can find records of stream measurements from which he can obtain a reasonably good idea of the run-off. Of course, some countries are more fortunate than others in this respect.

If no records are available, the first preliminary step is to measure the cross-section and slope of the river and to calculate the possible run-off and compare the catchment area with adjacent catchment areas, as also the known run-off (if any) by means of the rainfall records if the latter can be relied upon. In cases where reliable records are not available, and the water-power project appears to be a satisfactory one, it is then advisable (where possible to obtain at relatively little expense) to establish measuring stations and or put up rain gauges at the best localities in the catchment area. This will often mean the construction of weirs for measuring the stream flow. It will invariably mean the establishment of current meter stations. Ultimately, no matter what the method of calculation may be, the object in view is the determination of the number of cubic feet of water per second which will be available for each day, month or year.

The run-off from any catchment area fluctuates between very small quantities at times of drought and quantities sometimes many hundred or even many thousand times with, usually, little regularity about the occurrence of the extreme or intermediate stages of stream flow. Moreover, the average usual discharge for some years may be considerably lower than for others, hence the desirability of knowing the lowest ordinary minimum flow of the river.

Rarely is it commercially practicable to develop a water-power plant for an output based on *the extreme minimum* stream flow. Without storage or auxiliary steam or other power plant, the maximum power which can be developed continuously will depend on the water available during the period of *ordinary minimum* flow. The ordinary minimum flow referred to here is the mean of the average flows during about two of the lowest consecutive seven-day periods during the period of record (as decided upon), which period of record should extend over and be complete for a term of years (seven or more, as decided upon). In general, the extreme minimum stream flow lasts for only a very small portion of the year. Nevertheless, these records are of great value. In the determination of the maximum practicable economical development, several different methods are in use, but whatever method is used, much will depend on local conditions and circumstances and other considerations. With storage, the most economical development can be determined by obtaining the available power from storage, and balancing its economic value against the charges to be debited against the storage, &c. Due to circumstances that cannot very well be changed, over-development of water power is *the general rule*. The total cost of hydraulic and electrical plant in most cases represents only a small percentage of the total cost of the complete hydraulic works, which works must be completed for two main reasons, namely, (*a*) to provide at the least cost and in the quickest time a maximum supply of power to meet every growing and immediate demand, and (*b*) to avoid prohibitive costs in carrying out extension of the hydraulic works where the latter are completed only for part of the total hydraulic capacity. In general, it is almost as expensive to develop a small amount of power as to develop the stream

to its full development capacity. And seeing that the cost of a dam is proportional to its length and height, the cost will not vary materially with the capacity of the power plant. It may so happen (for a given river) that during the flood stage a water-power plant, *if not properly located*, may be completely incapacitated through loss of head. On the other hand, the water-power plant may be so located with reference to tail-water level (due to an oversight of or ignorance of the true value of extreme minimum flow) that the practical working draft-head has been exceeded.

In establishing the relationship between rainfall and run-off, factors such as geology, topography, size of catchment area, vegetation, distribution and intensity of the rainfall, temperature, &c., must all come into fair consideration. Moreover, the ratio of the total run-off to rainfall will depend largely on the evaporation, and the latter is dependent on such factors as velocity and humidity of prevailing winds, exposure, temperature, type, state and amount of vegetable growth, &c. It is obvious that much must be left to the judgment of the investigating engineer not only in the matter of the state of accuracy and completeness of these studies, but also in the application of a reliable run-off coefficient. A most desirable condition for the engineer is to have thoroughly reliable information available from actual discharge measurements taken over long and complete periods of time, together with comprehensive information of the catchment area, precipitation, &c., entering into the case. A good maxim to follow is always to deal with stream gauging in preference to collection of rainfall data.

In the technical working out of a water-power project it is best to follow along the broadest lines since the objective is to indicate a definite scheme which will utilise to the maximum extent the *full power resources* of the river. The full scope of such work is usually quite comprehensive. It may not only involve a close study of the complete water-power project requiring reliable information of all features and aspects of the scheme, but it often requires a detailed investigation and study of the load factor, diversity factor, the general conditions and character of power, lighting and other load anticipated, as well as a determination and safe estimate of the cost of the proposed development, &c. There is also the legal aspect involving not only the possession of the water rights, but also right of lands, right of ways, &c. Also, before a report is favourably received, it is necessary to know whether the vested interests and other properties, options, &c., are legally sound. The people offering to finance the project invariably engage a legal man to scrutinise carefully such legal matters and advise them accordingly.

In the selection of the best and most economical sites, the engineer may have to compare one site with another, and get together and put into proper shape information of an intricate nature, involving such questions as: information on the desired scope of investigations; the course and approximate length of river under investigation; route of river; gradient of river; location of gauging stations (giving the two extreme levels); duration of floods; condition of river bottom and banks; effects of sharp bends on flood flow, &c.; inundated lands, giving their extent and cost; territory surveyed; catchment area or areas; principal rivers and tributaries; rainfall records of districts, &c.; impounding flood water; run-off water; average daily or monthly run-off for development of power; natural reservoirs; artificial reservoirs; location of dam, of head works, conduit, pipe line, &c.; areas and altitudes; geological features; mineral resources in the territory; road diversions, &c.; vested interests; landowners; navigation and fisheries; towns, villages, population; transport facilities (giving access to proposed sites); route; foundations for works; scheme recommended; financial effect of impounding water, &c., &c.

A careful reconnaissance of the head-waters of a river is always necessary to provide the preliminary information as to possible good sites for storage, together with the nature of foundation material of the reservoir, and the capacity of the reservoir; the probable flow at the proposed site of dam; materials available on or near the site for its construction, and all other information that might have a bearing on the practicability and economic aspect of the site not requiring too much time and expense to ascertain. If no suitable reservoir site can be located on the river itself, an examination of the surrounding country will have to be made to find whether there is a suitable site on which a conduit of economical length could be constructed from the river. Examinations may also have to be made of the adjacent watersheds and rivers. The dividing ridge or ridges may also have to be examined to ascertain if it would be economically possible to divert water from one watershed to another, assuming that the Government concerned (Colonial, home or foreign) would allow such a step to be taken. These examinations, if carried out in detail, are usually quite expensive—for most preliminary purposes, rough examinations will usually suffice.

An examination of the catchment area will determine the feasibility of storage reservoirs to hold back the floods so that the water may be used during low-water months of the year. The principal objective in this case would be one large area or several areas (preferably the former) for impounding flood waters and offering good foundation material for a small dam to hold them.

The survey of a natural lake may include an investigation of the possibility of storage by damming the lake outlet in some way or other, or a diversion of the water to another watershed by tunnelling, &c. The boundary of the lake may be extensive, and profiles may have to be run up the slopes at 5-ft. contour intervals to a height sufficient to cover the highest elevation to which the water may be raised. Test pits or borings may have to be made at the selected site to give a good general indication of the nature of the bed of the lake where it is proposed to build the dam. The best type of dam for a particular location will depend to a great extent upon the nature of its foundations, the profile of the dam site, the materials available for construction of the dam and perhaps other hydraulic works, accessibility of the site as regards transportation facilities, and other considerations, &c. Such a dam may be required to (1) form the complete head works at the intake of a conduit, (2) create storage, (3) create a working head, or (4) increase the working head. Want of proper building sand and materials in the vicinity may cripple the development entirely or greatly increase the cost of it. Good rock foundations and abutments are always favourable assets. While carrying out these examinations, careful records should be made of rock outcrops, giving their classification, also records of all other classes of material such as gravel, sand and loam, &c., which may be in evidence. With regard to accessibility of sites, notes should be made of the nearest railway line and/or siding, giving distance, &c.; approximate cost of constructing a branch line to the site, the condition of rock on or near the site or the railway route and its suitability for heavy traffic, &c. In taking care of the water during the construction period, the absolute necessity and cost of a cofferdam should not be overlooked.

With regard to the selection of point of diversion from the river to the conduit at the headworks site, a preliminary examination should indicate in a general way the elevation at which it is necessary to divert the flow for power purposes. A close examination should be made for the purpose of locating the most suitable and the most economical diversion for the headworks and conduit intake. Generally, it is found necessary to build a dam or weir across the river at the point of diversion. This may mean that a certain amount of land will become flooded and, although relatively small in area, it may be very valuable and most difficult to acquire. Before finally deciding on the diversion site an examination should also be made of the banks of the river and its foundation material at the site of diversion, as these decide in a general way such matters as the type of dam, its height and length, &c.

In the matter of conduit location and the *complete* carrying out of the conduit survey, the same engineer carrying out the above mentioned work should be employed or, failing this, an experienced topographical surveyor should be employed. Unlike several other main links in the hydro-electric "chain," a conduit cannot very well be built in duplicate, and once a conduit is built it can only be taken down and relocated or replaced at prohibitive cost. Very often this part of the hydro-electric system represents a large percentage of the total cost of the complete hydro-electric development. In deciding on the kind of structure to adopt for the conduit, *i.e.*, wooden-flume, concrete or masonry section, &c., the first cost may be, and often is, relatively less important than the cost of operation and maintenance. As regards the conduit location, this is usually a simple matter, but to locate a conduit *economically* is an entirely different question, requiring broad experience of this class of work. As regards design, the most common problem in ordinary practice is that of determining the dimensions of the conduit with a given discharge and a given slope of the conduit bottom, the latter being the variable factor.

Apart from the many factors (fixed, variable, and uncertain) involved in the proper selection of sites and mentioned above, the engineer selecting water-power sites must also keep well in mind possible hydraulic losses, such as those due to leakage, seepage, evaporation, roughness factor (coefficient of roughness), tail-water level and back-water conditions, general losses in all the developed waterways such as those occurring in the conduit, pipe line and turbines, &c. Commencing with precipitation, and taking in the catchment area, including its complexity of conditions, storage, stream flow, and methods of harnessing the stream, &c., a long list of losses is in evidence. In the undeveloped waterways and those areas affected by precipitation, varying degrees of conservation can be effected in many ways. In the developed waterways themselves, *i.e.*, conduit, pipe line, storage or pondage, turbines and tail-race, improvements can be made in the way of more careful estimating of the stream flow; reduction in leakage and overflow, reduction in intake losses due to eddies, whirls, &c.; more efficient flashboard work; lining of open and closed conduits; losses due to grade; better maintenance of a higher forebay level; proper cleaning of trash racks; elimination of obstructions in all the waterways; operation of turbines at proper speeds for maximum power and efficiency; proper turbine setting, &c. Finally, in the construction of the hydro-electric works a point to bear in mind is that successful operation requires quick construction and quick use, and that the incurred interest up to the time the project is earning full income soon becomes a large part of the fixed charges.

In many instances power stations can only be economically placed on sites which at intervals may be subjected to flood conditions, and while available sources of information with regard to maximum water levels indicate the safety of the situation, an excessive flood, and, in some cases, an obstruction due to the position of part of the hydraulic work, may affect the normal characteristics of the river flow sufficiently to cause failure. Failure of hydraulic equipment or excessive rise of tail-water may cause power-house flooding. The failure of a section of conduit may completely destroy the hillside, and the failure of a forebay or penstock may destroy both the hillside and the power-house below. Failure of the project, taken as a whole, is usually due to such matters as over-estimation of the quantity of water available; under-estimation of the cost of the development; over-estimation of the market for power; and under-estimation of competition.

FRANCE REVISITED.—III.

Developments in the South.

By THEODORE RICH.

Although the slump in prices has seriously affected the business in electrochemicals and electric furnace metals, and this has led to the stoppage of work on several schemes in the South, yet, all the same, a good deal of water-power development is going on, especially in parts most affected by the "dear coal" problem.

The Midi Railway Electrification.

In France the Midi Railway was one of the first railway companies seriously to tackle the problem of heavy electric traction, and but for the war the most important section of the main line would have been equipped some years ago. The original programme of the company was on the basis of single-phase traction at 16⅔ cycles, 12,000 volts, and considering the fact that the traffic is not very heavy, from a strictly economic point of view, single-phase traction would probably have been the best. Four single-line branches aggregating 116 kilometres were equipped some years ago, and a stretch of main line was approaching completion when the war broke out.

Since the Armistice, in order to get uniformity of system, the use of direct current at 1,500 volts has been decided on by the Government for traction, and therefore development has taken place with a view to the ultimate use of this system. The first stretch of double main line to be tackled is that from Bordeaux to Toulouse *via* Dax, Pau, Lourdes and Tarbes; with the section from Dax to Bayonne and Bayonne to Puyoo, the total length of double track in this section amounts to about 500 km. (310 miles), or a little more than the distance from London to Carlisle (see fig. 1).

From Bordeaux the line passes through about 100 miles of forest, largely of fir trees, on land reclaimed with great skill from a desert of sand hills. Unfortunately fires are prevalent, which at times do enormous damage, and although it is realised by many that incendiaries have been at work, yet whenever possible the blame for damage is laid on the steam locomotives of the company, so that apart from any other factors it has been estimated that the electrification of this section will save a large sum every year in fire claims.

Power Stations and Trunk Mains.

The company has two water-power stations at work, one at Soulom, near Pierrefitte (not far from Pau), and the other in the Valley of the Neste, about 20 miles as the crow flies away to the East. Three power stations one above the other are under construction in the Valley of the Osseau to the west of Soulom, and three more power stations will ultimately be constructed near Ax-les-Thermes, in the South-East Pyrenees. The principal mountains in the Pyrenees run about 10,000 to 11,000 ft. in height, and while there are some glaciers, they are not very extensive, and therefore have no great storage capacity. The main transmission line will be worked at 150,000 volts; this line runs through the Landes forest through a cleared right-of-way close to the railway, and in other parts it runs across country. Except in the Eastern section, there will be two circuits run clear of one another. The lattice towers are spaced

about 200 metres apart. A 60,000-volt distributing main runs in most cases on the same main supports that are used for the catenary conductors. Many miles of the 150,000-volt line in a partly finished condition can be seen to the south of Bordeaux, and a very large proportion of the angle-iron steel work for the towers has been delivered on the site of the line in other parts. In many cases the concrete foundations for the towers are prepared with holes left to suit the angle-iron feet, so that they can be grouted in rapidly. The towers are



Figs. 1 and 3.—Plan of the Midi Railway, and Sketch of Safety Device.

delivered on site in three or four sections, the top section being galvanised. The traction sub-stations are 20 to 25 km. apart. A 10,000-volt line will be carried on the same supports for station lighting and motive power work.

Power Stations at Soulom and Eget.

The two power stations belonging to the Midi Company which are now at work have technical features of some interest. The Soulom station, fig. 2, is built at the junction of two mountain torrents, the development of both being in tunnel. A remarkable feature is that the pressure pipe lines from each torrent are alongside with a head of 110 metres from one and 250 from the other. The pipes are of welded steel, fixed to anchor blocks without expansion joints or stuffing boxes. There are six pressure pipes, three for each head. Each turbine has a separate pipe from the inlet chambers. The station originally contained six sets, three for each head, the turbines being of 3,500 h.p. with single-phase generators, 16⅔ periods; there are also four exciter turbines of 350 h.p. each. The generators are gradually being changed from single-phase to three-phase to suit the new system of traction. The low-fall turbines are of the Francis type, the high-pressure of the Pelton type. Some turbine wheels have been supplied for the latter sets with the buckets cast in one piece with the wheel, the result being, it is said, an increase in output and efficiency. These turbines were made by Messrs. Neyret Brenier & Co., of Grenoble. The supply of such a wheel of cast steel, which has to stand up against considerable centrifugal force, shows a high degree of foundry skill.



Fig. 2.—Soulom Power Station.

As each pipe forms a unit with a turbine, it has been found possible to install an ingenious arrangement, fig. 3, a patent of Messrs. Bouchayer and Viallet, to cut off the water in the event of any serious damage occurring to the pipe line. The inlet to the pressure pipe is arranged as a siphon rising above the normal water level; a U-tube is connected to the top of the siphon and is filled with water. If a pressure pipe were to burst and the flow of water to increase above a pre-determined amount, the suction on the U-tube would be increased by the water flow, and the water in the tube would uncover an air vent, v, which would let air into the pipe, destroy the slight vacuum, and thus instantaneously stop the flow of water. The top end of the siphon is exhausted when starting by means of a water-jet air ejector not shown on the sketch. Some British Kent Venturi recording water meters were seen in the works. The station at present supplies single-phase current for working some local branches, and is also feeding into a 60,000-volt, three-phase circuit, now used for lighting and power, but which will eventually be used also for traction.

The station at Eget has somewhat similar features, the



Fig. 4.—Open-air Sub-station.

same safety apparatus being used on the pressure pipe inlets. The station contains seven main sets each of 5,000 h.p., the gross head being 750 metres. Several lakes have been used to store water for this station, their capacities being increased with the aid of dams.

Ossau Valley Developments.

Some interesting works are in progress in the Valley of the Ossau not far from Pau. Three power stations are to be built; the lower one is now approaching completion at Hourat, close to Laruns, near the well known Spas "Eaux Bonnes" and "Eaux Chaudes." To enable the construction to be carried out economically, an ingenious system has been used. A 60,000-volt power line, which will eventually form one of the feeders from the new power stations, was erected and connected along the main line of the railway to the station at Soulom; three-phase current was furnished from the latter station to the railway terminal, and a sub-station was put up to supply the construction depôt and offices and to supply the power-house construction works, the works up the valley, and also the small town of Laruns with light. Fig. 4 shows the open air sub-station. In order to supply power to the works for the head canal, and for the works of the two upper power stations, a 15,000-volt line is run about eight miles up the valley.

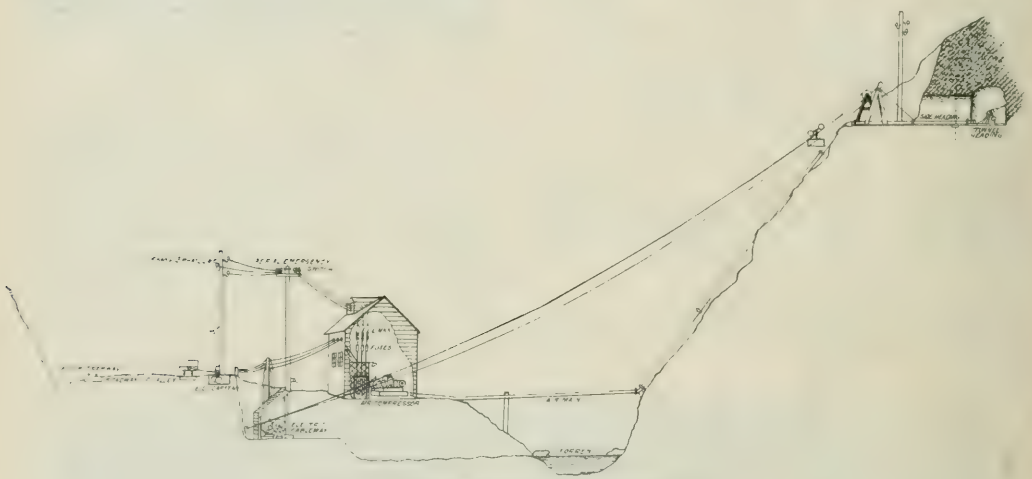


Fig. 5.—Arrangement of Construction Sub-station.

The Hydraulic Works.

The three installations to be put up in this valley are remarkable because practically the whole of the head canals are in tunnel, driven in the rock at the side of the gorge beside the torrent, to obtain the necessary head. French engineers both in the Alps and in the Pyrenees are very partial to water-power development with the aid of longitudinal tunnels; the system has a number of advantages provided the sides of the valley are of sound rock. The tunnelling is then comparatively cheap to carry out, as side headings can be driven every few hundred yards and the tunnel thus attacked at a number of faces, the rock *débris* only having to be hauled a comparatively short distance to the tip outside the side heading. Unlike an open canal, practically no useful land in the valley is taken up, and there is no danger from ice packs, falling timber, land slides, or avalanches.

Fig. 5 is a diagrammatic sketch showing one of the many construction sub-stations up the valley. The three-phase current at 15,000 volts is tapped off the main, taken through a horn switch through the roof of the wooden compressor station, through links, choking coils, and tubular fuses, to a three-phase transformer which steps down to 220 volts. Apparently it is not usual for this work to put an oil switch on the h.p. side of the transformer. For convenience of transport and operation, the air compressors in a number of cases have been placed close to the roadway running up the valley; the compressors are of 35 and 100 horse-power. At many points the materials for the tunnelling, the explosives, cement, and other stores are conveyed to the mouths of the cross headings by means of electrically-operated cableways, in some cases the same transformer serving for both compressor and cableway. At one point an electric capstan was seen; it was used to haul and shunt the contractor's trucks on the tramway siding. At some points, stone breakers, elevators for the stone for the concrete, and forge blowers for smiths' forges are electrically operated. At the site of the works for the middle station, an electrically-operated cableway has been installed, capable of handling a length of steel pressure pipe.

Three-phase Power for Civil-engineering Contractors.

It need hardly be pointed out that French civil engineering contractors, and for that matter Continental contractors in general, have for a number of years grasped the fact that a three-phase system at 50 cycles is exceedingly convenient and elastic, especially for works extending over a large area. A high-pressure line at 10,000 or 15,000 volts can be put up with forest poles, and when taken down the copper remains copper. There is little doubt that the rough-and-tumble electrical work done by the French Army during the war has taught some French contractors what they can do without. It must not be forgotten also that a system of workmen's compensation exists in France, and owing to the enormous number of able-bodied French workers who were killed in the war, in many engineering contracts, Spaniards, Italians, Algerians and all sorts of "rag, tag, and bobtail" can be found working together.

Head Tunnel under Pressure.

It is usual in high-head development, where tunnels are used, to find that the water flows from the intake to the head sluices with only sufficient fall to give a reasonable velocity to the water; in the Hourat scheme, part of the tunnel is under pressure, and for that reason this part is lined with about 20 cm. of concrete and rendered with two coats of a bituminous compound. The balancing chamber for this section is built as a well in the solid rock, and is also lined with concrete.

Tramroad for Construction Work.

In order to carry out the work with expedition, a 60-cm. tramroad was laid on the side of the road up the valley; at the lower end there is a roadway tunnel over 100 yards long which opens into a sort of canon about 100 feet wide. The Pyrenees apparently is a range of a considerably greater geological age than the Alps, and perhaps that is why there are so many very deep gorges to be found.

A number of trucks and steam locomotives marked W.D. are in use in the Osseau valley, and the rails are apparently old war stock. It was interesting to see such material close to the Spanish frontier. In France the roadway authorities give considerable facilities to contractors if the work in question has been proclaimed a "Public Utility"; one can hardly imagine a 60-cm. track passing the front doors of several hotels at an English Spa.

Pipe Line and Power Station.

The head at the Hourat power station is approximately 200 metres. The pipes are of welded steel, 1.65 metres in diameter, the fall being 115 per cent. Two pressure pipes are being installed; a U-loop and gate valves are provided at the power station, so that the turbines can be fed from either pipe, the turbine branches being taken off one side of the U. Fig. 6 shows a number of pipes made by Messrs. Buchayet and Vallet, of Grenoble, ready for erection. There will be four anchorages on the slope, the intermediate concrete supports being about 6 metres apart.

In order to haul up the pipes and to assist in the construction of the supports, a tramroad was laid alongside the pipe slope; this is worked with an electric hoist. Fig. 7 shows a view up the pipe line; an electrically-driven concrete mixer can be seen on the right. Fig. 8 shows the power-house buildings under construction, the heavy scaffolding being used to support the concrete roof; practically the whole of the structure will be of armoured concrete.



Fig. 6.—Pressure Pipes.

The station will contain five 5,000-h.p. sets, the turbines being supplied by Messrs. Singrün & Co., of Epinal, and the generators by the Constructions Electriques de France, of Tarbes. The tailrace, 640 metres long, is also in tunnel.

(To be concluded.)

INDIAN NOTES.

(From Our Special Correspondent.)

Rangoon.—This very modern town, whose main business is exporting oil, rice, and teakwood, deserves more attention from the British manufacturer than it apparently gets, especially from the electrical manufacturer. It has a combined electric light and tramway system, very up-to-date and well run. Paddy husk is the fuel used; this, before the war, was a useless commodity, because, although it could be used as fuel, the black cinder smuts emitted with the boiler smoke became a nuisance to the surrounding neighbourhood, and its use was prohibited. During the war, through scarcity of coal, the nuisance had perforce to be tolerated; meanwhile, however, a smart young employé at the power-house had developed a method of rendering the [illegible] sumed husk-carbon harmless by diverting it into a stream which runs under the boiler firegrate and direct from there into the river. Figures are not avai[illegible] to generation costs per unit, but presumably this should be a low figure indeed. Water from tube wells supp[illegible] the boilers, so that the power-house control finds itself in a particularly favourable position. Notwithstanding this, the load is not what one would expect it to be; but there are indications that when business improves there should be a brisk demand for a.c. motors for a multitude of purposes.

A system of free wiring is being developed by an enterprising firm, the idea being to encourage the use of electric fans and light among the poorer Burmese shopkeepers, who shy at the initial capital expense of an installation. There is plenty of scope for a firm of good electrical reputation to open a business in motors, dynamos, wiring, and good fittings; there are, of course, several firms handling this kind of work at present, but not in a wholesale business-like way—more of a side line to other businesses than anything else. Also a few small Burmese concerns have started electrical work, and have gone so far as to take on concessions from Government for the electrification of small up-country towns, but their success is doubtful. Among Burmese people it is found that women mostly do the work—the men do the looking on—and the female electrical engineer has yet to prove her success.



Fig. 7.—View of Pipe Line.



Fig. 8.—Power Station Buildings under Construction.

Mandalay.—This quaint, picturesque, and historical old city also boasts of an electrical installation working at 500 volts. This, of course, is good for tramcars, but, when it comes to fans or lighting, the trouble begins. As this voltage is not a standard for electric fans or lamps, things have to go in pairs—you switch on two fans when you want but one, and so on. A third wire suggests itself at once, but then Mandalay is in Burma! Pathetical appeals from small Mandalay contractors come now and again to India for 500-volt fans and lamps, but the reply invariably has to be—no stock.

Indian Electricity Act.—A recent number of the *Gazette of India* publishes the "New Electricity Rules, 1922." These supplant the old Rules of 1911, cover the whole of British India, and are applicable to the generation, transmission, supply, and use of electrical energy for the purposes of the Electricity Act. These new rules will, it is hoped, to a very large extent facilitate hydro-electric development in India, which has received a new stimulus since the publication of the last report on the water-power resources of India.

Produce in Exchange for Electricity Supply.—Owing to the shortage of money and the high prices of food supplies in the country, it is reported that the municipal authorities of Auma, a little town in Thuringia, have been forced to adopt a scheme of barter for the supply of electricity. It is said that ten eggs have been fixed as the equivalent of a kilowatt-hour; alternatives for those not keeping fowls are 3 lb. of wheaten flour or 25 lb. of potatoes for the above-mentioned quantity of energy.

BUSINESS NOTES.

Bankruptcy Proceedings.—John William Paul Adams, Market Street, [illegible], Warwickshire, electrical engineer, &c. The first meeting of the creditors of the above was held on September 26th at the Official Receiver's office, Ruskin Chambers, 191, Corporation Street, Birmingham. The statement of affairs showed ranking liabilities of £271, while the assets were estimated to realise £91, thus leaving a deficiency of £180. Debtor attributed his failure to bad trade and becoming guarantor for another. It appeared that he commenced business at Polesworth in June, 1917. He did not then possess any capital, the stock or parts required being purchased from time to time out of his earnings as a journeyman electrician, which employment he continued until September, 1919. The business was successful until March, 1921, when, on account of the coal strike, the takings declined, and they had not since recovered. In April last the debtor became guarantor for a friend for a sum of £30 in respect of the cost of insurance of a motor lorry. Judgment was obtained against debtor under the guarantee, and an execution was levied for £31. The matter was left in the hands of the Official Receiver as trustee of the estate.

A. E. Blower (Blower & Cooper), electrical engineer, merchant, late of 1 and 3, Paul's Bakehouse Court, Godliman Street, London, E.C.—First and final dividend of 4s. 5d. in the pound, payable at Carey Street, London, W.C.

H. J. Monson, radiographer, 26, Manchester Street, London, W.—Trustee: Mr. F. S. Salaman, 1 and 2, Bucklersbury, E.C. Released July 25th.

R. P. Baker and F. C. Stubbs (Sheffield Electric Construction Co.), electrical engineers, 124, Pond Street, Sheffield.—Trustee: Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield. Released July 6th.

Company Liquidations. — British Electric Vehicles, Ltd.—A petition for the winding-up has been presented to the High Court by the International Trade Exhibitions, Ltd., of Broad Street House, London, E.C.2, creditors, and will be heard in London on October 17th.

Rapid Submersible Ship Cleaner Co., Ltd.—Winding up voluntarily. Liquidator: Mr. T. F. Wild, 42-45, New Broad Street, London, E.C.2.

Dissolutions of Partnership.—Keating & Rumens, electrical engineers, 40, The Broadway, Winchmore Hill.—The partnership between Mr. T. Keating and Mr. P. J. Rumens has been dissolved by an order of the High Court, dated June 20th, so far as concerns Mr. T. Keating, who, from that date, ceased to be a partner in the business.

Pattison & Partner, automobile, electrical, and consulting engineers, Gate Garage, Denholme, near Bradford.—Mr. C. M. Pattison and Mr. H. H. Harding have dissolved partnership. Mr. Harding will attend to debts and continue the business.

Private Arrangements.—Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, London, E.—In response to a circular letter issued by the company, a largely-attended meeting of the creditors was held on Monday at Winchester House, Old Broad Street, E.C. The chair was occupied by Sir Arthur Whinney, who submitted an approximate statement of affairs, which disclosed ranking liabilities of £258,345 6s. 5d., of which £16,536 3s. 4d. was due to the partly-secured creditors, £200,000 to the holders of the short-term notes, and £41,809 3s. 1d. to the trade. The claims of the partly-secured creditors aggregated £166,536 3s. 4d., and they held securities valued at £150,000. At book values the assets amounted to £501,599 14s. 5d. On the basis of a going concern the assets were set down at £479,140 13s. 11d., from which had to be deducted £6,851 16s. 1d. for preferential claims, and £150,000 due to the partly-secured creditors. The net assets, therefore, totalled £322,288 17s. 10d., or a surplus as regarded the unsecured creditors of £63,943 11s. 5d. The assets consisted of freehold land and buildings, £139,173 18s. 3d., expected to produce £138,660; plant and machinery, £141,375 4s. 10d., estimated to realise £140,000; loose tools £15,773 2s. 7d., valued at £10,000; office furniture and fittings £3,612 14s. 11d., expected to produce £3,000; good book debts £64,735 16s. 10d., expected to produce £62,764 16s. 10d.; doubtful and bad debts £14,838 4s. 6d., estimated to realise £3,625 4s. 7d.; stock-in-trade £122,000 valued at £120,000; and cash at bank and in hand £90 12s. 6d. The issued capital of the company was £280,287 as, and as regarded the shareholders there was a deficiency of £216,343 16s. 7d. The issued capital consisted of 249,986 cumulative participating preference shares of £1 each, bearing interest at the rate of 8 per cent., and 151,507 ordinary shares of 4s. each.

Mr. C. Fuller (chairman of the company) at the outset expressed the regret of the directors at the position which had arisen. Circumstances over which they had no control overwhelmed the business. Every effort was made to avoid reconstruction, but it had become evident that there was no alternative left.

Sir Arthur Whinney pointed out that the company was incorporated on March 1st, 1919, for the purpose of amalgamating and taking over the business assets and liabilities of John C. Fuller & Son, Ltd., the Fuller Accumulator Co., Ltd., Fuller's Wire & Cable Co., Ltd., and Fuller's Carbon and Electrical Co., Ltd. The business of John C. Fuller and Son was established at Bow in 1875 for the purpose of manufacturing electrical batteries, and was formed into a limited company on the death of Mr. J. C. Fuller shortly before the outbreak of war. The Fuller Accumulator Co. was formed in 1913, and Fuller's Wire & Cable Co., Ltd., and Fuller's Carbon & Electrical Co. were incorporated in 1915. Those were offshoots of the original business of John C. Fuller and Son, Ltd. The first directors were Messrs. John Fuller, G. J. A. Fuller, Leonard Fuller, F. J. Gordon, J. J. Jarvis, and D. Palmer, who still held office, with the exception of Mr. Jarvis. The purchase price of the four businesses was fixed at £200,000, and was satisfied by the allotment of 50,000 preference shares of £1 each, and 150,000 ordinary shares of a similar face value, all of which were fully paid. The original capital of the company was £500,000, divided equally into preference and ordinary shares. The company started its career with cash resources to the amount of £201,507, obtained from the issue of shares. In July, 1920, further capital was required, and an issue of £200,000 in short-term notes was made, and these were over-subscribed. The proceeds of that issue were applied in paying off a loan to the bank, which then amounted to over £160,000, while the balance was utilised as additional working capital. The total money received by the company was £543,280 in cash, which had been expended as follows: purchase of additional land and extension of buildings, £85,600; additions to plant, tools, and machinery, £129,000; office furniture, fittings, and fixtures, £2,950; increase in stock, £90,139; preliminary expenses written off, £22,775; loss on the trading for the year ended March, 1921, £129,400; and loss for the year to March, 1922, £70,380. During the year ended March, 1920, the company made a profit of £48,045. In 1921 a change for the worse came over the business. It was affected by the trade slump, contracts were not completed, and many orders were cancelled. Similar conditions were experienced in other trades on which the company was dependent for orders. The company had made large purchases to meet the anticipated trade, and found itself with heavy stocks, with business shrinking. The directors then submitted proposals for reducing the capital by writing down the ordinary shares by 16s. a share. By that means a large amount was written off. The business for some time past had been carried on with a struggle against adverse circumstances. In August the position became acute. The company was pressed by its creditors, and the directors decided to take advice. He (Sir Arthur Whinney) was called in, and he advised the issue of a circular to the creditors. The company sought from its creditors a species of informal moratorium. It was very satisfactory to be able to say that the creditors from that time had waited with patience to hear what course it was proposed to adopt. He had never met a case where the creditors had shown so much forbearance. The company could not fail to be grateful to its creditors for their attitude. It was true that some creditors had issued writs and obtained judgment, but no hostile action had been taken. A petition had been presented to the Court for the winding-up of the company. That, however, was the act of a friendly creditor, and it was undertaken so that nothing should be done until the creditors generally had had an opportunity of saving how they would like the matter dealt with. The creditors could say whether they desired the business wound up and put an end to, or whether they desired it to continue.

Proceeding, Sir Arthur Whinney explained the statement of affairs in detail, pointing out that it was on the basis of a going concern. If it happened that the company was not a going concern, then a very different situation would arise. The stock originally cost £142,000, but it was now put down at £120,000, and it consisted of raw materials, manufactured articles, and partly manufactured goods. Nothing had been set down in the statement in respect of the patent licences, which stood in the books at £42,000, or the goodwill, which was set down at £25,000. The partly-secured creditors were the bank, and their security consisted of a charge covered by a mortgage debenture upon the entire undertaking for money advanced up to £150,000. The bank had, in fact, advanced £166,536, and they were unsecured for £16,536. The amount due to the bank was repayable on demand. The bank were sympathetic, and would not take any hostile action. On paper there was a surplus of nearly £64,000 so far as the creditors were concerned, but he emphasised that it was on the basis of a going concern. The creditors might consider what the position would be in the event of a break-up, and that was the only alternative to a reconstruction. In the event of a break-up the bank would take care of themselves. There would be a sale of the undertaking as a whole. Who, he asked, wanted to buy such an undertaking at the present time? It would have to be a cash transaction, and where was the money to come from? It would, he declared, have to come from a competitor. There was no competitor

who would be willing to buy. What their competitors wanted was orders, and not additional facilities. He thought they could rule out the possibility of any competitor coming along and purchasing the undertaking at anything like a fair and reasonable sum. The factory might be adapted for some other trade, but no one would buy such a factory in these days. A break-up would be very disappointing. Although the factory was well equipped there was not a great deal of heavy machinery, neither was there a large quantity of raw material. The manufactured and semi-manufactured goods would only fetch scrap prices at a forced sale. In addition, if a realisation took place the licences would be lost. He was of the opinion that if the company was broken up it would be very disastrous for the creditors. They would not get anything more than a fraction in the pound, perhaps a shilling or two. It would also be a very difficult business to realise, and could only be realised with very bad results. He thought he was justified in saying that a break-up would be a grave disaster. The only way to avoid a break up was to have a scheme which would be to the advantage of all the interested parties. There were two essentials to any scheme. In the first place, it must satisfy all concerned; and secondly, it must provide additional working capital. He had told the bank that they must help. Their money was payable on demand, and no one would find money for the business if the bank could call in their money at any moment. He thought it was necessary to raise an additional £30,000, of which £20,000 would be for further working capital, and £10,000 for the discharge of the preferential claims and the smaller creditors. The bank were willing to wait for their money conditional upon their claim being reduced by £50,000. That was a reasonable stipulation.

Sir Arthur Whinney went on to give details of his proposal for the re-organisation of the company's capital. He remarked that in order to provide for the continuation of the business it was necessary to raise funds for the purpose of dealing with the bank, providing further working capital, and settling the preferential and other claims. It was, therefore, proposed to create mortgage debenture stock bearing interest at the rate of 6 per cent. per annum, and containing a specific charge upon the company's assets. That stock would be issued in favour of trustees, and be for an amount of £200,000, of which £180,000 would be issued and dealt with as follows: To be accepted by the bank in exchange for existing debentures (to be surrendered) £100,000, and to be subscribed for in cash £80,000. That stock would mature in 1932. The cash to be raised would be applied: (*a*) in discharging the claims of the preferential creditors for rates and taxes, £6,851; (*b*) for costs of the scheme and contingencies and small creditors, £3,148; (*c*) in repayment to the bank, £50,000; and (*d*) additional working capital, £20,000. The source from which it was proposed that the £80,000 should be raised was as to £50,000 from the existing noteholders, and £30,000 from the preference shareholders. As regarded the noteholders, it was proposed that the holders should have the right of converting their notes at par into income debenture stock, thus becoming secured instead of unsecured creditors, as at present, but conditionally upon their subscribing for mortgage debenture stock to the extent of 25 per cent. of their noteholding. The mortgage debentures would also carry as bonus the right to an allotment of one ordinary share of 1s. fully paid for each £1 of stock taken up, thus enabling the subscribers to obtain a share in any prosperity which might arise from the future operations of the company. Noteholders who did not exercise their conversion rights would remain as unsecured creditors of the company. As regarded the preference shareholders, it was proposed to raise the sum of £30,000 from amongst them by inviting them to subscribe for £30,000 of the mortgage debenture stock. That stock would also carry with it as bonus the right to an allotment of one ordinary share of 1s. fully-paid for each £1 of stock taken up. It was also proposed to create income debenture stock, secured by a charge upon the company's undertaking, and ranking after the first mortgage debenture stock. It would carry interest at 7 per cent. per annum, and the stock would mature in 1932. There would be issued in satisfaction of the claims of trade and other creditors (other than those under £10, who would be paid in cash in full), including the unsecured balance to the bank, income debenture stock to such an extent as might be found necessary, and which might approximately be stated to be £60,000. Thus the total issue of income debenture stock would be £260,000. In order to provide for loss of capital incurred, and to bring the remainder into due relationship with the company's assets, it was found necessary that the share capital should be reduced. It was proposed that the preference shares should be written down to 10s. a share and the ordinary shares to 1s. per share. It was further intended that the board of the company and its management should be strengthened by the introduction of one or more new directors. A reconstruction on the lines indicated would mean that the issued capital would be £136,568, while there would be first mortgage debentures of £180,000, and income debentures of £260,000, or a total of £576,568. The assets would amount to the same figure, and consist of freehold land and buildings, £139,174; plant and machinery, £141,375; loose tools, £15,773; stock, £102,000; sundry debtors, £79,574; office furniture and fittings, £3,612, cash, £23,245, and patent licences and goodwill, £10,922. A question might be raised as to whether the business of Fuller's United Electric Works, Ltd., was worth saving. There could be very little doubt but that the business was a very big one. The company had [illegible] had a chance. Fuller had been open to [illegible] chance. He had suggested that Mr. Wade, the [illegible] mechanical engineer, should be called in to advise as to the prospects of the business. The latter had a large *clientèle*, with customers all over the world. The works were capable of an output of three-quarters of a million per annum. The present output was only a third of that amount. The company employed only 500 or 600 hands, and there ought to be at least 1,000. The open accounts on the books were over 2,000, and orders were increasing.

During the course of the discussion which ensued a question was asked as to what would be the position of the trade creditors who dissented from the scheme.

The Chairman replied that any dissenting creditor would be bound by the majority. If the requisite majority in favour of the scheme was obtained it would become binding upon all the creditors.

Mr. Greenhalgh declared that although times had been bad other concerns in a similar way of business were gradually pulling round. The point they had to consider was whether the company could make profits in the future. If it could, then the scheme should be supported. He called attention to a circular issued by the company, which stated that business was being carried on as usual, and he inquired if there was anything ironical in that observation. If it was being carried on as usual it meant that the business was being conducted at a loss of thousands of pounds.

The representative of Messrs. Armstrongs declared that anybody with a knowledge of the trade would realise that unless some scheme such as that foreshadowed was agreed upon there would be a complete *débâcle*.

A trade creditor suggested that under the reconstruction scheme the creditors might receive some proportion of their claims in cash, and the Chairman said he was afraid that could not be done.

Another creditor said the losses during the past two years had been appalling. Would the noteholders be justified in putting up fresh money to be dealt with by the directors who had lost the money in the past? It was true the directors had had to work under adverse conditions.

Sir Arthur Whinney pointed out that in his scheme it was proposed that new directors should be added to the board.

The following resolution was submitted, and was carried with practical unanimity: "That in the opinion of this meeting it is in the best interests of all parties that a scheme of reconstruction on the lines explained to this meeting by Sir Arthur Whinney should be proceeded with and submitted in due course at formal meetings to be called under the provisions of the Companies Act, 1908."

A. J. Way, late 94, St. Martin's Lane, London, W.C., dealer in electric lighting sets.—A meeting of the creditors of the above was held on September 29th at the offices of the Central Mercantile Association, 41, Bedford Row, London, W.C. Mr. B. J. Cherry, the accountant to the Association, occupied the chair, and reported that the matter was a somewhat unsatisfactory one, and he thought some of the creditors might like the estate dealt with in bankruptcy. The liabilities amounted to £451, while the assets were only estimated to realise £65, or a deficiency of £385. The debtor had hoped that by continuing to trade the business would improve, and that it would reduce his liabilities. He suggested that he should set aside a sum of £20 per month for the benefit of his creditors and continue trading. He hoped to obtain one or two agencies.

Mr. Waller, of Messrs. Brown Bros., asked if the debtor would file his own petition, and Mr. Cherry replied that he did not want to do so. Mr. Cherry added that the debtor had done a very big business at one time with Messrs. Vandervell, while his drawings had never exceeded £5 a week.

On the proposal of Mr. Waller, seconded by the representative of the Radmill Lamps, Ltd., it was decided to accept a cash composition of 10s. in the pound, failing which the debtor should be requested to file his own petition.

The following are creditors:—

	£		£
Vandervell, C. V., & Co.	11	Crellish, R., & Sons	36
Rapaults, Ltd.	53	Anglo-Auto Accessories Co., Ltd.	17
Henderson & Thornton, Ltd.	71	Brown Bros., Ltd.	108
Radmill Lamps, Ltd.	35	Bankers	21
Motolite Dynamos, Ltd.	52	East London Rubber Co.	15
Dew, A. J., & Co.	15		

Trade Announcements.—Messrs. Electrical Conduits, Ltd., of Walsall, have appointed Messrs. E. S. Johnson and Co., 126, Pilgrim Street, Newcastle-on-Tyne, as their representatives for Newcastle and district, and Mr. A. Wheatley, 11, Walker Road, Higher Blackley, Manchester, as their representative in Manchester, Liverpool, and district.

Owing to the death of their Glasgow representative, Mr. J. Hally Craig, Messrs. Berry's Electric, Ltd., have appointed Messrs. Wood & Cairns, Ltd., as their agents for the whole of Scotland. Messrs. Wood & Cairns Ltd., have established branches at 9, Meuse Lane, Edinburgh; 9, Royal Exchange Lane, Dundee; and 65, Waterloo Street, Glasgow.

The Prendergast Electrical Engineering Co., Ltd., have removed to 12, Lower Seymour Street, Portman Square, London, W.1. We are informed that Mr. J. F. Prendergast is now the sole managing director, Mr. N. J. Waller having left the company.

Mr. E. S. Cleave has commenced business as an electrical engineer at 10a, Dover Road, Folkestone.

Messrs. Associated Dunn & Co., makers of enamelled slate and marble slabs for electrical purposes, have removed from Holderness Road to new works that they have built at Ryde Street, Hull. Telegraphic address: "Mantel, Hull." Telephone No. 7577 Central."

Messrs. W. Canning & Co., Ltd., Birmingham, have just opened a warehouse at 7 and 9, Sycamore Street, Sheffield. It is being stocked with the necessary machinery and equipment for electro-plating, polishing, lacquering, and bronzing, to enable them to cope with their Sheffield connection.

Catalogues and Lists.—Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester. An illustrated brochure entitled "The Universal Application of Storage Batteries,' giving some idea of the scope of the activities of the firm.

Messrs. C. J. Thursfield & Co., Ltd., Cecil Works, Clement Street, Birmingham.—A comprehensive catalogue of electric light fittings. Fully illustrated and priced.

British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C.4.—Folder L245, illustrating and describing the "Tungar" rectifier for charging wireless set accumulators from a.c.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—An illustrated and priced pamphlet describing ten types of electric fires and heaters.

Blackman Export Co., Ltd., 374, Euston Road, N.W.1.—An illustrated catalogue of fans and blowers of various descriptions, air heaters, forges, &c.

Messrs. Southall & Smith, Ltd., Villa Street Works, Birmingham.—An illustrated pamphlet describing automatic weighing and packing machines.

The Standard Carbon Brush Holder Co., Ltd., 3, Frederick's Place, Old Jewry, London, E.C.—Descriptive price list of standard carbon brush-holders.

The Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10. A booklet giving prices of various types of wires and cables.

Messrs. Robert Ingham Clark & Co., Ltd., West Ham Abbey, E.15.—An illustrated booklet dealing with the insulating compounds, varnishes, &c., made by the firm for various purposes.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—Twenty-four page price list (section M), particularising meters, call testers, insulation test sets, resistance measurers, medical meters, leakage indicators, cut-ins and cut-outs, and wireless meters.

The London Factors and Agents, Ltd., 38 and 39, Parliament Street, London, S.W.1.—Priced circulars of L.F.A. electric lamps and of various electrical accessories.

Mr. M. W. Woods, 146, Bishopsgate, London, E.C.2.—Priced leaflets relating to ceiling fans, a.c. and d.c. exhaust fans, and rectifiers for battery charging, &c.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway, London, W.C. 2.—Illustrated bulletin No. 50S, describing and giving prices of new X-ray accessories—Dreadnought interrupters, h.t. transformer with immersed winding, deep therapy equipment, &c.

Messrs. C. B. Davis, Cash & Co., 47, Mount Pleasant, Holborn, London, W.C. 1.—23-page priced catalogue of electric light fittings.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—16-page price list (No. 9922) of electrical accessories, cables, conduits, &c., all Standard E.L.M.A. lamps (carbon, vacuum, and gas-filled), electric light fittings for industrial purposes, electric bells, &c.

Messrs. Belling & Co., Derby Road Works, Montague Road, London, N.18.—New list of electric fires and other domestic appliances, including new designs of fires. The 1,000-watt "Multi-parabola" fire bar is now used with all Belling fires, having been found more efficient than the well-known 500-watt bar which was the standard for 10 years; it has withstood a life test of over 4,000 hours.

Catalogues Wanted.—The manager of the Tullamore Electric Light & Power Co., Ltd., Tullamore, Ireland, desires to receive catalogues and price lists of electric fittings and accessories.

Book Notices.—The latest addition to the list of Trade Union journals is "The Commercial Traveller," the official organ of the National Union of Commercial Travellers. No. 1, the September issue, contains articles on "The Need for Unity," by the Right Hon. J. R. Clynes, M.P., "Incorporation or Trade Union?" by Alfred Lugg, general secretary, Actors' Association, and "Lord Leverhulme and Trade Unionism," dealing with the latest development of co-partnership at Port Sunlight. The publishing offices of "The Commercial Traveller" are at Rugby Chambers, Chapel Street, London, W.C.1.

"The Choice of Steam Conditions in Modern Power Stations," by L. C. Kemp, B.Sc. (Eng.). Publication No. 388 of the English Electric Co., Ltd. A reprint of an article which appeared in the *Electrician*. Copies may be had upon application to the company.

The *M. & C. Apprentices' Magazine*, autumn number, contains further reminiscences by Mr. Henry Edmunds, articles on "Japanese Hospitality" and "Trade with Russia," by Mr. Sam Mavor, and many other interesting features.

We have received from the Association of Engineering and Shipbuilding Draughtsmen copies of two lectures:—"Elevating and Conveying Machinery," Part I, by H. Davies; and "Graphical Methods for Treating Certain Beam Problems," by W. R. Needham. The lectures delivered before this society are notable for their practical nature and the utility of the information which they contain, and these are not exceptions to the rule.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Any firm desiring to enter an objection to any of the applications has one month in which to do so from the dates mentioned below. In the case of foreign firms, the address of the British representative to whom objections must be sent is also given:—

DXN (lettering and design). No. 423,254. Class 6.—Dynamo brushes. No. 423,255. Class 50.—Electric resistance cores, &c. Joseph Dixon Crucible Co., Railroad Avenue, Jersey City, N.J., U.S.A. (Page, White & Vaughan, 27, Chancery Lane, London, W.C.) September 20th, 1922.

Pro-pel-lite, John Taylor (lettering and design). No. 426,298. Class 8.—Electric accumulators and batteries. John Taylor, 11, Wilton Crescent, Glasgow, in conjunction with Alex. Sinclair, of Paisley, and Arch. Robertson, of Kirkintilloch. September 27th, 1922.

Radiocert. No. 426,658. Class 11.—Wireless communicating instruments and apparatus. Mitchell's Electrical and Wireless, Ltd., McDermott Road, Peckham, S.E.15. September 27th, 1922.

Cosmos. No. 425,742. All goods in Class 11. No. 425,743.—All goods in Class 14. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. September 27th, 1922.

German Machinery for Serbia.—An Exchange Telegraph despatch says that Serbia has accepted a German proposal to supply machinery instead of cattle for reparations purposes.

Swedish Engineering Industry.—The Swedish Board of Trade report for the quarter ended September is issued in the *Sweden Economic Review* just to hand. There is a review of general business conditions, finance, &c., and in the section relating to mechanical industry the position is summarised as follows:—"In the engineering trade the number of workmen employed reached the low-water mark at the end of the first quarter of 1922, the total being only 25,200, compared to 60,000 on September 1st, 1920. At the end of the second quarter of the year some advance had taken place, as the figure stood at 26,400. This advance is mainly due to an increase of 6.5 per cent. in the number of employés in the general mechanical trades; in the electrical industry the rise was only 3 per cent., while the shipyards even display a slight decrease. Between 4,000 and 5,000 workmen are occupied with Russian orders for the construction of railway engines, but as these works are confined to a few large shops, the general situation has not much improved. Competition from Germany and other countries with a depreciated currency is still of importance, but tardy deliveries and export control often discourage Swedish importers to place orders with the German and Austrian works. Were it not for the still prevailing 'buyers' strike' in the expectation of further declining prices for mechanical appliances, probably a good number of stored orders would be filed with the Swedish concerns."

The Industrial League and Council.—The first meeting of the Council for the present quarter was held on Wednesday, when Mr. W. L. Hichens spoke on "The Industrial Outlook." The following is a list of the arrangements that have been made; the meetings are held on Wednesday evenings at Caxton Hall, and no tickets are necessary:—

October 11th.—Major A. G. Church, D.S.O., M.C., B.Sc., "Labour: its Status and Reward."
October 18th.—Mr. Walter Greaves-Lord, I.L.B., K.C., "Some Reflections on Industrial Unrest. Its Cause and Prevention."
October 25th.—Mr. George Latham, "Industrial Councils on the Railways."
November 1st.—Lt.-Col. F. F. Fremantle, M.P., "The Economic Value of the Public Health."
November 8th.—Mr. H. H. Elvin, "Education as a Function of Management."
November 15th.—Sir Arthur R. Holbrook, K.B.E., M.P., "Industrial Liberty."
November 22nd.—Mr. F. S. Button, "Industrial Co-operation Works. District. National."
November 29th.—Mr. J. Ellis Barker, "Britain's Industrial Problems."
December 6th.—Mr. Robert Young, M.P., "Difficulties in the way of Increased Production."
December 13th.—Mr. J. Lort-Williams, M.P., "The Only Remedy for Unrest."
December 20th.—Mr. James Sexton, C.B.E., M.P., "Can Industry be Divorced from Politics?"

A Submersible Electric Cooker.—The Jackson Electric Stove Co., Ltd., has sent us a copy of a letter from a purchaser of one of its No. 20 cookers. This was installed on a house-boat, and when the boat was sunk the cooker went with it and remained under water for nearly a week. When the stove was recovered it was dried out and resumed service in a satisfactory manner, although it was found necessary to renew the lagging a few weeks later. This is yet another example of the robust nature of good electrical apparatus.

Machinery Catalogues for Chile.—According to a report forwarded to his government by the U.S. commercial attaché at Santiago, Chilean firms are manifesting a specially active demand for catalogues of machinery of all kinds. Naturally the catalogues should be compiled in Spanish, bear the name and address of the Chilean representatives, and be forwarded by registered post, in order to avoid the Chilean charges on parcel post packages for the non-collection of the latter within seven days after arrival. At present special interest is being shown in catalogues of wood-working machinery driven by electric motors, and in fact the difficulties experienced in the matter of coal are causing greater attention to be paid to the question of the use of electrically-operated machinery in general. In this connection the developments taking place at the hydro-electric works near Santiago are expected to impart a stimulus to the use of electric power. Both the direct and the alternating current systems are in use, although motors of the latter type are coming more into favour. Nevertheless, when stating prices for machines fitted with electric drives it is desirable to quote prices for both types of motors, specially at a pressure of 220 volts.

The Algerian Market.—As might be expected from a French colony, the market for electrical material and equipment in Algeria is, to a great extent, controlled by French firms, although English exporters are stated by a United States Consular official to have a small share in the business, usually supplying goods on consignment—to a commission agent. Keen competition in this market was offered by German firms before the war, as they were able to offer better facilities than the French firms, but it seems that the former will be unable again to grant such credits as they did ten years ago. Some of the French works maintain local branches in Algeria, which are provided with stocks, and also have travellers on the road as well as agents in the interior, while other firms work through commission agents, and make allowances for advertising purposes. The manufacturing firms only deal direct with large consumers and wholesale houses, leaving the retail trade to be handled by the local firms. It is advisable for firms entering the market to have a representative on the spot or to send a traveller regularly to Algiers, Oran, and other large cities. It is necessary to conform to French style and tastes, and the sale prices must be low, consistent with good quality. The consumption of the current is almost entirely for lighting purposes, and the wiring is usually carried out on the surface of the walls.

Domestic Equipment in Canada.—According to the latest census returns of Canada, a considerable decrease has taken place in the number of different classes of domestic servants employed in the past ten years. The diminution is attributed to the adoption of labour-saving machinery, and the reduction of drudgery in connection with housekeeping at home or in hotels, &c. Domestic appliances, such as vacuum cleaners, electric washing machines, irons, cooking apparatus, &c., have found a larger market under these circumstances, and this demand has had to be met by the employment of a larger number of engineers, mechanics, &c., during the past ten years.

The Australian Working Week.—Many engineers in the various States of the Commonwealth are refusing to work forty-eight hours a week. In a recent message from Melbourne it was reported that the Arbitration Court had dismissed claims put forward by the Timber Workers' and Amalgamated Engineering Unions for recognition of a 44-hour standard working week. The President of the Court maintained that industry should not be expected to bear the increased cost of production.—*Reuter* (Melbourne).

A number of engineers at the Broken Hill Proprietary Co.'s steelworks near Newcastle, at which only a skeleton staff has been employed for some months, have struck in opposition to an increase of hours from 44 to 48. It is feared that the trouble will extend.—*Reuter* (Sydney, September 26th).

At a mass meeting of 1,200 Melbourne engineers, held on September 30th, to discuss the question of resisting the Federal Arbitration Court's award fixing a 48-hour week instead of a 44-hour week, it was decided not to call a strike.—*Reuter* (Melbourne).

Kilmarnock Electrical Exhibition. — The Corporation opened an "all-electric" home on September 25th, in which electrical heating, cooking, and labour-saving devices of all kinds are exhibited and demonstrated. A recent advertisement in the *Kilmarnock Standard* drew attention to the exhibition, and contained a special message to each of the villages in the district. The house remains open until October 9th.

Calendar.—We have received from the Metropolitan-Vickers Electrical Co., Ltd., a calendar (September, 1922, to August, 1923) bearing a reproduction of the latest "Cosmos" poster design, together with the same picture mounted as a showcard. The design, which is excellently produced, depicts a young lady exultantly holding out a "Cosmos" lamp against a background of well-lighted buildings. Having regard to the lady's attire, we suspect that the legend, "The last word in economy," has a double application. Another showcard advertises "Cosmos" electrical appliances, and illustrates, in colour, an iron, a kettle, hotplate, radiator, and percolator.

Lamp Prices in Germany.—The lamp works belonging to the Central Union of the German electrotechnical [illegible] have decided to raise the supplement on incandescent lamps from 100 to 400 per cent. as from September 21st [illegible] the further increased prices for raw materials [illegible] and other expenses.—*Reuter's Trade Service* (Berlin, September 21st).

Chinese Notes.—A telephone service was introduced in March in Shasi, and over 80 subscribers were registered during the remaining part of the year.—*Shasi Trade Report*, 1921.

Owing to mismanagement, the P'u Chao Electric Light Co. in Shasi was suspended in August.—*Shasi Trade Report*, 1921.

The following are among the principal business enterprises in Huchow and vicinity:—

Huchow Electric Light Co., Ltd.
Huchow Merchants' Telephone Co., Ltd.
The Tung Li Electric Light Co., Ltd.
The Chin Chen Electric Light Co., Ltd.
Shwang Li'ai Electric Light Co.
The Nanzin Telephone Co., Nanzi.

Metropolitan-Vickers Activity.—On Wednesday afternoon last week upwards of 200 members of the Manchester Association of Engineers, by the courtesy of the directors of the Metropolitan-Vickers Electrical Co., Ltd., had the opportunity of viewing the company's works at Trafford Park. The party were conducted through the various departments by the works manager (Mr. George E. Bailey) and the technical staff, and each member was presented with an illustrated pamphlet as a souvenir of the visit. The area covered by the works is about 72 acres, and the normal number of employés is 8,500; at the present time practically all the departments are having a busy time. Among a number of contracts now occupying attention are several which are being completed for the Manchester Corporation, especially two 25,000-kW turbo-alternators, two 25,000-kW turbines, and six 19,500-kVA transformers for the new generating station at Barton. The normal capacity of the Metropolitan-Vickers own generating plant, it was explained, was 4,000 kW, but the company is now engaged in building a sub-station to take power in bulk from the local supply authorities to replace the works generating plant. The new sub-station will have an ultimate capacity of 5,000 kW mixed, alternating, and direct current. After the works had been viewed, tea was served to the visitors, during which the president of the Association, Mr. Daniel Adamson, proposed a vote of thanks to the directors, and Capt. Hilton, the managing director, responded.

New Zealand's Tariff Policy.—A complimentary luncheon was recently given in Wellington by the N.Z. Association of British Manufacturers and Agents, which acts as New Zealand correspondent for the F.B.I., to the Rt. Hon. W. F. Massey, Prime Minister, and the Hon. W. Downie Stewart, Minister of Customs. Mr. G. H. Scott, the chairman of the Association, pointed out the benefits gained by both New Zealand and the Mother Country by admitting one another's goods free from protective tariffs. Mr. Massey said that the New Zealand Parliament had been fortunate last session in being able to give a substantially-increased preference to the United Kingdom. The broad effect of the changes made in the tariff had been to increase the number of articles included in the British preference by 100 per cent. He thought that a close association with the Mother Country was in their interests, and in the interests of the Dominion as a whole.

New Czecho-Slovakian Wireless Apparatus Company.—Krizik and Co. and Telegraphia, manufacturers of telegraph and telephone apparatus, have founded a mutual enterprise at Prague under the style of Radioslavia, which will undertake the manufacture of special apparatus for wireless telegraphy and telephony, the construction and maintenance of wireless stations, and the transmission of Press messages. The capital of the new concern, which is 100,000 crowns, will be subscribed by the two companies mentioned.—*Reuter's Trade Service* (Prague).

Cable Service to Near East.—Ever since the war, communications to the various countries of Asia Minor have been subject to numerous restrictions, both on account of the destruction of some of the previous commercial routes and because of regulations established by the various governments concerned. At the present time the following codes are authorised by the International Telegraph Bureau at Berne, for use on messages to Syria: A.B.C., 5th edition; Scotch, 10th edition; Western Union, universal edition; Lieber's; Bentley's (except oil and mining supplements); Broomall's; Myers' Atlantic Cotton Code, 39th edition; Broomall's (rubber edition); Riverside, 5th edition, 1901. Apart from these nine codes, messages must be in plain language, English, French, or Italian, and will be accepted only at the sender's risk. Replies may be prepaid, but none of the other usual supplementary services are allowed.—*Commerce Reports*.

Trouble in the German Electrical Industry.—The Siemens-Halske Co. has closed its Werner works [illegible] dismissed 10,000 workmen owing to the action of a number who are alleged to have used threats of violence to [illegible] reinstatement of a member of the works' committee [illegible] been dismissed. The A.E.G. has also dismissed [illegible] from one of its works, owing to what is described as the "cat'canny" attitude of some of the workers.—*Reuter* (Berlin).

Forthcoming Exhibitions.—The following exhibitions are being organised :—

London.—October 28th to November 3rd, Brewers' Exhibition; November 2nd to 11th, International Motor Show; November 14th to 24th, Marine and Small Craft Exhibition; November 28th to December 2nd, Motor-cycle and Cycle Show; February 19th to March 2nd, 1923, British Industries Fair.

Birmingham.—February 19th to March 2nd, 1923, British Industries Fair.

Cardiff.—November 20th to 25th, Engineering Exhibition, arranged by the South Wales Institute of Engineers.

Belgium (*Mons*).—November, Commercial Fair.

France (*Paris*).—December 15th to January 2nd, 1923, International Aero Exhibition.

The Situation in Constantinople.—As the city of Constantinople is prominently before the public at the present time, it is of interest to learn from the United States General Consul in that city that the two gas companies there have not yet resumed their services, and that the electric lighting company is alone in the field for the moment. The plant installed comprises 28,000 kW, but the maximum demand is only 9,000 kW, of which power represents 2,200 kW, and traction 1,000 kW, while the balance is formed of the lighting load. The number of consumers at the beginning of last April was nearly 23,000, and the connected load 28,185 kW. The policy of the company is to keep the tariff as low as possible in order to promote the use of electricity throughout the city, so as to increase the load. It is proposed to grant favourable rates to encourage the use of energy for power, and also for heating purposes, and in the latter respect an extended use of electric radiators and of electrical ranges and small cooking equipment is held to be in prospect. As the company does not undertake wiring work or dispose of electrical apparatus and appliances, these branches are filled by local contractors and firms, and no restrictions are imposed on the placing of such equipment on the market.

Railwaymen's Wages.—There is a possibility of an almost immediate claim by British railways for a revision of the National Wage Agreement made during the period of Government control. Representatives of electricians employed in railway workshops throughout the country interviewed the representatives of the various railway companies at their offices at Westminster with reference to the periodical adjustment of wages under the sliding scale agreement. The September cost of living index figures failing to reach the 5.4 fall necessary to justify a reduction, it was agreed that the present rate of wages remain unchanged until January next.

Trade Union Clause in Contracts.—Southwark Borough Council has decided to appeal to the Ministry of Health against a surcharge of fifteen members of the Rating Committee for refusing to consider a tender in which the fair wages or trade union clause had been struck out. They accepted the next highest tender, which in six months involved an extra expenditure of £293 19s. 6d. The District Auditor (Mr. A. Carson Roberts) held that the Council should have been informed that they were not recommended to accept the lowest tender, and that inserting in their tender form a clause that trade union wages and conditions solely must be observed was against public policy and detrimental to the best interests of the ratepayers. The Rating Committee came to the conclusion that the surcharge had been improperly imposed, seeing that the committee had acted *bona-fide* in rejecting the alleged tender, and in accordance with the Standing Orders of the Council. The Finance Committee supported this contention, adding that, in their opinion, the action of the Rating Committee did that which the Council required them to do, and consequently, if the Committee committed a wrongful action, the Council, and not certain members of the Rating Committee, should be held responsible. The Council appointed a special committee to take such steps as were deemed essential to fight the surcharge, even if necessary, by an appeal to the Law Courts.

Stoke Newington Electrical Exhibition.—The Stoke Newington Electric Lighting Committee (Mr. A. P. Starbuck, chairman) is organising an electrical exhibition in the Library Hall, Edwards Lane. It will be opened on Tuesday next, October 10th, by the Mayor, and will remain open until the following Saturday. The Mayor will formally start up the new 500 kW rotary converter and switchgear in the electricity station, which adjoins the Library Hall. The exhibition will be open daily from 5 to 10 p.m., and there is an admission charge of threepence. The exhibitors will include the British Insulated & Helsby Cables, Ltd., the B. & K. Accessories Co., Ltd., the Flotpoint Electric Appliance Co., Ltd., the Russell Electrical Appliances Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd., Frank Feesey & Co., and several other firms.

French Companies.—There has been formed at Paris (14, Rue Blaise de Vigenère) the "Société Professionnelle de l'Industrie des Transports de l'Energie Electrique, with a capital of 100,000 fr. for the objects shown in its title.

The Ateliers Electrotechniques du Nord has been established at Lille (202, Boulevard de Douai) with a capital of 1,100,000 fr. in 2,200 shares of 500 fr. of which 1,200 fully paid shares and 440 founders' shares are allotted to M. Henaut in consideration for his asset.

Skilled and Unskilled Wages at Birmingham.—The Salaries and Wages Committee of the Birmingham Corporation received on Thursday last week a deputation from the Electrical Trades Union, the Amalgamated Society of Wood Cutting Machinists, and the National Union of Vehicle Builders, with reference to a recent reduction in wages. It was stated by them that skilled men in some departments were, at the moment, in receipt of wages no more than those of semi-skilled or unskilled workers. The margin that had existed in the past between skilled and unskilled workers was practically wiped out. Sir David Brooks (chairman) stated that an endeavour would be made to find a satisfactory basis for remedying the position. The principle the Corporation had to maintain was that they followed the rates of pay settled by the outside industries through negotiation between the employers' associations and the trade unions.

Cable Prices in Czecho-Slovakia.—The papers report that the Czecho-Slovak cable manufacturers have reduced the price of cable by a further 10 per cent., so that the total reduction is now 20 per cent. A first reduction of 10 per cent. was effected about the middle of August.—*Reuter's Trade Service* (Prague).

For Sale.—Winchester Corporation has for disposal a quantity of "RB" and "BF" type street lighting switches. By direction of the Disposal Board, Messrs. Roland Stuart (1921), Ltd., will sell by auction, at the Royal Small Arms Factory, Enfield, on October 17th and following days, plant, machinery, electrical material, &c., including motors, fans, bells, telephones, &c. (See our advertisement pages to-day.)

Tramway Workers' Wages.—In the hope that Joint Industrial Council negotiations might issue in a settlement of the wages dispute, the delegate meeting of municipal tramway workers was adjourned on September 26th to the 27th, when, also, both sides continued their efforts for a settlement. The men were instructed to remain at work. The delegate conference at Essex Hall, Strand, was informed that the situation is easier. It is believed that the danger of a break-up has been averted. The local authorities' attitude, it is reported, has undergone modification, and it is probable that the men's desire for the future regulation of wages to form a part of an agreement will be conceded, says the *Westminster Gazette*.

The workers' negotiating committee presented the revised proposals of the employers for a settlement. These provide for a reduction of 3s. per week on November 15th, with further consideration by a joint committee of the future wages of the workers, in substitution for the original demand of 12s. per week reduction in three cuts of 4s. each. The men's representatives expressed themselves desirous of continuing the sliding scale arrangement, which the employers have intimated must terminate, and the conference was adjourned until September 28th to allow their negotiating committee to again submit its case to the Joint Industrial Council. Several of the delegates expressed their belief that a settlement was within reach.—*Financial Times*.

Films in Electrical Propaganda.—A glimpse of the further development of E.D.A.'s activities was seen on Friday last at an exhibition of electrical films at 15, Savoy Street. One of the films has already been freely exhibited up and down the country, and we are informed that any of them can be booked forward by arrangements with the Director and Secretary, The British Electrical Development Association, 15, Savoy Street, W.C.2.

No. 1, "Back of the Button," a 15-minute reel, illustrates in a dramatic manner the beginning of electricity and the conditions of home life before its introduction to domestic tasks, and displays a vivid contrast between the drudgery of the old-fashioned method and the ease and comfort of the new. The application of electricity to other industrial activities is also dealt with.

No. 2 is an 8-minute reel, featuring a practical demonstration of electrical cookery in one of the London housing colonies, interspersed with "real live captions" of an educative character.

No. 3 is a 15-minute reel, "The Power that Serves," depicting a very human story of tired wives, bored husbands, unwilling servants, and the atmosphere of the home generally before electricity is introduced—and the very different conditions after its adoption.

Report on the Industry.—In the *Bulletin* of the Federation of British Industries, published on Tuesday, there appears a survey of a number of industries during September. The following reference is made to the "Electrical Fittings" industry :—"The makers of electrical fittings have noted a slight increase in orders, and German competition is no longer so severe as it was at the beginning of the year. The principal reason, apparently, is that purchasers have found it is impossible to rely on the delivery of goods ordered from Germany. As a result, even Dutch purchasers have recently been turning to Great Britain. There is a certain amount of inquiry from South Africa, but India still remains quiet owing to political unrest."

A French Exhibition.—The Exposition Internationale de l'Ouest de la France will be held at Mans in 1923. It embraces industry, husbandry, science, arts, and sports, and will be open for five months.

Electrical Salesmanship Conferences.—We have received from Mr. J. W. Beauchamp, the Director and Secretary of the British Electrical Development Association, Inc., particulars of the full programmes of Electrical Salesmanship Conferences (London area) that have been arranged for between October 13th and March, 1923. In all there will be 12 meetings, and they will be held on Fridays at Caxton Hall, Westminster, at 7.30 o'clock p.m., and it should be noted that any persons engaged directly or indirectly on the selling side of the electrical industry, or coming in contact with the public in the course of their work, are invited to attend. Tickets, admitting to the full series, will be forwarded on application to the Director and Secretary, British Electrical Development Association, 15, Savoy Street, Strand, W.C.2. The following is a list of the dates, subjects, authors, and chairmen :—

Date.	Subject.	Paper by	Chairman.
Oct. 13	"Salesmanship in Relation to Lighting."	Mr. W. E. Bush (B.T.H.)	Mr. Lt. B. Atkinson, M.I.E.E., A. M. Inst. C.E. (Chairman: British Electrical Development Association).
Oct. 20	"Fires & Cookery." (Small).	Mr. R. Smith (Tricity).	Mr. L. L. Robinson, M.Inst. C.E., M.I.Mech.E., M.I.E.E. (Metropolitan Borough of Hackney).
Nov. 3	"Fires & Cookery." (Large).	Mr. F. H. Howell (Hotpoint and Falco).	Mr. A. N. Rye (Edmundsons' Electricity Corporation, Ltd.).
Nov. 17 Dec. 1 Dec. 15	"Theory & Practice of Salesmanship in Relation to the Electrical Industry."	Mr. Wallace Attwood (an Expert Trainer of Salesmen).	Mr. A. F. Berry (British Electric Transformer Co., Ltd.). Mr. Hugo Hirst, M.I.E.E. (The General Electric Co., Ltd.). Mr. W. C. Lusk (The British Thomson-Houston Co., Ltd.).
Jan. 5	"Possibilities of the immediate future, and Competition with other forms of Light and Heat."	Mr. J. W. Beauchamp, M.I.E.E.	Captain R. S. Hilton (Metropolitan-Vickers Electrical Co., Ltd.).
Jan. 19	"Wiring Salesmanship in Relation to Spring Cleaning Decoration, &c."	Mr. H. T. Young (Troughton and Young).	Mr. R. S. Downe, M.I.E.E. (Brompton and Kensington Electric Supply Co.).
Feb. 2	"Portable Accessories: Irons, Fans, Small Cookers, &c."	Mr. C. S. Davidson, M.I.Mech. E., M.I.E.E. (Barnes).	Mr. H. Marryat, M.I.Mech.E. (President: Electrical Contractors' Association).
Feb. 16	"Electric Power in the Home, Motor-Driven Appliances."	Mr. L. J. E. Genner (Western Electric).	Mr. A. C. Cramb, M.I.Mech.E., M.I.E.E. (Hon. Sec. Incorporated Municipal Electrical Association).
Mar. 2	"The Industry, The Press, and The Public."	Mr. A. Gowans Whyte, B.Sc. (Electrical Press).	Mr. C. H. Wordingham, C.B.E., M.Inst.C.E., M.I.Mech.E., M.I.E.E., A.I.N.A. (Consulting Electrical Engineer).
Mar. 16	"Showroom and Exhibition Work."	Mr. H. W. Gregory (North Met. E. S. Co.).	Mr. A. G. Beaver (Chairman: Electrical Wholesalers' Federation).

Leeds Corporation and the Whitley System.—At a special meeting of the District Council (No. 2) for the Electricity Supply Industry (Yorkshire, &c.) at Leeds on Friday last, it was reported that the Leeds Corporation had adopted a uniform rate of pay of 1s. 2d. per hour in respect of general labourers employed in the tramway, electricity, and gas departments, and had granted six days' holiday a year with pay (Bank holidays) to all craftsmen on the permanent staff of one year's service. The District Council decided that the action of the Corporation was contrary to the principle of Whitley Councils, and resolved that the National Council should be requested to hold a special meeting to consider the matter, and that deputations should approach the National Council and the Leeds General Purposes Committee with a view to obtaining the rescission of the decisions of the Corporation.

Australian Tariff.—The Australian Commonwealth Customs authorities have lately given a decision to the effect that "alternating-current recording watt-hour meters" are to be classified under No. 181 of the Tariff, the duty being 35 per cent. on British goods and 45 per cent. on foreign manufactures.

LIGHTING AND POWER NOTES.

Australia.—Sydney.—*Year's Working.* The income of the city electricity supply undertaking during 1921 was £943,124, as compared with £755,512 in 1920. The net result was a loss of £23,747.

Bury.—Year's Working.—The report and accounts of the Corporation electricity undertaking (engineer and manager: Mr. S. J. Watson) for the year ended March 31st last shows a total revenue of £95,465, as compared with £98,406 in the preceding year. The working expenditure amounted to £71,307, as against £77,873, leaving a gross surplus of £24,158 (£20,533). Capital charges absorbed £22,728, leaving a balance of £1,430, which was divided between the reserve fund (£430) and rate relief (£1,000). Last year's net profit was £2,419. The capital expenditure was large, amounting to £94,450. It included items of £68,847 for plant and machinery, and £13,795 for buildings in connection with the Chamber Hall station. The energy sold was 15,030,223 kWh, as compared with 16,931,907 kWh in 1920-21. The three-bay extension of the engine-room and boiler-house buildings was completed during the year, and the installation of a 6,000-kW turbo-alternator, two 50,000-lb. boilers, and a steel chimney, 150 ft. high, proceeded with.

Continental. Italy.—It is proposed to erect a new power plant in the district of Branca, Province of Perugia, to utilise the national supply of lignite. The Government has undertaken to subsidise such an installation, provided it is of the standardised steam-power type, with a minimum capacity of 15,000 kW, divided into three units of 5,000 kW each. Lignite will be employed, the consumption being estimated at 150,000 tons per annum. The Government's offer includes a subsidy for 20 years of 1,950,000 lire. The Società Lignitifera Umbra, which possesses the exploitation rights on lignite deposits, will accept the Government concession and erect the new plant.

A capital of 10,000,000 dollars has been subscribed by an American financial corporation for the purpose of hydro-electric enterprises in Italy, principally to supply the provincial districts in the northern part of the kingdom.—*Reuter's Trade Service* (Rome).

France.—The development of the Middle Dordogne River has been allotted in part by the Le Trocquet plan to Germany to carry out as a portion of the reparations agreement. It will develop 400,000 h.p., and will supply chiefly the region between Vernéjoux and the district granted to the Orleans Co. Of its total cost, about half will fall to Germany's share. The work comprises the building of four weirs, forming reservoirs, each weir being equipped with a generating station. The largest, that at Chambon, will generate 12,500 h.p. The Argentat I. station will supply 12,500 h.p., the Argentat II. station, 10,800 h.p., and the Brivezac station 21,000 h.p. The four stations will have a total output of 185,000 kW, and the estimated cost of the plant is 65,000,000 fr. The ultimate cost of this scheme will amount to 290,000,000 fr.

The Société Générale d'Enterprises has applied for a concession to set up a distribution network to supply a number of communes in the departments of the Côtes-du-Nord and of Morbihan with electricity.

The Société Electrique de Bretagne has made application for a concession to establish a network and supply electrical energy to some 60 communes in the departments of Ile-et-Velaine and Côtes-du-Nord.

The constitution has been authorised at Commercy (Meuse) of two syndicates for the electrification of 31 communes—the Syndicat du Haut-Ornain serving 11 communes and that of Meligny-le-Grand 21 communes.

Important electrical power developments are announced for the Pas-de-Calais. Owing to the success which has attended the utilisation of cheap and unmarketable fuel for developing power at the various electric power stations established at the coal mines, it has now been decided that from this source the department of the Somme shall be electrified. This will require the present 220-V installation to be converted to one of 110 volts. From the Pas-de-Calais station one single line at 90,000 volts will run from Boulogne-sur-Mer to Abbeville; while another, passing by Arras (Pas-de-Calais), Amiens, and Abbeville (Somme), will carry 45,000 volts. This pressure will be transformed down to 15,000 volts at Amiens and Abbeville for distribution to the rural districts.—*Reuter's Trade Service* (Paris).

French Tidal Scheme.—The Minister of Public Works has been visiting at Aberwrach, on the Breton coast, the site of the first tidal power stations to be erected in France at an estimated cost of 28,000,000 fr. If the experiments here and at another station are successful there will ultimately be a supply of electricity sufficient to meet the needs of the whole of Western France.—*Reuter* (Brest).

The Times points out that the scheme comprises a tidal power or "blue coal" works; a barrage of 150 metres (492 ft.) will be established, and four groups of turbines will, under the double play of the ebb and flow, drive alternators placed in caissons of reinforced concrete. It is believed that from one to four million cubic metres (from 35,300,000 to 141,200,000 cubic feet) can thus be stored, according to the height of the tide. The four turbines placed in the barrage will furnish from 750 to 1,200 h.p. A fresh-water station will regulate the energy produced intermittently by the tidal power station. The Minister, M. Le Trocquer, expressed his conviction that the question of "blue coal" was one of capital importance, and that the solution of the problem would proceed from Aberwrach. When the results had been definitely ascertained, the river range would be provided with the necessary plant, and it would then be possible to supply electrical energy to the whole of Western France.

Crieff.—New Company.—The Town Council has approved the arrangements under which Edmundson's Electricity Corporation will form a local company, and the scheme is making good progress.

Crompton. Electricity Supply.—The Urban District Council is making inquiries with a view to obtaining a Special Order for the supply of electricity in the district.

Deal.—Proposed Electricity Supply.—The Town Council has received communications respecting an electric light scheme for the town from the Western Electric Distributing Corporation and from Horace Boot & Partners, Victoria Street [illegible], S.W., and a committee has been appointed to interview representatives of the latter firm.

Denbigh.—Hydro-Electric Plant.—A hydro-electric plant, deriving its energy from the River Ystrad, was recently started up to supply the North Wales Mental Hospital, Denbigh. By the construction of a reservoir and dam, a head of 15 ft. has been made available. The plant consists of a 120-h.p. vertical-shaft Francis turbine directly coupled to an 84-kW, 120-V generator. The set runs at 270 r.p.m. The plant replaces three 35-kW steam sets, and it is proposed to extend it later to utilise the water power which still remains available. The plant was supplied and erected by Messrs. J. Gordon & Co.

Elgin.—Progress of Electricity Scheme.—Work in connection with the new electricity supply undertaking has commenced. The site is prepared for the works, and cables are being laid. The Street Lighting Committee has recommended the acceptance of the company's offer for public lighting in the centre of the town. The whole of the work is being carried out by Edmundson's Electricity Corporation.

Fiji.—Suva.—A new steam generating set was put into commission by the municipality two or three months ago. According to the *Commonwealth Engineer*, it consists of two B. & W. double-drum boilers of 2,852 sq. ft. heating surface, with superheaters and chain-grate stokers, a 350-kW Allen-Crompton compound condensing set, and accessories.

Gillingham (Kent).—Price Reductions.—The Town Council has reduced the price of electricity for lighting from 9d. to 8½d. per kWh, and for heating, cooking, &c., from 1½d. to 1¼d. per kWh.

High Wycombe.—Price Reductions.—The Electric Light Co. has reduced the price of electricity for power to 6d. per kWh for the first 100 units per quarter, 3½d. per kWh for the next 3,000, and 2½d. per kWh beyond, from October 1st.

Hoole.—New Transformer Station.—The preparations for the building of a transformer station at Hoole, Cheshire, are now complete, and the work is to be immediately commenced. The site has been leased to the Chester Corporation for 21 years by the Hoole Urban District Council. The laying of cables in certain streets will also be proceeded with. The electricity will be transmitted from Queen's Ferry to Hoole for lighting and power purposes, and it is anticipated that the electrical energy will be available at Hoole in four months time.

London.—St. Marylebone.—*Loan Sanctioned.*—The Electricity Commissioners have sanctioned the borrowing of £82,750 in respect of the £85,550, for which sanction was sought, is to be met from revenue.

Plant Purchase.—The Electricity Supply Committee recommends the purchase of a 60-kW Belliss-G.E.C., 105-V exciter, a 2,500-gallon steel tank, and a set of Crosby indicators from the Hampstead Borough Council for the sum of £200.

Report on Breakdown.—The Oerlikon Co., reporting upon the mishap in February last, which involved the stripping of one of the wheels of an 8,000-kW turbine and damage to the rotor, states that the structure of the steel used in the blading of the runner wheels was uneven, and attributes this to the lowering of the quality of steel brought about during the war.

Hampstead Bulk Supply.—The Electric Supply Committee reports that the transfer of consumers to the St. Marylebone source of supply was completed by the Hampstead authorities on August 25th, and the plant at the Hampstead station has been closed down.

Electricity Year's Working.—A total revenue of £168,763 was earned by the municipal electricity undertaking during the year ended March 31st last. This compared with a revenue of £158,816 in the previous year. The working expenditure totalled £87,564, as against £100,651, leaving a balance of £81,199 (£58,165). To this was added bank interest, and against the total £48,492 was charged for loans, &c., making the net result a profit of £32,753, as compared with £13,170 in 1920-21. Capital expenditure out of revenue amounted to £7,688, and the net surplus was transferred to reserve (£3,500) and allotted to rate relief (£21,381). £72,155 was expended on capital account, including items of £23,758 for buildings, £17,991 for machinery and plant, and £28,605 for mains and services. There was a slight decrease in the amount of energy sold, the total being 17,426,605 kWh, as against 17,439,387—or .07 per cent. decrease. Mr. Robinson, the borough electrical engineer, states in his report that the loss of £165 on the sales department was due to the fall in values of stock. The prices for energy were comparatively low during the year, but the new tariff put into force in March last compares very favourably with the charges of the majority of British undertakings. The result is to be seen in the increased profits. The generating cost was reduced from 1.23d. to 1.14d., bringing it down to the 1919-20 level.

Price Reduction.—The Westminster Electric Supply Corporation is reducing the charges for electricity by 1d. for the first 1,000 kWh used for lighting. From the Michaelmas quarter's readings the charges will be as follows:—Lighting: For first 4,000 kWh. 6½d. per kWh. for all kWh used in excess of 4,000, 5d. per kWh. Heating, cooking, and motors: If taken through a separate meter, 1½d. per kWh. The above rates are subject to a minimum charge of 10s. per quarter.

Monmouth.—Loan.—The Town Council has decided to make application to the Electricity Commissioners for sanction to borrow £6,000 for repairs, &c., to the electricity works.

Morley.—Proposed Price Reductions.—The Electricity Committee has recommended the Corporation to reduce the charge for electricity for lighting from 10d. to 8d. per kWh, and to reduce the charges for power purposes by 20 per cent.

Oldham.—Year's Working.—The report of the borough electrical engineer (Mr. F. L. Ogden) for the year ended March 25th last shows that the total income of the electricity department was £169,138, comparing with £146,845 in the previous year. The working costs amounted to £121,661, as against £117,326, leaving a gross surplus of £44,474 (£29,519). To this was added a balance from the previous account and interest, making a total of £56,508 available. Capital charges, &c., including £3,836 transferred to reserve, absorbed £55,100, giving a net profit of £1,403, which compared with £3,836 in 1920-21. A total of £170,479 was spent on capital account during the year. This was distributed as follows:—Buildings, machinery, and plant, £110,590; street mains, £40,226; services, £3,152; and transformers, £16,511. Contrary to most undertakings, the amount of energy sold increased—from 18,340,242 to 22,245,947 kWh—the principal increase being due to larger power sales. During the year a great deal of new plant has been installed. This includes two 6,000-kW Metropolitan-Vickers turbo-alternators; three cooling towers; two 26,000-lb. and one 35,000-lb. B. & W. boilers and accessories; and a 30-ton overhead travelling crane. Progress has also been made in the erection of a further 6,000-kW turbo-alternator; two 1,500-kW rotary converters; and two 35,000-lb. boilers. The low-pressure supply mains have been extended a distance of 10,668 yd.

Peterhead.—Electricity Scheme.—The Town Council has asked Mr. E. J. Williams, Scottish district manager to Edmundson's Electricity Corporation, Ltd., London, to prepare an electricity scheme for the borough.

Ramsgate.—Price Reductions.—The Electric Supply Co., Ltd., has reduced the price of electricity to 8d. per kWh for the first 50 kWh per quarter, to 7½d. per kWh for the next 450 kWh, and to 7d. per kWh beyond.

Reigate.—Loan Sanctioned.—The Town Council has received sanction to a loan of £5,000 for mains.

Slough. — Special Order. — The Slough and Datchet Electric Supply Co. is applying to the Electricity Commissioners for a Special Order authorising the confirmation of an agreement between the company and the Slough Urban District Council and to amend the provision of the Slough Electric Lighting Order, 1902.

St. Helens.—Year's Working.—Referring to a note in our last issue, Mr. F. N. Rendell-Baker, electrical engineer to the Corporation, points out an error in our summary, which we regret. It was stated that the amount of £1,888 carried forward for the year 1921 and 1922 included the sum of £3,862 brought forward from the previous year; this is not so. The £3,862 was the amount of the net profit for the year 1920-21, and was carried direct to the reserve fund. The amount of £4,888 represented the absolute net profit for the year 1921-22, and this was after providing £1,421 for revenue contributions to capital.

Stevenage.—Electricity Supply.—The Urban Council has consented to the grant of a Special Order authorising the Stevenage Motor Co. to supply electricity to the town. The Council has also agreed to the company laying down the necessary cables pending the grant of the Order.

Swansea.—Extension of Supply.—Plans for the extension of the electric light to Sketty and Dunvant by co-operation with two local collieries are under consideration by the Highways Committee and the Electricity Committee.

Venezuela.—Maracaibo.—A number of local concerns have contributed the amount necessary for the construction of a new electric plant for the city of Maracaibo. The order for the machinery will be shortly placed.—*Reuter's Trade Service* (Caracas).

Wickford. Special Order. The Wickford and District Electricity Supply Co., Ltd., has applied to the Electricity Commissioners for authority to provide and distribute electrical energy for lighting, heating, &c., within certain portions of the parishes of Wickford, Downham, Ramsden, Bell House, and Runwell.

Wimbledon.—Action for Wrongful Dismissal.—At the meeting of the Town Council on Monday last a report of a sub-committee on the settlement of the action brought against the Council by Mr. H. Tomlinson Lee, for alleged wrongful dismissal, was discussed and approved by a large majority. At the time of his dismissal the Council paid Mr. Lee four months' salary, and after a writ was issued, paid into Court a further sum making, with the previous payment, six months' salary, as already reported in our pages.

TRAMWAY AND RAILWAY NOTES.

Continental.—Spain.—The Tranvias Electricos de Vigo is about to extend its lines so as to connect the port with the neighbouring towns of Redondela, Panjon, Ramallosa, Gondomar, Bayona, and Canido, these extensions comprising a further length of 17 kilometres. The estimated preliminary outlay amounts to 7,000,000 pesetas. New road construction will first be taken in hand, and tenders for this part of the work will shortly be examined.—*Reuter's Trade Service* (Madrid).

Croydon.—Proposed Track Reconstruction.—At a recent meeting of the Town Council plans for the reconstruction of the main tramway route at an estimated cost of £259,625 were submitted by the Tramways Committee, which also proposes to enter into an agreement with the L.C.C. for the through running of double-deck cars between Purley and London. The matter was deferred until October 23rd.

Dover.—Railless Cars Rejected.—The Town Council has rejected a recommendation by the Tramways Committee that powers be applied for to run railless cars in the town on account of the cost of obtaining the powers not having been included in the estimates. The estimated cost of the work and the purchase of three double-deck cars was £8,000.

Glasgow.—New Routes.—The immediate extension of the tramways to Dutocher is proposed.

The Corporation has approved of a scheme of improvements at the Cross, which includes laying a track on each side of the old Tolbooth Steeple.

Guatemala.—San Jose.—A contract has been granted to a newly-established company with a capital of 2,000,000 dollars to work an electric street railway, nine miles in length, in the town of San José, Guatemala, permission being given to extend the lines beyond the city limits to the Departments of Chimaltenango and Sacatepéquez, these extensions to be completed within two years. The Ministry of Promotion, which has granted the concession, has stipulated that the railway shall not be on the overhead trolley system, and shall be built of regulation gauge steel rail.—*Reuter's Trade Service* (Guatemala City).

London.—Tube Extension.—The *Evening News* is officially informed that a contract for the building of the second portion of the Hampstead Tube extension—between Hendon and Edgware—was signed on October 1st. The successful contractors are the Foundation Co. The contract was obtained in close competition with more than a dozen of the leading British contractors, and is for £258,468, bringing up the total contract for the extension to roughly £1,500,000. The work, which has to be completed within two years, includes the building, tunnelling, bridging, and completion of the four miles of track between Hendon and the terminus at Edgware. Work will be begun at once, it will be continued at full pressure throughout the winter, and will provide employment for several thousand men. The managing director of the Foundation Co., Mr. Walter Rutherford, previously acted in the same capacity for Dick, Kerr & Co. and the London Electric Co. The company was only formed in February, and this is its first big contract.

"Speed Up."—On October 2nd the Underground inaugurated a further speeding-up of the train services over its system. During the past few months several sections of the various lines have been re-signalled, and more rolling stock has been acquired, thus enabling improvements to be made in the autumn services.

On the District Railway the train speeds during normal hours of the day and on Sundays will be accelerated, and the running time of trains to Wimbledon, Richmond, and the Ealing line reduced by from one to three minutes. Wimbledon is to have more trains during the normal hours of the day; there will be a ten-minute service of trains instead of a fifteen-minute service. This in turn will increase the mid-day service of trains between Earl's Court and Mansion House from three minutes to two and a-quarter minutes. The Circle trains will be strengthened from four to five car trains throughout the day. A new theatre train for the Richmond line will leave Mansion House at 12.30 a.m., this being the last train also to Ealing and Hounslow.

On the Bakerloo line all trains during the rush hours will be built up to six-car trains instead of five cars. The through Watford trains will be accelerated by three minutes during the rush hours by non-stopping some of the quieter stations. A later train to Watford will be run, and on week-days a special late train will run.

During the busy hours the service on the Piccadilly line is to be speeded up from a three-minute to a two and a-half-minute service, and six-car trains will be run. The theatre services, too, are to be improved by reducing the headway from four minutes to three and a-half minutes; the speeding-up on this line has been made possible by the introduction of new rolling stock and readjustment of the electric pneumatic signalling. On week-days a special late train will run.

A big speeding-up of the service on the Hampstead and Highgate lines has been effected by the introduction of eight more trains per hour. Thirty-eight trains instead of twenty will be run, and the closer working will permit of additional non-stop running during the busy hours. The journey time from Strand to Golders Green will be nineteen minutes instead of twenty-one minutes, and to Highgate three minutes instead of seventeen minutes. When the extension to Edgware is completed, the Underground anticipate being able to run through from Strand to Edgware in thirty minutes, and Hendon is twenty-three minutes. Special late trains will be run.

The siren system will be installed at Charing Cross station in order to minimise delay, as it has been proved that where this scheme is working it enables a considerable acceleration in the service by reducing station stops and the holding-up of trains between stations.

Additional trains are being fitted into the schedules on the Central London line to ensure a continuous 2-minute service throughout the day. The service to Ealing Broadway will be strengthened by the introduction of seven-car trains. This will be appreciated by City workers, as the new G.L.R. route is steadily providing relief to the District passengers.

Owing to the success of the experimental train which has been constructed for the Piccadilly tube, with pneumatically-controlled doors, two further trains of this description will be put into service next week. The advantage of the new train is that 48 ft. of door space is provided, as against 20 ft. in the ordinary train; that is to say, there are twice the number of doorways 4 ft. 6 in. wide, against 3 ft. on the ordinary trains. So successful has this train proved to be that in future all new tube trains will be constructed on similar lines, and, where possible, the older type converted.

To minimise booking-office congestion after the theatres have closed, arrangements have been made to issue return tickets from the more important tube stations.

After brighter trains, brighter stations. Charing Cross station is therefore to be taken in hand for a complete internal redecoration. Other stations will follow, and improvements in the working of the railways are foreshadowed.

Extension of Time.—The Minister of Transport has extended the time for the completion of the railway and works authorised by the Wimbledon and Sutton Railway Act, 1910, until July, 1924.

Manchester.—Fares.—The Tramway Committee has decided to continue the reduced fares in spite of a loss of over £50,000 since the reduction was made. The Committee considers that public convenience should come before profits. The present scale will be maintained to the end of the financial year.

Plymouth.—Accident.—While a small tramway-car used as a travelling workshop and a grinding machine were descending Tavistock Road, a long, steep hill, at midnight on Saturday, the grinder, which was leading, became uncoupled. The machine dashed down the hill, and, after turning the curve at Drake Circus, left the track and crashed into a shop. A workman named Joseph Parker, 48, who was on the machine, was fatally injured. Two other men jumped off.—*Daily Mail.*

Rawtenstall.—Through-running. The Corporation has agreed to the through-running of tramcars between Accrington and Rawtenstall up to October, 1923.

Wakefield.—New Track.—The Yorkshire (West Riding) Electric Tramways Co., Ltd., is giving notice, under Section 34, sub-section 2, of the Wakefield and District Light Railway Order, 1901, of its intention to lay a double line in place of the present single line from Wakefield Bridge, along Doncaster Road, to the Calder and Hebble Bridge, Wakefield.

TELEGRAPH AND TELEPHONE NOTES.

Anglo-French Telephone Service. Increased Facilities.—The postal superintendent of the Seine Inferieure Department has informed the Chamber of Commerce of Rouen that an agreement has been concluded between the postal authorities of France and Great Britain for telephonic communication to be made between all exchanges in the Seine Inferieure and all British exchanges.—*Reuter* (Rouen).

Australia. Wireless Telegraphy.—Sir William Vicars has been appointed chairman of the Amalgamated Wireless Co. instead of Mr. Hughes, the Prime Minister, who does not want the position.—*Financial Times.*

Ireland.—Postal Strike Settlement.—The settlement of the Irish postal strike at midnight on September 29th was entirely unexpected, says *The Times*. The postal servants have taken the terms which the Government offered on the eve of the strike—namely, the application of the wages cut in two instalments. The first instalment of three-eighths will operate as from September 1st, and the second of five-eighths, will be enforced on December 1st.

Italy.—Telephone Extensions.—The city of Florence is about to enter into contracts for an entirely new telephone equipment, to be installed and in working order within the next two years. Action by the municipality has been influenced by the serious damage occasioned to existing overhead lines during the heavy snowstorms of last winter, when many telephone wires in all parts of Italy were broken down. The present scheme contemplates the placing of all cables underground. The Florence section forms part of the Italian State telephone system, for which all contracts are negotiated by the Central Administration at Rome. During the war telephone equipment in many Italian centres was allowed seriously to deteriorate. It is now proposed to replace such defective installations as rapidly as possible, so that during the next few years a considerable amount of equipment will be required.

The City of Leghorn has also resolved to expend 4,000,000 lire (nominally £160,000, but no more than £40,000 at the present rate of exchange) upon telephone improvements. The contemplated work will include the construction of an entirely new post and telegraph office, upon which a commencement was made under previous legislation. The installation of new equipment is expected to take place with greater speed than hitherto.—*Reuter's Trade Service* (Rome).

Switzerland.—New Wireless Station.—A new wireless telegraph and telephone station was opened at Lausanne on October 1st. The station enables constant telephonic communication to be kept up with aeroplanes of the Paris-Lausanne air service.—*Daily Mail.*

Wireless Convention.—The Federal Council has asked the Federal Assembly to authorise it to adhere on behalf of Switzerland to the International Wireless Convention concluded in London on July 5th, 1922.—*Reuter* (Berne).

United States.—Communication Activities.—*Commerce Reports* says that every American communication company is now actively engaged in the construction of additional facilities and in plans of new routes and for methods of improving operating conditions. As in the Latin-American republics, radio-telegraphy is not a Government monopoly, Americans have secured a number of concessions for the erection of stations. In Buenos Ayres and Rio de Janeiro American, British, French, and German companies have united to erect high-power stations. American radio companies are also developing systems of radio communication with Central America, using New Orleans as the main centre for American transmission and reception. The consolidation and co-ordination of the system of high-power radio stations on the Atlantic coast is going on steadily, and is keeping pace with the development abroad. "With the completion of the new Belgian station near Brussels and the new Italian station at Cultano, the radio traffic will undoubtedly pass into the hands of American commercial radio companies. The same is true of the projected extension of governmental radio facilities in the Far East." Among the new submarine cables planned are lines from New York to Emden *via* the Azores; a line to Japan by way of Hawaii and Midway Island; an extension to Brazil, part of a complete circuit around the continent of South America; and a cable extension along the northern coast of South America, touching various parts in Colombia and Venezuela, and connecting with the constructing company's West Indian system.

Wireless Telephony.—Transatlantic Communication.—An attempt to transmit the human voice, as well as musical selections, by wireless telephony across the Atlantic, was made on October 1st (Sunday) between Messrs. Bamberger's store in Newark, New Jersey, and Messrs. Selfridge's, of London. Unfortunately, complete success cannot be claimed, says the *Daily Telegraph*. Six o'clock on a Sunday morning does not sound too inviting, but such is the prevalent enthusiasm for experimental work in connection with wireless that before that hour there was an attendance of 200 at Messrs. Selfridge's. The two receiving sets, which form part of Messrs. Selfridge's wireless equipment, had been tuned up overnight, and at 6.5 a.m. both operators declared they could [illegible] sounds, very faint, but bearing a distinct resemblance to a woman's voice singing. The sound continued for a few moments, but it was impossible to identify any words, and then there was a perfect babel of notes from ships and from the various wireless stations, which effectively jammed the receiving instruments.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—January 31st. Victorian Electricity Commissioners. Back-pressure steam turbine, driving a 1,500-kW turbo-alternator (Spec. 308), four water-tube boilers and accessories (Spec. 317). (September 22nd.)

November 21st. Postmaster-General's Department. Telephone switchboard parts.*

Perth (W.A.).—November 15th. Postmaster-General's Department. 1,490 galvanised tubular poles.*

Queensland (Mackay).—January 31st, 1923. Boiler and generating plant, switchboard, and transformers. Messrs. Frew & Bridger, Queen Street, Brisbane, are the consulting engineers.

Belgium.—October 25th. Third Direction Générale du Ministere de la Defense Nationale, 10, Rue du Meridien, Brussels. Twenty-nine wireless telegraph and telephone sets for the Wireless Division of the Belgian Army.

Edinburgh.—October 17th. Tramways Department. 86 trucks, electrical equipment of cars, &c. Forms from manager.

Egypt.—Manfalout.—November 15th. Installation work in connection with a power station and distribution system. Director of Technical Service, Section of Municipalities and Local Commissions, Savoy House, Cairo.

Alexandria.—December 20th. Administration of Ports and Lighthouses. Eight travelling electric portico quay cranes, eight travelling balcony cranes, eight electric lifts, rails, &c.*

Cairo.—October 30th. Egyptian State Railways. Direct-coupled steam engine and alternator, switchboard, &c., for the power house, Gabbary, Alexandria.*

Holmfirth.—October 18th. Electricity Department. Additional conductor on existing poles for converting system of supply to a.c. (See this issue.)

New Zealand.—Auckland.—February 1st. Twelve 5-ton (and alternatively 3-ton) electric quay cranes. Four 5-ton (and alternatively 3-ton) electric roof cranes. Six 1-ton electric mono-rail cranes. Specifications from Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, E.C.

Invercargill.—December 15th. Southland Electric Power Board. Turbines and valves, generators, exciters, and battery equipment, steel penstocks and valves, switchboards, switchgear and cables, for the Monswai hydro-electric development scheme. Mr. W. Hinchey, chairman, Southland Electric Power Board, P.O. Box 121, Invercargill, N.Z.*

Carterton.—November 25th. Wairarara Power Board. Hydro-generating plant and steel pipe line.

Wellington.—November 28th. Public Works Tender Board. Two exciter transformers for the Waikato power scheme.*

January 9th, 1923. One electric travelling crane (capacity 27 tons) for the Waikato power scheme.*

Nottingham.—October 27th. Electricity Department. Two 650-kVA, 3-phase static transformers, two 900-kVA, 6-phase ditto, one 150-kVA, single-phase ditto, three steam-driven turbine boiler-feed pumps, four gravity bucket coal conveyors with crushers, accumulators, &c. (September 29th.)

Portsmouth.—Electricity Supply Department. One 4,000-kW turbo-alternator, with condensing plant, one water-tube boiler (30,000 lb. per hour capacity), with steel bunker and economiser. (September 29th.)

South Africa.—Johannesburg.—November 16th. Municipal Council. Four or more double-deck tramcar bodies or four or more single-deck do., 15 or more double-deck bogie tramcar complete with truck and electrical equipment, 15 single-deck do. complete, 28 gear wheels.*

Spain.—The municipal authorities of Villarrobleda, province of Albacete. Tenders invited for the concession for lighting the town by electricity.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—The New Antwerp Telephone and Electrical Works Co., of Antwerp, last week submitted the lowest tender to the Belgian Post and Telegraph authorities in Brussels for the supply of a quantity of central battery telephone commutators.

Holland.—According to a Berlin newspaper, the Netherlands State Railway Administration has placed an order with the Bergmann Electricity Works Co., of Berlin, for the supply and erection of the overhead conductor network in connection with the electrification of the first section—Amsterdam-Leyden—of the State railways. The Berlin company is said to have submitted the first scheme and to have thereby gained an advantage over foreign competitors.

London.—Construction of new railway between Edgware, Church Lane and a point north of Queen's Road, Hendon, where a connection will be made with the line now being constructed between the latter point and Golders Green.—The Underground Electric Railways Co., of London, has placed a contract for the above with the Foundation Co., of Kingsway (for particulars of the company, see Elec. Rev. p. 310, issue of March 3rd, 1922), at £258,468, for construction of the permanent way, steel superstructures, signalling station buildings, &c. The work is scheduled to be completed in 14 months' time.

Manchester.—The Lancashire Electric Power Co. has placed an order with the British Electric Transformer Co., Ltd., for ten 4,250-kVA, 33,000-V transformers in connection with its linking-up arrangements.

Mitcham.—Urban Council. Accepted:—
Electric light installation at the vestry hall and offices (£147). County of London Electric Supply Co., Ltd.

Reigate.—Town Council. Accepted:
H.p. feeders and extensions to distribution network (£4,151).—Callender's Cable and Construction Co., Ltd.

Shrewsbury.—Joint Hospital Board. Accepted:—
Installing electric light at the hospital (£768). W. Thomasson & Co.

Torquay.—Electricity Committee. Accepted:—
Boiler-house plant for the new powerhouse station at Newton Abbs (£16,697).—Stirling Boiler Co.

Woking.—Education Committee. Accepted:—
Electric light installation at Maybury school (£129). W. Bradley.

FORTHCOMING EVENTS.

Electrical Power Engineers' Association (Kent Section).—Saturday, October 7th. At the Church Institute, Union Street, Maidstone. At 3 p.m. General meeting at 6 p.m., lecture on "Transformers," by Mr. S. Austen Stigant.

Institution of Electrical Engineers (Western Centre).—Monday, October 9th. At the Merchant Venturers' Technical College, Bristol. At 6 p.m. Inaugural address, by the Chairman, Mr. F. Tremain.

Institute of Marine Engineers. Tuesday, October 10th. At the Institute, the Minories. At 6.30 p.m. Paper on "Conditions to get High Economy from Oil Fuel," by Mr. A. Keenes.

Stoke Newington Borough Council Electrical Exhibition.—At Edward's Lane. October 10th-14th.

National Association of Supervising Electricians.—Tuesday, October 10th. At St. Bride's Institute, Ludgate Circus, E.C. At 6.45 p.m. Lecture on "Single-phase Commutator Motors, their Progress and Reasons why they demand the Attention of Power Engineers," by Mr. F. Creedy.

Electro-Harmonic Society.—Wednesday, October 11th. At Caxton Hall, Westminster, S.W. At 8 p.m. Smoking concert.

Association of Engineers-in-Charge.—Wednesday, October 11th. At St. Bride's Institute, Bride Lane, E.C. At 7.30 p.m. Presidential address by Prof. H. S. Hele-Shaw, F.R.S., on "The Advantages of Incorporation."

Optical Society. Thursday, October 12th. At the Imperial College of Science, South Kensington, S.W. At 7.30 p.m. Ordinary meeting.

Edinburgh Electrical Society.—Friday, October 13th. At the Philosophical Institute, Queen Street. At 8 p.m. Paper on "Walkerburn Hydro-electric Works," by Mr. G. F. Ewan.

British Electrical Development Association.—Salesmanship Conferences.—Friday, October 13th. At Caxton Hall, S.W. At 7.30 p.m. Paper on "Salesmanship in Relation to Lighting," by Mr. W. E. Bush.
At the Drawing Room Café, Newcastle-on-Tyne. Thursday, October 12th. At 7.30 p.m. Address by Mr. J. W. Beauchamp.

Birmingham and District Electric Club.—Saturday, October 14th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper by Mr. F. R. Unwin.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:—
The Coffield electric washer.

NOTES.

The Electro-Harmonic Society.—We wish to remind our readers that the first concert of the present season will be held on Wednesday next, at 8 p.m., at the Caxton Hall, Westminster, S.W. (instead of Cannon Street Hotel), a change which, the committee believes, will be generally approved by members. There is every promise of a very successful season. The following is a list of the later events: Tuesday, November 14th, ladies' night; Tuesday, December 12th, smoking concert; Wednesday, January 10th, smoking concert; Wednesday, February 14th, ladies' night; Wednesday, March 14th, smoking concert. The chairman at next Wednesday's concert will be Mr. Bernard M. Drake, and the artistes are as follows: Miss Constance Drever, soprano; Miss Barbara Samuel, contralto; Mr. Ivor Walters, tenor; Miss Evelyn May, violinist; Miss Beth Tate, American comedienne; Mr. Harry Atkinson; Mr. T. C. Sterndale Bennett; the Gleesome Singers; Mr. Bernard Flanders, A.R.A.M., pianist. Extra tickets for the concerts may be obtained at 2s. 6d. each for single tickets, or 2s. each for two or more tickets on application to the hon. secretary, Mr W. E. Lane, 286, Finsbury Pavement House, E.C.2

Swansea Electrical Exhibition.—Under the auspices of the Swansea Corporation Electricity Department a most successful electrical exhibition was opened at the Drill Hall on Monday afternoon in the presence of a large gathering of members of the Corporation and general public. It is the first exhibition of the kind ever held in the town, and the general arrangements have been designed by the committee, of which Col. Alexander Sinclair, M.I.E.E., is the chairman, in order to bring to the notice of the general public and particularly to housewives the manifold uses of electricity. There are 26 stands, and the floor space covered is 150 ft. by 80 ft.; the stalls are very artistically arranged. In addition the riding school adjoining has been converted into a kinema hall where kinematograph films are daily shown illustrating the use of electric power in the home and in industry. The borough electrical engineer, Mr. J. W. Burr, M.I.E.E., who has been ably assisted by Mr. Harry Davies, A.M.I.E.E., and other members of the staff, was warmly complimented at the opening ceremony which was performed by the Mayor, Ald. W. Owen, upon what his worship described as a splendid exhibition; he referred to the labour-saving devices exhibited, and urged the public to adopt them. On the proposition of Col. Sinclair, seconded by Mr. Burr, the Mayor was heartily thanked for opening the exhibition. The visitors then went the round of the exhibits, and saw a complete electric bakery and also a laundry in working order, the former supplying the foodstuffs sold at the exhibition; flood-lighting by the British Thomson-Houston Co., which had a double-front shop window set up for the purpose; an electric bungalow, prettily furnished; electric fires, and numerous novelties in the way of lighting effects. In the Kinema Hall a wireless telephone set is set up which has a range of from 300 to 20,000 metres, and during the exhibition concerts are heard from the Paris Opera House. The exhibition runs until the 14th inst., and is already proving of great educational value with regard to the uses to which electric power can be put.

The following is a complete list of the exhibitors:—Armature Repairing & Supply Co., Ltd.; Automatic Telephone Manufacturing Co., Ltd.; Beatty Brothers, Ltd.; British Electric Transformer Co., Ltd.; British Thomson-Houston Co., Ltd.; Cable Accessories Co., Ltd.; Callender's Cable and Construction Co., Ltd; Carron Company; Electric Appliances Co., Ltd.; Engineering Equipment Co. (1919); Furneaux and Thomas; General Electric Company, Ltd.; Haslam and Stretton, Ltd.; Holophane, Ltd.; Hotpoint Electric Appliance Co., Ltd.; Jackson Electric Stove Co., Ltd.; John Kerr & Co.; Meetropolitan-Vickers Electrical Co., Ltd.; Morgan Brothers; Ransomes, Sims and Jefferies, Ltd.; Rawlplug Company, Ltd.; Singer Sewing Machine Co., Ltd.; Smith and Page; Sun Electrical Co., Ltd.; Mr. Velardo; Mr. John H. Whitehouse; D. O. Williams & Co., Ltd.

Summer Time Ending.—Summer time will cease at 3 a.m. (summer time) in the morning of Sunday next, October 8th, when the clock will be put back to 2 a.m.

Appointments Vacant.—Electrical engineer for India, for the Calcutta Electric Supply Corporation; electrical fitter, for Borough of Torquay; teacher of electrical installation (Monday evenings), for the Redhill Technical Institute. (See our advertisement pages to-day.)

A Maximum Demand Problem.—A correspondent writes: "Could some of your readers answer the following query? It is very important, as I know of cases in which electricity charged for as given below is 50 per cent. in cost above a flat d.c. rate for the same description of work:—

"How far, if at all, will a consumer on a 3-phase circuit, taking his current through a maximum-demand indicator (depending on temperature rise), be affected by conditions outside his own premises—*i.e.*, assuming (1) a very low power factor in the supply main; (2) a unity power factor.

"It would seem reasonable, as the mains are warmed up by the extra current, when power factor is low, that the maximum demand indicator and also the capacity of his motors should both be affected adversely to the consumer."

[This query appeared in our "Correspondence" columns on August 4th, but no reply was forthcoming. So long as the declared pressure of supply is maintained at the consumer's terminals, there is no obvious reason why the low power factor of the general load (outside his premises) should affect his meter or indicator in the least. The warming-up of the mains could not do so, as the amount of heat conducted along the service cable would be negligible; moreover, power factor is usually at its lowest when the general load is small, and the current in the mains, therefore, is at a low value. The consumer need not worry himself about other consumers' power factors. Eds. Elec. Rev.]

Rural Supply from a Municipal Undertaking.—As we go to press we have received the following letter: "In last week's issue of the Electrical Review, page 450, dealing with Hereford, it is stated that Hereford was the first municipality to establish a scheme for supplying towns and villages within twenty miles. I am doubtful if this statement is correct, as the Kilmarnock Corporation were supplying a large part of Ayrshire of a radius of twenty miles from Kilmarnock power station in the year 1914. In this area are included five other burghs, and a number of small villages, and we have connected a considerable number of farms situated near our transmission lines.—William C. Bexon, engineer and manager, Kilmarnock Electricity Supply. October 3rd, 1922."

Fatality. James Smith (11), of Stanley, Durham, who climbed a pole to dislodge a football, came in contact with a live wire and was instantly killed.

E.P.E.A. Working Agreements.—The Electrical Power Engineers' Association has recently concluded agreements with the Municipal Employers' Association and the National Amalgamated Union of Engineers, Firemen, Mechanics, Motormen and Electrical Workers. In both agreements it is arranged that in the event of the E.P.E.A. being involved in a dispute with an employer in the electricity industry, the other unions shall be notified. In the event of "an officially recognised dispute," the other unions agree not to permit their members to [illegible] members of the E.P.E.A., or to accept a supervisory position over anyone who may take their places. This is to be reciprocated by the E.P.E.A. in the case of disputes affecting the other unions. Joint action will be taken to enforce all agreements arrived at by recognised local and national bodies in the electricity supply industry. Where the dispute is about matters other than the enforcement of such agreements, a joint meeting of the executives of the unions will decide whether joint action shall be taken. Victimisation for the observation of these agreements is guarded against, and it is provided that nothing in the agreements shall restrict the right of any of the parties to accept or refuse arbitration in the settlement of any dispute. The agreements are subject to annual revision, and are terminable by the giving of six months' notice. In the agreement with the National Union of Enginemen, &c., the E.P.E.A. agrees not to take into membership anyone in the engine-room or boiler-house who is not recognised as being on the technical staff. The transfer of members of the National Union to the E.P.E.A. is to be arranged between the local officials of the two unions.

Film of Coaling Arrangements.—Under the auspices of the Mitchell Conveyor & Transporter Co., Ltd., a private view of a film showing some of the firm's coal-handling machinery was accorded to representatives of the Press last week. The first portion of the film showed the travelling transporter-crane at the Blackburn East power station in operation. This is an electrically-operated machine, which can be used either for lifting and tipping coal trucks or fitted with a grab, as a crane for unloading barges in the adjacent canal. An ingenious form of cradle is used to support the trucks when the transporter is used for the purpose of tipping these. The film also showed the boiler coaling arrangement by which an electrically-hoisted skip feeds a belt-conveyor, which discharges into the boiler hoppers. The coaling arrangements at the Crewe depôt of the London and North-Western Railway were then shown. This plant consists of steel framework in the form of an arch, beneath which the trucks to be unloaded are shunted. At the top of the structure is a bunker holding sufficient coal to supply the locomotives for 24 hours, from 120 to 140 tons. The trucks are raised on a specially-designed cradle, which retains them securely without damaging them. Hooks on this cradle engage with trunnion pins on the side of the hopper when the upper limit is reached and the trucks are completely inverted. From the bunker a shoot leads to a coal valve situated at the correct height for filling the tenders of locomotives. Through this valve coal is released in half-ton parcels, affording a means of checking the amount supplied.

"Who Invented the Telephone?"—This question has again been raised, in connection with the death of Dr. A. G. Bell, and in a letter to the *Electrical World* Signor Emil Boschetti quotes an Italian magazine to the effect that Antonio Meucci anticipated Bell; but, it is added, Meucci himself had been forestalled by Innocenzo Manzetti, who in 1861 talked clearly by telephone over a distance of nearly two miles. The magazine states that shortly after this demonstration a stranger called on Manzetti and was shown the instrument; on leaving the laboratory he left his visiting card, inscribed "Alexander Graham Bell," which card is now in the possession of Sir E. Berardin, of Aosta.

The Editors of the *Electrical World*, however, point out that Bell in 1861 was a lad of 14, still living in his native country—Scotland.

Harvesting by Electricity.—This year, harvesting at Greater Felcourt Farm, East Grinstead, has been carried out [illegible] by the aid of electricity. This is another triumph for electricity in the field of agriculture. A tractor, equipped with a dynamo for generating electricity, was [illegible] of the usual pattern. This reaper however, differed from its fellows, in that an electric motor had been fitted on it, to operate the cutting knives and binding mechanism. Usually a reaper is worked by the friction of one of its wheels on the ground. It will be appreciated that if the ground is soft, or if the reaping machine is not drawn along quickly enough, the knives do not cut properly. In the [illegible] machine these troubles do not arise, for, by aid of a controller, something like that worked by a [illegible] can [illegible] the farm labourer, [illegible] the knives and other parts of the [illegible] to [illegible] most suitable. A reaper, when electrically equipped, will cut one-third more [illegible] a day [illegible] result of equipping it electrically. The great secret of a good harvest is getting the corn [illegible] the correct time has arrived. That it is of very great importance, if by calling in the aid of electricity, over 30 per cent more cutting than usual can be done in a day. Incidentally the electrically-operated reaping machine cuts the straw closer to the ground, so that the length of straw cut is a maximum. This is due to the knives running at the proper speed, as, when they do not, the straw is bent over and finally cut higher up than it should be.

Thus another agricultural success has been achieved by Mr. R. Borlase Matthews at his all-electric farm, for it is only a few weeks ago that it was announced in our columns that hay had been "made" or "cured" (*i.e.*, not that grass had been merely "dried") in large ricks, on this farm.

The following technical details of the equipment may be of interest to the farmer or the engineer interested in electro-farming: The motor is rated at 2 h.p., and its speed is variable between 1,000 r.p.m. and 1,600 r.p.m., a suitable combined starter and speed regulator being used. After being electrically equipped as above, the ordinary reaper will cut 22 acres per day instead of the 16 acres, which is its usual maximum. Although a good deal of experimental work was required to bring the present equipment to success, it is possible to fit it to existing reaping and binding machines at very little expense. On large farms the saving in time and gain due to speedy working during intermittent spells of fine weather will repay the cost in one season. When the crop is to be dried and cured in stacks (by Mr. Matthews's recently-described system for hay-making), rapid cutting is desirable to keep pace with the stack building.

A New Cable Ship.—After nearly half-a-century's arduous work in connection with the laying and repairing of submarine cables in all parts of the world, the well-known cable ship *Faraday* of Messrs. Siemens Brothers & Co., Ltd., Woolwich, is shortly to be replaced by a new one. Although still capable of performing her duties in a trustworthy and creditable manner, the good old vessel was gradually becoming obsolete in various ways, and in order to meet the anticipated increase in cable-laying during coming years, the company decided to build a new ship designed on the most modern lines and complete in every respect. The order has been placed with Messrs. Palmers Shipbuilding and Iron Co., Ltd., Hebburn-on-Tyne. The new vessel, which will be ready for work early next year, will be of steel, 380 ft. long and 48 ft. wide, and the depth to the upper deck will be 29 ft. 3 in. The approximate dead weight will be 6,700 tons. The ship will have twin screws and will be driven by triple-expansion engines; sufficient oil fuel can be carried to give a steaming range of about 10,000 miles. There will be four cable tanks, capable of carrying approximately 4,350 tons of cable.



C.S. "Faraday."

It may be of interest to recall a few leading particulars relating to the cable ship *Faraday*. This vessel is of iron, and was built by Messrs. Charles Mitchell & Co., Low Walker-on-Tyne, being launched in 1874. Her length is 360 ft. 4 in., breadth, 52 ft. 3 in., depth of hold, 34 ft. 7 in., gross tonnage, 5,028, and the net tonnage 2,334. She is propelled by means of twin screws, each of which is driven by a compound condensing engine of a nominal horse-power of 500. There are three cable tanks in the ship, two of which have a capacity of 47,712 cubic feet each, the other having a capacity of 22,500 cubic feet.

Altogether the *Faraday* has laid some 50,000 miles of submarine cable in all parts of the world, including eight submarine cables across the Atlantic, the first of which was submerged in 1874. She has also been employed for carrying out many repairs in deep water up to depths of 3,000 fathoms.

Protection Against Case-hardening. In case-hardening articles, parts of which are not to be cased, it is well known that a coating of copper electrolytically deposited on the latter parts affords a convenient means of protection. Dipping the articles in solutions of copper salts is ineffective. In an article by Prof. L. Guillet in the *Génie Civil* the author gives the results of experiments made to determine the least thickness of copper that suffices for the purpose, from which we learn that a coating of 0.02 to 0.03 mm. affords complete protection at a temperature of 1,000 deg. C., whilst the exposed parts are cased to a depth of 1 mm.; if the casing is to be 2 mm. thick a coating of 0.03 to 0.04 mm. is required. At a temperature of 850 deg. C., for a case 1 mm. thick, a coating of 0.01 to 0.02 mm. suffices.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Students' Premiums.—The Council has awarded students premiums, of the value of £10 each, to: Mr. C. Dawson (Birmingham) for his paper on the "Testing of Materials used in Manufacture of Electrical Machinery"; Mr. A. Tustin (Manchester) for his paper on "Hydro-electric Power Supply", Mr. J. C. Stewart (Glasgow) for his paper on "Electricity in Mines"; Mr. J. A. Cooper (Birmingham) for his paper on "Long Distance Telephony"; Mr. H. S. Petch (London) for his paper on "Automatic and Semi-Automatic Railway Signalling"; Mr. F. C. Lawrence (Manchester) for his paper on "The Engineer and Manufacturing Cost."

Scholarships.—The Council has also awarded the following scholarships: A Salomons Scholarship, value £50, to Mr. A. H. Maggs, of Bristol University; a David Hughes Scholarship, value £40, to Mr. W. H. N. Hellier, of University College, Cardiff; a Paul Scholarship, value £50, to Mr. C. A. Wilck, of Finsbury Technical College, London.

Western Centre.—The 48th ordinary general meeting and the first meeting of the 1922-23 session of this Centre of the Institution will be held at Bristol on October 9th, when Mr. F. Tremain, chairman, will deliver his inaugural address. Tea will be provided before the meeting.

"Science Abstracts."—On the recommendation of the Committee of Management of *Science Abstracts*, the Council has appointed Mr. W. R. Cooper, M.A., B.Sc., M.I.E.E., to be Editor of the publication in the place of the late Mr. L. H. Walter. It will be within the recollection of many that Mr. Cooper was Acting-Editor of *Science Abstracts* in the first year of its existence, 1898, and subsequently was Editor from 1899 to 1901.

Institute of Transport.—The Council has presented its report of the progress and activities of the Institute during the third year ended September 30th, 1922. The Ministry of Transport, early in the year, invited the Institute to investigate an improtant situation which had arisen with regard to the training in England of Siamese railway students. By the courtesy of the general managers of some of the leading British railways the Council will be enabled to advise the Government that places can be found in this country for a limited number of students. In the last annual report it was stated that the subjects of the application of science to transport and the co-ordination of educational facilities were engaging the attention of the Council. The scheme briefly outlined has been developed on broad lines, and regulations governing examinations were adopted by the Council on March 15th, 1922. Two congresses were held during the year. The membership at the conclusion of the first, second and third years was respectively 652, 1,081, and 1,318. Amongst the premium awards, 1921-1922, the following have been made:—Railway (Operating) Gold Medal: J. P. Thomas for paper on "The Operation and Development of Urban Electric Railway Services." Institute Silver (Graduate) Medal: A. K. Dalton, for paper on "Tramway Rolling Stock—a short review of the development of the tramcar." It being the practice that no premium shall be awarded to a member of the Council, consideration of the paper submitted by Mr. Roger T. Smith was precluded.

A statement of accounts for the period ended September 15th, 1922, shows that the expenditure amounted to £2,792, and income from subscriptions and interest to £2,445 and £58 respectively. Entrance fees totalled £549. The sum of £1,500 was invested during the year.

On Monday last Sir Sam Fay delivered his presidential address, at the Institution of Electrical Engineers. He said that the world was passing through a momentous period of transition, and there never had been so great a change in the railway situation as that wrought by the Railways Act of 1921, the keynote of which was "consolidation." The railways had been formed into four large groups, and their linking-up should result in efficiency and economy. The charging powers of the combined companies might be regarded as a "dividend-earning charter." The men engaged in such essential work as transport should be paid, in the words of Mr. Rowntree, "sufficient to maintain a reasonable standard of comfort, should have reasonable hours of work, reasonable economic security during the whole working life and in old age, and a reasonable share with the companies in determining the conditions of work." The large payment provided for by the Act should give the new groups an excellent start in life—never before had their financial position been so sound. The welding of the various lines into an economical whole would involve the dismantling of some establishments and the enlargement of others, and the selection of the best in each case. During and since the war factories had been enlarged, and if they were run at anything like their full capacity the transportation machine might be taxed to its maximum. Many changes would be necessary if railway transport was to live up to Sir Eric Geddes' dictum—"efficient and economical working and management."

Institution of Heating and Ventilating Engineers.—The autumnal general meetings will be held at Caxton Hall, Westminster, S.W.1, on October 10th, at 8.15 p.m., paper by Mr. Robert Fortune, Barrister-at-Law, on "Some Points in the Law of Heating Engineers' Contracts", [illegible] 11th, at 6.30 p.m., paper by Mr. [illegible] and Ventilating of Passenger Ships", [illegible] cussions. The Institution [illegible] larger [illegible] at 28, Victoria Street, S.W.1. [illegible] continues to increase, and the sphere of its activities is extending. A number of committees have been appointed by the Council, on such matters as research, boiler rating, district heating, fan standardisation, etc., and an interesting series of papers will be read during the coming session. The president for 1922-23, Mr. A. H. Barker, B.A., B.Sc., Wh.Sc., is also arranging for a series of [illegible] sions to be held in addition to the ordinary meetings and papers.

A Proposed Co-ordination of Engineering Societies.—On September 29th the Society of Engineers organised a luncheon and convened a meeting of representatives of a number of engineering societies, at the Engineers' Club, to lay before them proposals for the formation of an association of British Engineering Societies. The result was a large attendance, and after an excellent luncheon Mr. Gueritte, the president of the Society of Engineers, outlined the scheme. He said that his Society had made no attempt to formulate any hard-and-fast arrangements; the idea was merely to put forward suggestions. He read a number of letters from various societies approving the principle of the scheme. Mr. Twelvetrees, past-president of the Society of Engineers, referred to similar schemes which had been successfully instituted abroad, particularly the German Association of Engineers, which had a membership of 20,000. In this country the Royal Institute of British Architects had arranged the affiliation of a number of smaller societies. He wished to emphasise the fact that the Society of Engineers had no wish to assume control of such an association, but wanted to be merely a member. Mr. C. H. Wordingham said that although he was the president of the Junior Institution of Engineers, one of the bodies concerned, he was speaking in his private capacity. He had constantly advocated such a scheme as that now mooted. He realised that it would be impracticable to have one engineering society to cover all the wide field of engineering. Special sectional institutes were essential, but he felt that co-ordination was very necessary. There was nothing worse than overlapping and duplication of effort; he welcomed the formation of a central body by the four leading institutions, but considered that every branch of engineering should be represented upon it. It was not possible for every society to send a representative, and for this reason he was glad to see this effort made to co-ordinate the smaller bodies in one association. He suggested the formation of a provisional committee to formulate a scheme in consultation with the societies concerned. Mr. Twelvetrees thereupon moved:—"That this meeting considers the principle of the formation of an association of British engineering societies of sufficient importance to justify the appointment of a committee to consider the question and to submit detailed proposals to the societies eligible to join such an association." This was seconded by Mr. Wordingham, and carried *nemine contradicente*. The meeting then elected the following to act as a committee:—Mr. Norman Wyld (Society of Technical Engineers), Mr. Twelvetrees (past-president, Society of Engineers), Mr. Blizard (President, Institute of Sanitary Engineers), Mr. C. H. Wordingham (past-president, Institution of Electrical Engineers), Mr. S. E. Ackermann (secretary, Society of Engineers), Mr. E. J. Cullis (past-president, Gloucester Engineering Society), and Miss Haslett (secretary, Women's Engineering Society).

Edinburgh Electrical Society.—The Society resumed its meetings on September 29th, under the presidency of the chairman (Mr. R. W. J. Stark) when the opening address for the session was given by Lieut.-Colonel Ogilvie, O.B.E., B.Sc., the subject being "Considerations in Electric Lighting by Incandescent Lamps." After a brief review of the salient features and controlling factors in the great development which has been achieved from the early carbon to the gas-filled lamp, the lecturer proceeded to deal in detail with the distribution of light from lamps and the resulting illumination obtained at the point where the work was to be done. With the larger efficiencies obtained in the gasfilled lamp there had been a general tendency to [illegible] provision of light, resulting, not infrequently, in an unnecessary amount of illumination, with consequent loss of economy.

Radio Association. The inaugural meeting of the newly-formed Radio Association was held on September 27th at the Hotel Cecil, Professor Low in the chair.

According to *The Times*, Mr. S. Landman, hon. secretary *pro tem.*, said the Association would probably never have come into existence but for the way in which the question of broadcasting had been treated. A promising British industry was being held up by inexplicable official delays.

Mr. C. L. Malone, M.P., read part of a letter from the Postmaster-General, in which he said: "I am disposed to retain in all cases the present fee of 10s. for a receiving licence and to require from the person who does not propose to buy his set from a member of the [illegible] ing Co. some evidence that he has a sufficient [illegible] of the subject to justify his being granted an [illegible] licence. The term 'experimenter' will be interpreted in a liberal sense."

Wireless Society of London.—Admiral of the Fleet Sir Henry Jackson, President of the Wireless Society of London, presided at the opening meeting of the society for the winter session, held at the Institution of Electrical Engineers on September 27th. Owing to indisposition Mr. Marconi was unable to be present.

The Chairman said that on September 21st the Secretary of the General Post Office, on behalf of the Postmaster-General, with Captain Loring and Mr. Shaughnessy, received a deputation, introduced by himself (the Chairman), representing the experimental wireless amateurs of the country. While strongly holding that their rights must be fully considered, the members of the deputation were much impressed with the difficulties which the Post Office had to meet in attempting to satisfy all parties concerned.

Mr. E. H. Shaughnessy, representing the Post Office, said that there was some difficulty in distinguishing between real experimenters and those who simply wanted broadcasting. If the state of affairs which now existed among the skilled amateurs who already possessed licences were to be extended, broadcasting would be a failure. Experimenters caused his own receiving apparatus to whistle a good deal. It was to avoid that evil becoming greater that the Post Office had to deal with the technical aspect of the case very carefully. With regard to broadcasting apparatus, the Post Office was going to test every type of apparatus sold. It was going to issue licences which would enable people to buy only harmless apparatus, which was just as efficient as harmful apparatus. Also, there must be no oscillation on the aerials. The wave length band on which broadcasting would take place was very limited. The authorities wanted to give serious experimenters every opportunity.

Captain Loring, who also represented the Post Office, said that the question of broadcasting had increased the number of licences tenfold.

Captain Phillips, as a member of the committee of the new broadcasting company, said that it was not proposed that the company should, in any way, be a monopoly. It was essential that there should be some guarantee that the apparatus should be British-made. That could only be done by the manufacturers banding themselves together.

Replying to questions, Mr. Shaughnessy said that he did not anticipate any difficulty in getting eight broadcasting stations in Great Britain working at the same time, and also in serious experimenters being able to get fairly good results in the zone of the parent stations.—*The Times.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Mr. J. S. Evenden, boiler-house engineer at the Metropolitan Railway Co.'s Neasden power station, has resigned his position in order to join the staff of Messrs. William McIlroy & Co., industrial fuel specialists, of 66, Victoria Street, S.W.1. Upon leaving Neasden Mr. Evenden was presented with a dressing case and a barometer, subscribed for by the staff of the power station and the electrical department.

During an epidemic of burglaries at Leeds, last week, the house of Mr. J. B. Hamilton, tramways general manager and commercial manager to the Corporation, at Kirkstall, was broken into and some articles of gold and silver, together with about a score of war medals and other decorations awarded to Mr. Hamilton's sons, were taken.

Mr. W. E. Johnson has resigned his post as assistant engineer to the Nuneaton Electrical Contracting Co. to take up the appointment of engineer and manager to Messrs. H. Pratt, Ltd., electrical engineers, High Street, Aston, Birmingham.

Ilford Urban Council has decided to increase the salary of the electrical engineer, Mr. A. H. Shaw, by two increments of £50 each, the first to be operative from the beginning of the present financial year, and the second a year later. The increments are not to carry any bonus.

Luton Town Council has appointed Mr. Walter Clark, the present manager of the tramways, to continue in that position under the Council when the lease of the tramways expires in February next, at a salary of £500 per annum.

On September 30th, at Bedford, Mr. Maurice W. Singer, M.Sc.Tech. (Manchester), of the Brush Electrical Engineering Co., Ltd., Loughborough, was married to Winifred Beatrice Shelton, of Bedford.

The Stockport Corporation electrical department held its second annual supper and smoker on September 28th. Presentations were made to three of the staff: Mr. T. R. McCandlish, chief draughtsman, who is leaving to take up the appointment of chief draughtsman and clerk of works to the Torquay Corporation electricity department; Mr. A. Turner, jointer, who has been appointed clerk of works for Cheadle Council's electricity scheme; and Mr. J. Ball, who was recently married. The first was presented with a leather travelling case, the second with an attaché case and electrical book, and the last with a clock.

Obituary.—Mr. G. W. Day.—The death occurred very suddenly, on September 22nd, of Mr. George William Day, electrical engineer, of 202, Balfour Road, Ilford, and 10, Dacre Street, Westminster. Mr. Day, who was 51 years of age, had a seizure whilst at his office at Westminster, and died before medical aid could be obtained.

Mr. J. Marsh.—The death has taken place, at the age of 62 years, of Mr. J. Marsh, who held the position of electrician at the Barracks at Winchester.

Dr. F. T. Trouton.—We regret to record that Dr. Frederic Thomas Trouton, D.Sc., F.R.S., late Quain Professor of Physics at University College, London, passed away recently at the age of 58 years. *The Times*, in referring to his work, says: "He will be chiefly remembered for his work on molecular latent heat, commonly known as 'Trouton's Law.' Among other researches he occupied himself with the repetition of Hertz's experiments and the determination of the direction of the vibrations of light, and also made experiments on electromagnetic radiations, including some of the phases of secondary waves."

M. Herman-Victor Hubert.—We regret to announce the death of Prof. Hubert, Emeritus Professor of the University of Liége, and the holder of numerous public offices and decorations, including that of C.B.E.

Will.—The late Mr. F. E. Hesse, for many years general manager and secretary of the Eastern Extension, Australasia and China Telegraph Co., Ltd., left £11,759.

NEW COMPANIES REGISTERED.

British Laboratory Ware Association, Ltd.—Registered on September 23rd as a company limited by guarantee. The objects are:—To take over all or any part of the business and activities of the British Laboratory Ware Association, Ltd. (incorporated in 1915); to register and use a trade mark in respect of any specified goods or classes thereof as may be arranged or approved of by the Board of Trade, and have complete control thereof, and permit the use of, the trade mark on such conditions as the Association may think fit; to protect the interests of members and others manufacturing and dealing in goods manufactured of glass, porcelain, filter paper, and general laboratory ware and requisites, and surgical, medical, chemical, physical, electrical, optical, mechanical, and scientific appliances; to provide for the examination of any such goods in respect of origin, material, mode of manufacture, quality, accuracy, or other characteristics; to promote the manufacture of such goods; and circulate and furnish information and advice to persons and corporations engaged in the trade, particularly in connection with prices and foreign competition; to prepare and advise on forms of agreement with manufacturers and suitable for use by members of the Association, and to negotiate agreements with any such persons on behalf of the members; to protect the trade against offences under the Merchandise Marks Act and prevent the use of false trade marks and description in respect of such goods and materials made in imitation thereof. The management is vested in a council, the first members of which are:—H. G. Jarron, 19-21, Sun Street, E.C., chemical apparatus manufacturer; C. A. Mercer, 34, Camomile Street, E.C., chemical apparatus manufacturer; J. George, 17-27, Hatton Wall, E.C., manufacturer; A. L. S. Wood, Kemble Street, Kingsway, W.C., chemical apparatus manufacturer; H. S. Shorthouse, 144, Edmund Street, Birmingham, chemist; S. Belcher, 61, Church Street, Birmingham, chemical apparatus manufacturer; F. W. Branson, 14, Commercial Street, Leeds, Fellow Institute of Chemistry. H. F. Jarron is the first chairman. Solicitors: Janson, Cobb, Pearson & Co., 22, College Hill, E.C.4. The registered office is at 80a, Coleman Street, E.C. The file number is 184,549.

C. A. Sidebottom (Dukinfield), Ltd. (184,551).—Private company. Registered September 25th. Capital, £250 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in, electrical goods and equipment, electrical engineers, millwrights and furnishers, advertising contractors and agents, &c. The first directors are:—C. A. Sidebottom, 289, King Street, Dukinfield, Cheshire; W. Birtwell, 304, John Street, Ashton-under-Lyne. Qualification: One share. Remuneration as fixed by the board. Secretary: C. A. Sidebottom. Registered office: 289, King Street, Dukinfield, Cheshire.

Irish Power Syndicate, Ltd.—Private company. Registered in Dublin, September 16th. Capital, £5,000 in £1 shares. To obtain concessions for the supply of electricity, &c. The first directors are:—Lt.-Col. F. G. Bayley, Midleton Park, Castletown, Westmeath; A. R. H. Campbell, 278, Molesworth Street, Dublin. Secretary: R. Studdert. Registered office: 28, Molesworth Street, Dublin.

Wireless Components, Ltd. (184,624).—Private company. Registered September 27th. Capital, £2,000 in £1 shares. To adopt agreements with C. G. Lilley for the acquisition of the business carried on by him in connection with appliances for wireless telegraphy and installations, together with the assets and benefit of his services. The first directors are:—C. G. Lilley, 10, Kinsale Road, Peckham, S.E.; B. A. Starley, 18, St. Saviour's Road, Brixton, S.W.1 (both permanent, subject to holding 100 shares each). Secretary: B. A. Starley. Registered office: 16, Manette Street, Soho, W.1.

Lang Squire Wireless Manufacturing Co., Ltd. (184,609). Private company. Registered September 27th. Capital, £500 in £1 shares. To carry on the business of manufacturers of, and dealers in, apparatus, machinery, plant, and accessories for use in connection with wireless telegraphy and telephony, &c. The subscribers (each with one share) are:—T. H. D. Lang, 16, Woodside Road, Golders Green, N.W., electrical engineer; R. G. H. Squire, 12, Marine Avenue, Westcliff-on-Sea, electrical engineer. R. Mors is one of the first directors. Remuneration £10 each per annum. Registered office: Wales Farm Road, Acton, W.

Pembroke Motor and Electrical Engineering Co., Ltd. (184,632). Private company. Registered September 28th. Capital, £2,000 in £10 shares. To carry on business as indicated by the title. The first directors are: Mr. W. R. J. Wilkinson, St. Oswald House, Pembroke; T. L. Bennett, Station Road, Pembroke. Qualification £100. Remuneration as fixed by the company. Solicitor: R. D. Fowkes, Town Clerk's Office, Pembroke.

Wilfrid Francis & Co., Ltd. (184,572).—Private company. Registered September 25th. Capital, £1,000 in £1 shares. To carry on the business of electrical engineers and specialists in electric lighting systems, &c. The subscribers (each with 25 shares) are:—J. F. Perry, A.M.I.E.E., "The Cottage," Bolham, Tiverton, Devon, electrical engineer; W. Brooke, "Braemar," Laburnam Lane, Hale, Cheshire, electrical engineer. W. Brooke signs as director. Qualification: £25. Secretary: W. Brooke. Registered office: 49, Deansgate, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wezdon Lamp Co., Ltd.—Issue on September 18th, 1922, of £900 debentures, part of a series already registered.

Tudor Accumulator Co., Ltd.—Satisfaction in full on September 1st, 1921, of mortgage debenture dated December 18th, 1919, securing £50,000. (Notice filed September 20th, 1922.)

Associated Electric Traders, Ltd.—T. J. Wilson, of 59-60, Old Bailey, E.C.4, was appointed receiver and manager by orders of Court dated September 16th and 20th, 1922.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

In the report for the year ended December, 1921, it is stated that during the year a further £350,160 of the 5 per cent. first mortgage debentures, and £78,260 of the 5½ per cent. second mortgage debentures were purchased for redemption. Debenture interest and premium amounted to £160,886; depreciation and income tax, &c., to £410,873; leaving £172,926 as net profit, which together with £92,482 brought forward leaves a total of £265,408. Two dividends each of 3 per cent., less income tax, on the preference shares for the year 1921, were paid, absorbing £84,000, leaving a surplus of £181,408. In respect of this surplus a dividend of 5 per cent., less income tax, on the ordinary shares for 1921 was declared in June, and as the preference shares are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference shares have received a total dividend of 10 per cent. for the year in respect of which the distribution is made, the directors also declared at the same time a further and final dividend of 4 per cent., less income tax, on the preference shares in respect of the year 1921. The above dividends were paid in July, and absorbed £91,000, leaving £90,408 to be carried forward.

International Light and Power Co.—In their report for the year to June 30th, the directors regret that, due to the unfortunate position of the Mexican Co., it has not been possible to resume payment of cumulative preferred dividends. No part of the company's large cash deposits with the now defunct Reguladora has been returned, while the arrears of payment on account of public lighting in Mérida are larger now than at the beginning of the year. During the year the company acquired the entire share capital of the Paraná Tramways Co., which owns and operates a tramway system in the City of Paraná, Argentine, in conjunction with the electric supply services.

Prospectus.—According to a newspaper report, the *Ramsey Electric Light & Power Co., Ltd.*, is offering for public subscription (up to October 25th) 10,000 ordinary shares of £1 each at par. The company was formed to carry out at Ramsey and elsewhere in the Isle of Man the business of an electric light and power company in all its branches, and the present directors are Mr. W. S. Lees, North Promenade, Ramsey, electrical engineer, who is also managing director of the company; and Mr. F. W. Longworth, 69, Walsingham Road, Wallasey, Cheshire, electrical manager.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Yorkshire Electric Power Co.—£73,000 five and a-half per cent. redeemable debenture stock.

The undermentioned have been ordered to be officially quoted:—

British Thomson-Houston.—1,000,000 7 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 1,000,000).

Metropolitan Railway.—£600,000 5 per cent. preference stock.

The Berlin A.E.G.—The management of the A.E.G. expect that the dividend for 1921-21 will be at the rate of 25 per cent. as compared with 16 per cent. in the previous year. It is proposed to increase the ordinary share capital by the issue of new shares for 300,000,000 marks, of which one-half will be offered to present shareholders at the price of 400 per cent.

Central Electric Supply Co.—According to the financial Press, this company some days ago announced its intention to redeem all the notes forming the issue of £500,000 (part of £800,000) eight per cent. secured and guaranteed redeemable notes at a premium of 2 per cent. on April 1st, 1923. It is proposed shortly to place before holders an alternative proposal, particulars of which are under consideration.

Still Engine Co.—According to the *Financial Times*, this company announces that the remaining £50,000 debentures and 50,000 "A" shares are now offered to shareholders at par. The "A" shares will be payable in full on application and will be allotted as soon as the debentures corresponding thereto become fully paid.

United River Plate Telephone Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum, free of tax, on the ordinary shares for the half-year.

Parsons Marine Steam Turbine Co., Ltd.—Total dividend for the year ended June, 1922, 12½ per cent. per annum, free of tax, carrying forward £20,210.

Trafford Park Estates, Ltd.—In their report for the year ended June last the directors recommend a dividend of 7 per cent. per annum, carrying forward £107,359.

Bromley (Kent) Electric Light and Power Co., Ltd.—Dividend at 5 per cent. per annum, free of tax, for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

Considering the shocks which the events of the past ten days have aimed at the nerves of peaceable folk, it is not a little surprising to find Stock Exchange prices exhibit steadiness in most departments. Naturally, the speculative stocks and shares gave way on sales by some of the more timid holders who deemed it discreet to get out before the skies fell, as the Stock Exchange phrases it. But apart from the gambling element, the principal markets sustained their prices without yielding more than small fractions in most cases, though Home Railway stocks dipped rather sharply, in consequence of selling by holders rendered apprehensive at the political outlook. The War Loan set the barometer in respect of investment issues, and as something like 65 million pounds sterling was released at the beginning of the week, through the repayment of National War Bonds and release of dividends, the market found a liberal supply of money awaiting employment in good stocks.

The way in which cheaper monetary conditions work is exemplified in the announcement that the Central Electric Supply Co. intends to pay off at 102 all the 8 per cent. notes, forming last year's issue of half-a-million pounds. These notes came out at 97 in April, 1921, and a premium was promptly established. Of late, they have been difficult to obtain, holders recognising that they have a first-class security. It may be shrewdly surmised that those holders will not be pleased at the company's determination to redeem the notes before the longest date of maturity, namely, April, 1926. The step, however, is obviously sound finance. It underlines the plain hints given in this column during the past few months that, with the increasing supplies of money, investors should carefully observe the conditions attaching to repayment of all these short-dated issues. Otherwise, buyers might be tempted to pay a higher price than they would do if they realised that companies in most of these cases possess the right to redeem their high-yielding obligations at short date.

The annual report of the Ministry of Transport is distinctly interesting, not only from the technical but from the financial point of view. The Minister states that it is generally realised that, with the increased efficiency of lamps, the consumer can afford to pay higher prices than hitherto for the supply of the current, and still be on the right side. This sounds a little paradoxical in these days when the prices of everything are being cut. Moreover, the leaders in the electricity world are looking well ahead to the time when they will be able to make concessions to their present customers. Sir Harry Renwick, in his address last week to the Provincial Electric Supply Association, said roundly that any over-charge for current was due more to an old Act of Parliament than to the companies concerned, and that he confidently looks for some probable lowering of rates in the near future.

The South-Eastern & Chatham Railway Co. is plainly told by the Electricity Commissioners that, by taking an outside supply instead of putting up its own generating station, the company would be relieved from incurring capital expenditure amounting to over a million pounds, and would also have the advantage of effecting an annual saving in the cost of energy. The Commissioners are satisfied that one or other of the three undertakings—the West Kent, County of London or London Electric—will be in a position to give the railway company the necessary supply when electrification is expected to be completed, on or before June, 1925. The construction of a power-supply station by the railway company is not essential to the scheme, and they add that the question of Government guarantee need be no obstacle in the way of proceeding with the electrification, apart altogether from the proposed power station. This is important, in that it admits the principle of companies being able to supply the necessary energy, and so saving the railways from needlessly spending money on the erection of power stations, &c. The decision establishes a precedent which will carry substantial weight when other questions of similar nature come up for consideration.

Brompton & Kensington ordinary shares are 10s. higher at 8½, this being the principal change amongst the shares in the electricity supply list. City Lights went back to 2 1/32, County of London new ordinary are 2s. 9d. premium, the preference 1s. 9d. premium. Indian stocks are dull: Madras Electrics eased off to 18s. 9d. There are talks in Calcutta Tramways second debentures at 96, Madras sevens at 94 and Indian Electric 5 per cent. tax-free debentures at 92. The nervousness aroused over Indian investments, in

connection with the Near East trouble, has not yet blown over; most securities connected with the Dependency are disposed to be heavy.

Amongst manufacturing shares, Electric Constructions [illegible] and General Electric ordinary at 18s. 6d. are a trifle lower. Siemens are nominally unchanged at 25s. 3d., but shares can be bought at the moment at 25s. 6d. British Insulated at 2 3/16 show a small fall.

There are no material changes amongst the cable manufacturing shares, and, in the group of cable stocks, the Eastern varieties maintain their prices. Anglo-American preferred is ½ down at 102; Indo-Europeans fell £1 to 33½. Marconis present a firmer appearance. The ordinary shares found support at 45s. and Marines at 27s. 6d. Radios [illegible] the preferred to 11s. Rumour is busy with whispers about the possibility of several subsidiary Marconi companies being likely to appear within the next few weeks. It has already been announced, of course, that the African Marconi is well developed. Now that the dispute between the Postmaster-General and the broadcasting companies has been patched up, there is likely to be more [illegible] the season of this trance, and the companies concerned should find considerable accession of orders as a result of their enforced abstention from noteworthy progress during the past few months.

Stocks and shares in the foreign divisions are steady. The rubber market shows an improving tendency, owing to the fact of rubber moving up a trifle. Engineering shares are quiet, and there is nothing much doing in the armament varieties. Anticipated new issues are held back, for the time being, by the financial hesitation engendered by Greece, Turkey and another country.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Oct. 3, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	8⅝	+ ⅛	£7 1 2
Charing Cross Ordinary	8	8	7⅞	—	5 17 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6¼	—	4 16 0
City of London	14	14	2½	— ½	6 18 0
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	12	—	5 16 4
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7⅜	—	6 13 4
London Electric	2½	4	2⅜	—	4 11 5
do. do. 6 per cent. Pref.	6	6	6	—	5 17 1
Metropolitan	7	7	6	—	5 16 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9	—	6 13 4
South London	7	7	4	—	7 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅜	—	6 11 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	102	— ½	5 17 8
do. Def.	1½	84/6	23½	—	7 8 6
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 9 8
Eastern Extension	10	10	18⅝	— ⅛	5 7 5
Eastern Tel. Ord.	10	10	186½	—	5 7 3
Globe Tel. and T. Ord.	10	10	18⅜	—	5 6 8
do. do. Pref.	6	6	11¼	—	5 5 4
Great Northern Tel.	24	22	24½	— ½	7 18 0
Indo-European	10	10	33½	—1	7 9 3
Marconi	25	16	2½	—	6 6 4
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	6⅜	—	*5 18 6
West India and Panama	Nil	Nil	6/-	—	Nil
Western Telegraph	10	10	18⅜	—	*5 8 1
Home Rails.					
Central London Ord. Assented	4	4	87	—	5 19 5
Metropolitan	1½	2½	66	—1	4 0 4
do District	Nil	1	41	—1	2 6 6
Underground Electric Ordinary	Nil	Nil	2⅛	— ⅛	Nil
do. do. "A"	Nil	Nil	7/6	—6d.	Nil
do. do. Income	2	4	87½	—1	*4 13 7
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	8⅞	—	8 0 0
do. do. 2nd Pref.	Nil	5½	84⅜	—	7 0 9
do. do. 5 per cent. Deb.	5	5	80½	+2	6 4 3
Brazil Tractions	Nil	Nil	47	—2	8 10 2
British Columbia Elec. Rly. Pref.	5	5	76½	—	6 9 9
do. do. Preferred	5	98/-	66	—	*7 1 8
do. do. Deferred	8	124/-	71½	—	*8 12 6
do. do. Deb.	4½	4½	75xd	—	5 18 1
Mexico Trams. 5 per cent. Bonds	Nil	Nil	70½	—	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	41½	—	Nil
Mexican Light Common	Nil	Nil	19½	—1	Nil
do. Pref.	Nil	Nil	40½	+1	Nil
do. 1st Bonds	Nil	5	84½	—	7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	15	21⅝	—	5 12 3
British Aluminium Ord.	10	5	17/9	—	5 12 8
British Insulated Ord.	15	15	2 3/16	— ⅛	6 17 0
Callenders	15	15	2⅛	—	6 17 0
6½ Pref.	6½	6½	1⅜	—	5 15 7
Crompton Ord.	10	5	16/-	—	6 18 1
Edison-Swan	10	Nil	8/-	—	Nil
do. do. 6 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	25/6	+6d.	7 17 0
English Electric	8	5	15/0	—6d.	6 7 0
do. do. Pref.	6	6	1	—	6 0 0
Gen. Elec. Pref.	6½	6½	21/3	—	6 2 4
do. Ord.	10	5	18/6	—6d.	5 8 1
Henley	15	15	2½	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1½	—	—
Met.-Vickers Pref.	8	8	9½	—	6 8 0
Siemens Ord.	10	10	25/9	—	*7 15 4
Telegraph Con.	20	20	26⅞	—	*4 18 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

Wednesday, October 4th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	7½d.	...
a Ammoniac, Sal ... per ton	£63	...
a Ammonia, Muriate (large crystal) ,,	£48	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ,,	£30	...
a Copper Sulphate ... ,,	£26 10s.	...
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a ,, Perchlorate ... ,,	7½d.	...
a Shellac ... per cwt.	£14 15s.	25s. dec.
a Sulphur, Sublimed Flowers ,,	£10 10s.	20s. dec.
a ,, Lump ... ,,	£10	20s. dec.
a Soda, Chlorate ... per lb.	3½d.	...
a ,, Crystals ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£100	...
b ,, Wire ... per lb.	1/9 to 2/6	...
b ,, Sheet ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£154	£4 inc.
Grade II ... ,, ,,	£111	£3 inc.
Grade III ... ,, ,,	£63	£1 inc.
c Brass (rolled metal 2' to 12' basis) per lb.	9¾d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ... ,,	9¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£96	£2 inc.
c ,, Sheet ... ... ,,	£96	£2 inc.
c ,, Rod ... ... ,,	£96	£2 inc.
d ,, (Electrolytic) Bars ... ,,	£72 10s.	20s. inc.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£82 10s.	20s. inc.
d ,, ,, H.C. Wire per lb.	10½d.	½d. dec.
f Ebonite Rod	3/6	...
f ,, Sheet	3/-	...
n German Silver Wire	2/6	...
h Gutta-percha, fine	12/6	...
h India-rubber, Para fine	10½d.	...
l Iron Pig (Cleveland Warrants) ... per ton	92s. 6d. to 96s.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£24	...
g Lead, English Pig ... ... ,,	£26 5s.	20s. inc.
g Mercury ... ... per bot.	£13 5s.	10s. to 15s. inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/1	...
p ,, drawn bars and rods ,,	1/3	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... per lb.	1/1	...
r Steel, Magnet, in bars ...	1/-	...
n Tin, Block (English) ... ... per ton	£162 15s.	65s. to 70s. inc
n ,, Wire, Nos. 1 to 16 ... per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r. W. F. Dennis & Co.

Electric Vehicles for Refuse Collection.—Further testimony to the money-saving attributes of the electric vehicle for the collection of refuse appears in the September issue of *The Electric Vehicle*. The Cleansing Superintendent of Grimsby provides figures showing that the costs per ton collected were as follows:—1921: Electric vehicle, 9s. 7¼d.; own horses, 12s. 1d.; hired horses, 12s. 9¼d. 1922: Electric vehicle, 8s. 11¼d.; own horses, 11s. 6¾d.; hired horses, 12s. 1¾d. This shows a total annual saving by "electric" over hired horses of £2,600, and over own horses of £2,149. At Islington, according to the Cleansing Superintendent, the cost of horse-collection per ton was, in January, 1922, 14s. 11d. Collection by electric vehicle cost 12s. 1¾d. per ton. The Islington Council has built a garage to house 12 electric vehicles at a cost of £5,708; another building, costing £20,000, is also being erected for the accommodation of 22 vehicles. Generating plant, charging panels, &c., have been installed at an outlay of £4,851. There are five charging panels, each capable of charging two vehicles at a time. The five generating sets are each capable of giving a maximum output of 150A at any desired voltage between 90 and 115.

The Effect of Impurities on Storage Batteries.—According to Miss H. C. Gillette, in the *Electrical World*, experiments on the effect of metallic impurities on the performance of lead storage batteries show that manganese, cadmium, antimony, and platinum are highly detrimental to the life of the plates. Hydrochloric and acetic acids are also very injurious. In view of the common use of the cadmium electrode in testing cells, the detrimental effect of cadmium is noteworthy.

THE BRITISH ASSOCIATION.—V.

The Use of Electricity in Nitrogen Fixation.

Section B.—Chemistry.

A discussion on the nitrogen industry, before Section B, on September 12th, brought out some interesting facts and expressions of opinion with regard to the application of electricity to the industry. Four papers were read, dealing with various aspects of nitrogen fixation, the first being "Post-War Progress in the Fixation of Nitrogen," by Dr. J. A. Harker. The author dealt at some length with the arc process, which was put into commercial operation in Norway as long ago as 1904, and has now reached an enormous development. Although the power requirements of this process are very large, it nevertheless affords the cheapest known method for the manufacture of nitric acid. Dr. Harker was desirous that it should be fully recognised that the arc process, in its industrial form, owes its initiation in a very great measure to scientific researches carried out mainly by British investigators. At Notodden, in Norway, plant is now installed to utilise about 45,000 kW, and in the two great works at Rjukan there are furnaces in operation employing, in all, over 200,000 kW, or 270,000 continuous h.p. At Rjukan II a 15,000-kW steam-operated set has been added to utilise waste steam raised in the boilers employed in the cooling of the process gases. Though the arc process has now reached the stage of a magnificent engineering achievement, less than 2 per cent. of the electrical or heat energy expended in the average arc furnace is absorbed as chemical energy in the initial oxidation of the nitrogen. The concentration of nitric oxide in the gases leaving the furnace averages only about 1.2 per cent., and therefore it is not surprising that many suggestions have been made for the improvement of the efficiency of the process. About 14 arc plants of various types are now distributed throughout the world, one being an experimental plant of about 300-kW capacity, which was erected at a munition works at Birmingham on the Kilburn-Scott system. Enriched air, instead of common air, has been used on a considerable scale by a company operating works in Switzerland and in Germany. The oxygen content of the air utilised is increased to 50 per cent., and to prevent loss of oxygen, the whole operation is carried out in a closed circuit. The product, instead of being absorbed in towers, is generally removed by cooling, as liquid nitrogen peroxide. Although under certain conditions the increase in yield of fixed nitrogen obtained from the enriched air was considerable, and although many tons of liquid NO_2 were made by the process, certain serious difficulties were encountered, and several explosions have recently occurred in these works, the power being employed for railway purposes. The chief developments of a number of other processes were then dealt with briefly, among them being the Casale process, which is now running in Italy, the hydrogen being obtained electrolytically from large cells of a new type operated with hydro-electric power. Some of this hydrogen is burnt with air and thereby the required mixture of hydrogen and nitrogen is produced. There is good reason to believe that, under present conditions, with the much higher price of coke now prevailing, hydrogen produced in bulk at favourable sites from cheap hydro-electric power will easily be able to compete with that obtained by other methods. To ensure this, however, the type of cell employed requires to be much cheaper. In conclusion, the author referred to the internal capacity of Germany for the production of fixed nitrogen, which, at the end of this year, will reach about 500,000 tons annually.

In a paper on "Raw Materials for Synthetic Ammonia: the Manufacture of Hydrogen and Nitrogen," Mr. J. H. West called attention to the high cost of electrolytic hydrogen. The two main sources of commercial hydrogen are coal and water. Various methods of hydrogen production were discussed, among them being the method of obtaining it from water by electrolysis. Although the resulting gas from this method is very pure the capital cost of the plant is very high, amounting to not less than £5 per electrical h.p. of battery installed, together with another £2 10s. for rotary converters. Even these figures can only be realised on extremely large plants, where cells taking from 10,000 to 15,000 A each are used. The amount of electrical energy required to produce hydrogen in large quantities is also very great, amounting to over 7,000 kW per million cu. ft. of hydrogen produced per 24 hours. It is only in exceptional cases, therefore, where very cheap hydro-electric power is available, that electrolytic hydrogen can be considered.

Capt. C. J. Goodwin, in a paper on "The Häusser Process of Nitrogen Fixation," referred to the "economic failure of the arc process." He was of opinion that the solution of the nitrogen fixation problem is unlikely to be attained by any single method; each one must play its part. The economic failure of the arc process, he said, except under exceptionally favourable conditions, will restrict its future to relatively small dimensions. The explosion process seemed to him to be the only one which will render it possible economically to manufacture nitric acid by a direct process. A well-designed Häusser plant requires no external energy, the motive power for compressors, pumps, &c., being fully covered by suitable [illegible] plant.

From the [illegible] point of view the [illegible] appear to be a little [illegible] paper on "Some Aspects of the Relation between Water Power and Nitrogen Fixation." The [illegible] any of the three principal processes, namely, by the synthesis of nitric oxide in the high-pressure arc flame, by the production of calcium cyanamide, and by the synthesis of ammonia involves in each case two [illegible] materials. The predominance of the one or the other of these factors will determine, not only the most suitable site for the operation of the process, but also the economic practicability of the method of fixation under given geographical and mineralogical conditions. Under British conditions it is probable, save, perhaps, for the manufacture of nitric acid as such, contrasted with the broader problem of fixed nitrogen for agricultural purposes, that only two of the three processes, *i.e.*, the manufacture of calcium cyanamide and the direct synthesis of ammonia, are economically possible. The author then discussed a number of points connected with the relationship of these processes to hydro-electric power, with especial reference to the position in Great Britain. The synthesis of ammonia itself, he said, might be regarded as economically independent of cheap power, were it not that the hydrogen employed as a necessary raw material may be [illegible] by two types of process, namely, from fuel (by way of water and gas), or electrolytically, in which case it may be translated directly in terms of power, the hydrogen being regarded substantially as water, plus the energy required for its decomposition. Water resources, estimated to be capable of producing some 250,000 kW, were examined in detail by the Water Power Resources Committee of the Board of Trade in a recent survey of the potential resources of Great Britain. This figure was not exhaustive, and excluded the Severn Estuary scheme. By far the larger proportion of potential water power sites of any considerable magnitude are located in Scotland. An important factor is the maximum power available at a given site, and of the ten Scottish sites reported on favourably by the Committee's engineers only one is estimated to produce over 30,000 kW, and only two over 20,000 kW. The total power potentially available from the ten sites is about 100,000 kW. In Wales five sites were reported on favourably, of which only one was estimated to have a potential output greater than 5,000 kW. This is important, since sites capable of producing less than about 10,000 kW are not suitable for the production of cyanamide or carbide at the lowest possible rates. The cost of power will depend principally on the interest charged on capital cost. An average figure for the capital cost of installation (which will vary from site to site) at the ten Scottish sites considered by the Committee is estimated to be about £30, on a pre-war basis, for each kW installed, at any rate, for the larger sites. Apart from interest on capital, operating and other costs are relatively low, about 3 per cent. of the capital cost per kW being quoted as a conservative estimate in the case of an installation of 10,000 kW or over. Under present conditions it should be possible to produce power from several of the more suitable sites for about £4 or £5 per kW year. If hydro-electric energy can be obtained at £5 per kW year, then, on the basis of a power consumption of about 155 kWh per thousand cu. ft. of hydrogen generated by electrolysis (a figure in accordance with results obtained in practice—the cost of power should be about 1s. 7d. per thousand cu. ft. of hydrogen, the oxygen being regarded as possessing a problematic value, which, for the purpose of this calculation, has been set down as zero. In this country it would appear that a sufficiently strong case may be established for the generation of hydrogen by electrolysis to warrant, at any rate, a careful examination of the method side by side with that of producing hydrogen from fuel. The principal drawback of the electrolytic process consists in the relatively large floor space required, and in the multiplicity of cells necessary. These disadvantages are being met, to a certain extent, by the introduction of large-unit cells. Dr. Maxted then considered the problem from a slightly different aspect. In the first place, he assumed that power of a given magnitude, say 10,000 kW, was available at a certain site, and that this power was utilised completely; first, for the synthesis of ammonia—the hydrogen being generated electrolytically—and secondly, for the production of calcium cyanamide. In the first place some 5,000 to 5,500 tons of nitrogen per annum could be fixed as synthetic ammonia, about 7,500 to 8,000 kW of the 10,000 kW being used for electrolysis, 1,000 kW for compression, and the remainder for other purposes, including the separation of the requisite nitrogen by a low temperature process from air. Under such conditions the bulk of the power would be used for electrolysis. If, on the other hand, the 10,000 kW were used for the fixation of nitrogen as calcium cyanamide, the weight of nitrogen capable of being fixed per annum would be more or less the same, the important difference being, however, that in the case of synthetic ammonia some 33,000 cu. ft. per hour of waste oxygen would be available from the hydrogen-nitrogen plants, assuming the latter gas to be separated from

as in a process of low temperature separation, whereas, in the case of a cyanamide plant, the whole of the coal and lime required would have to be brought to the factory site and there handled. Costs would be balanced, to a certain degree, by the greater simplicity of the cyanamide method.

In the course of a short discussion Mr. E. Kilburn Scott asked what was the cause of the explosions Dr. Harker had mentioned in connection with the arc process using enriched air. He believed that the real solution of the nitrogen fixation problem was a combination of existing processes. In defence of the arc process he mentioned the case of a large engineering firm in this country which had been investigating a site in Scotland which would give about 10,000 kW. In considering the process to be used it had had due regard to the economic and engineering possibilities of each, and had decided to use the arc process. Energy could be provided on the site mentioned at £4 per kW year. Dr. Harker, replying to Mr. Kilburn Scott's question, said that the explosions mentioned were caused by contact between the NO_2 and the organic liquids employed for cooling.

Applications of Psychology to Breakage Problems in Industry.

By George H. Miles, D.Sc. (*Abstract*).

Section L.—Psychology.

This paper was a report upon investigations into the causes of accidents and carelessness in industry, and applied not only to material damage but also to accidents in which human lives were involved.

The author stated that the economic loss due to the large number of small accidents was "appalling," and the community paid the price of the loss of time and labour. Among the principal causes of these accidents were defective lighting, temperature, but above all inexperience. Workers required careful training and adequate protection. Three-quarters of the deaths in industry could be prevented, and in the same way it was possible to reduce material damage. It had been shown that the most efficient safety work had been accompanied by organisation and education to the extent of two-thirds, only one-third being accounted for by mechanical safeguards; this proved the importance of the psychological factor. Fatigue was an important cause of accidents; this could be mitigated by removing causes of distraction, irritation, and excitement. An attempt was made to ascertain from workers some explanation as to how direct breakages occurred, but with little success; the explanation of "carelessness" by the non-psychological person was very far from the truth. Each place where a jar or a clash might occur was a "danger point" and should be properly dealt with. The author illustrated this by examples of the prevention of clashing, which eliminated irritation to the employé, and incidentally speeded up production, and he also mentioned one or two very small improvements which produced beneficial results. In one case articles had to be placed in a rack and it was found that by painting the partitions of this a lighter colour the work of quickly placing the articles in position was assisted. By a number of similar minor adjustments a saving of 10 per cent. in time was effected, and what was more important, there was a considerable reduction of annoyance and irritation. Apart from the improvement of fixtures, an endeavour was made in the same factory to improve the "human" factor by substituting signalling and indicating systems in place of the employés' calling out to one another.

In other directions improvements were made; for example, workers were screened from undue heat, heights of benches were altered, &c. The effect of these improvements upon breakages was shown by a reduction of the percentage which varied at different times of the day; in one period, from noon to 2 p.m., a reduction of from 3.3 to 1.8 per 1,000 was shown, and the reduction was much greater towards the end of the day.

The author stated that by careful investigation and the removal of many underlying causes, a reduction in breakages amounting in the case of some articles to over 70 per cent. had been effected, and he was convinced that it was equally possible to reduce the colossal waste in other branches of industry if full consideration were given to the psychological factors involved. Industry would be well repaid, and employer, worker, and consumer would benefit.

The Atoms of Matter.

By Dr. F. W. Aston, F.R.S.

On September 12th, Dr. Aston gave a popular evening discourse on the above subject and mentioned many recently-discovered facts which savoured of the miraculous. To give his audience an idea of the diminutiveness of the atom, he said that if atoms of air were allowed to stream through a very small aperture into an exhausted electric lamp bulb at the rate of a million per second it would take a million years to fill the bulb. A helium atom projected as a high-velocity α ray through a radio-active substance might travel so rapidly as to cause a distinct flash when it struck a zinc-blende screen. Referring to the transmutation of the elements, Dr. Aston said that the conversion of four grammes of hydrogen into one gramme of helium would involve the destruction of .008 gramme of matter. This would liberate a vast amount of energy. It had been calculated that if the hydrogen in a tablespoonful of water was transmuted into helium, the equivalent of 200,000 kWh of energy would be set free. He reassured his audience, however, that before the means of liberating this energy was discovered a way of controlling it would be found.

ELECTRICITY SUPPLY FOR THE SOUTH-EASTERN AND CHATHAM RAILWAY.

Application for Consent to Establish Generating Station at Angerstein's Wharf.

A supplementary statement dated September 27th, 1922, has been issued by the Electricity Commissioners, in which they state that in a previous announcement,* dated August 21st, 1922, they set out the broad conclusions they had arrived at as the result of the public inquiry held by them into the above-mentioned application. At that inquiry the Railway Co. pressed strongly for consent to the erection by it of a generating station at Angerstein's Wharf, but indicated that it was prepared to consider taking a supply for its railway electrification scheme from an outside source subject to satisfactory guarantees as to cost, reliability of supply, and time of delivery. The Commissioners postponed their decision on the application in order to afford those concerned a further opportunity of entering into negotiations and discussing the actual terms of a firm contract for a supply to the Railway Co., including a guarantee to indemnify the Railway Co. against loss in the event of the supply not becoming available by the required time. The Commissioners further expressed the opinion that if the negotiations were conducted in a spirit of mutual goodwill, the terms of such a contract could be adjusted without undue difficulty.

Since August 21st renewed offers have been made to the Railway Co. by the West Kent Electric Co., Ltd., and the County of London Electric Supply Co., Ltd.; an offer has also been made by the London Electric Supply Corporation, Ltd. On September 8th, however, the Railway Co. informed the Commissioners that "the directors had unanimously resolved that no satisfactory agreement with either of the three companies could be arrived at."

The Commissioners have further considered the whole matter, and have decided to refuse their consent to the erection by the Railway Co. of the proposed generating station at Angerstein's Wharf.

At the public inquiry previously referred to, only outline plans of the proposed station were submitted by the Railway Co. In the announcement dated August 21st it was pointed out by the Commissioners that the proposed design was impracticable for a station of an ultimate size of 150,000 kW.

The Commissioners also came to the conclusion that it had been proved that there were authorised undertakers willing to give the Railway Co. an adequate supply of electricity at a cost not greater than would have been incurred by the Railway Co. in supplying itself.

The revised offers made to the Railway Co. since August 21st by the West Kent Co. and the County of London Co., and the offer made by the London Electric Supply Corporation, Ltd., have been examined by the Commissioners. The terms contained in the two revised offers are more favourable to the Railway Co. than those previously put forward at the inquiry, and the terms offered by the London Electric Supply Corporation are also favourable to the Railway Co. The Commissioners are thus confirmed in their conclusion quoted above.

With regard to the question whether any of the undertakers concerned is or will be in a position to give the Railway Co. the requisite supply in accordance with the proviso to Section 11 of the Electricity (Supply) Act, 1919, the Commissioners have satisfied themselves that no particular obstacles stand in the way and that one or the other of the undertakers in question will be in a position to give the necessary supply by the date when the electrification of the suburban lines is expected to be completed, namely, on or before June 30th, 1925. Two of the offers relate to supplies at a frequency of 25 cycles, and the other offer to a supply

* Electrical Review, September 1st, 1922, p. 321.

at 50 cycles. The Railway Co., at the public inquiry, expressed a preference for a 25-cycle supply, but from the technical point of view a supply at 50 cycles is also practicable, owing to the adoption by the Railway Co. of a direct current system of electrification.

On the question of a guarantee to the Railway Co. against loss arising from failure to give a supply by the due date, two of the offers are supported by letters from one of the leading banks in the country, stating that the bank would be quite prepared to give a guarantee subject to the form thereof being satisfactory; and in the other case the company undertakes to satisfy the Railway Co. as to the guarantee of payment of penalties. The Commissioners understand that the Trade Facilities Act Advisory Committee would be willing to adopt an arrangement the effect of which would be that in the event of the supply of electricity not being available by June 30th, 1925, the obligation of the authorised undertakers concerned would be substituted for that of the Railway Co. in respect of loan charges during the period of default. The Commissioners are satisfied that no greater risks would be run by the Railway Co. in taking an outside supply than in proceeding with its own station. Moreover, by taking an outside supply the Railway Co. would be relieved from incurring capital expenditure amounting to over £1,000,000, and would also have the advantage of an annual saving in the cost of energy, which the Commissioners are satisfied is possible under the offers made to the Railway Co.

In the first instance the power station was not regarded by the Railway Co. as an essential feature of the electrification scheme, and it was admitted in evidence that on technical grounds alone there was no objection to an outside supply. The Commissioners are satisfied that the electrification scheme could be carried out without detriment to the Railway Co. if reliance were placed upon a supply of energy from an outside source, and that the construction of a power station by the Railway Co. is not essential to the scheme.

The Trade Facilities Act Advisory Committee foresees no difficulty or delay in adjusting the Government guarantee to cover the railway electrification scheme only, subject to a satisfactory assurance from the Commissioners that the supply of energy required by the Railway Co. will be forthcoming when required.

Having regard, therefore, to the evidence given on behalf of the Trade Facilities Act Advisory Committee, to the fact that the Commissioners are satisfied that the conditions as to an outside supply laid down in Section 11 of the Act of 1919 can and will be fulfilled, and to the further fact that the Commissioners are prepared so to advise the Trade Facilities Act Advisory Committee, the only conclusion possible to the Commissioners is that the question of the Government guarantee need be no obstacle in the way of proceeding with the railway electrification scheme, apart altogether from the proposed power station.

The Commissioners have considered the bearing of the Railway Co.'s proposal upon the question of the re-organisation of electricity supply, and on the policy underlying the various schemes contemplated in this connection, including the scheme for the London and Home Counties Electricity District. After reviewing the recommendations of the Electric Power Supply Committee of the Board of Trade in 1918, endorsed by Parliament when the Electricity (Supply) Act, 1919, was enacted, the Commissioners state that the pooling of the Railway Co.'s supply and that of other classes of consumers would constitute an important contribution towards the centralisation of generation in Greater London, and the advantages due to saving in capital expenditure, increased efficiency (and hence lower cost) of generation, and enhanced reliability of supply consequent upon the eventual interconnection of the principal stations forming the centralised system, would be to the benefit not only of the Railway Co., but also of other classes of consumers supplied from the central system. To these advantages must be added the national gain by the saving in fuel consumption.

The proposal of the Railway Co. at this juncture to erect its own generating station, thereby involving the forgoing of all the benefits to be derived from the pooling of supplies and the centralisation of generation for all purposes, is not only contrary to the views to which railway engineers and railway companies have expressed their adherence, but is in direct conflict with the fundamental basis upon which the re-organisation of electricity supply must proceed.

Unless it were proved to their complete satisfaction that no alternative was possible, the Commissioners could not, with proper regard to their statutory duties, sanction in the present case a course of action which would be prejudical to the re-organisation of supply in Greater London, and probably in other districts also. Thus, the considerations bearing upon policy and the re-organisation of supply only serve to strengthen the conclusion of the Commissioners that consent to the Railway Co.'s application ought not to be given.

Low Temperature Carbonisation.—A party of French engineers recently paid a visit to the works of Low Temperature Carbonisation, Ltd., near Barnsley. It is proposed to erect similar works in the Sarre Valley.

THE PROVINCIAL ELECTRIC SUPPLY COMMITTEE.

Annual Meeting.

The annual meeting of the Provincial Electric Supply Committee of the United Kingdom was held on Tuesday, September 26th. Sir Harry Renwick, K.B.E., presided. The present executive committee was re-elected en bloc for the ensuing year, and a general discussion took place on matters affecting provincial companies.

In the course of his speech the chairman said that they had now, he hoped, seen the end of general electricity supply legislation, and might look forward to some relief from the anxieties inseparable from Parliamentary proceedings. In all these proceedings, covering a period of over three years, the Association had taken an active part and laboured incessantly in their interests, with a result which he was sure was not altogether disappointing.

The new Act contained several clauses of considerable benefit to provincial companies, for which the Association consistently pressed the Electricity Commissioners. One of these was the revision of prices, which very closely concerned all their companies; the other was that of enabling certain companies which had been hitherto debarred from doing so to obtain an increase of price under the Electric Lighting Acts. Another very important feature was the provision by which, with the concurrence of the local authority concerned, the Commissioners could grant an extension of tenure. Potentially this was of immense value, particularly seeing that it could be effected by the Commissioners without a special Act of Parliament. There was, he thought, no doubt that if a company could show the Electricity Commissioners that by an increase in tenure it would be able to give some substantial *quid pro quo* and the local authority concurred, the Commissioners would readily grant such extended tenure. The handicap of a limited tenure meant that no company was in a position to supply the public as cheaply as if it had had a really long lease; but the new Electricity Act amended this mistaken policy by giving facilities for removing the handicap, and directly this was done the companies would be in a position ultimately to effect a radical cheapening of supply. There was also an advantageous section dealing with wayleaves, and small companies were very specifically protected against any possibility of their being forced to take a bulk supply when they could themselves generate more cheaply. The trouble with most small companies was certainly the other way about, namely, they could not get a bulk supply at any price. Certain of the provincial companies had very materially benefited by the Trade Facilities Act. A proposal made by Mr. Scott at the last meeting was to try to obtain from the Trade Facilities Committee financial support for the smaller electricity companies which could not for various obvious reasons find capital themselves, and in return unemployment would be relieved in the districts in which the companies were operating. They interviewed the Committee, and were most cordially received, and a very considerable sum was for the time being ear-marked for the use of their companies. A certain number of companies made application, and those who came to terms had the loan at their disposal. Assistance was afforded to the North Somerset Company, the Minehead Company, and the Egham and Staines Company. Public utility companies were exempted from payment of the Corporation tax for three years, and this exemption would have finished in December, 1922. They made a good fight to get the exemption continued, and achieved their end; they were free from this trouble for another three years. The National Council very wisely formulated a general reduction in wages to keep pace with the fall in the cost of living. A number of reductions had taken place, and everything seemed to have worked very smoothly. Throughout their work on the Whitley Council they had tried to protect their smaller companies as much as possible. As regarded technical staffs, up to the present all undertakings under 1,000 kW did not come under the schedule of wages and working conditions formulated by the National Board.

With regard to their small companies generally, the fact that these had their own special interests had led them to create a small sub-committee, of which Mr. Edwards was chairman, and among matters which the committee had dealt with was that of overhead mains. The activities of the Executive Committee were pretty wide, and it was in touch with all sections of the industry and other organisations likely to further their interests. In connection with these outside activities, they were much indebted to Mr. Gripper, and to Messrs. Spencer Hawes and Jackson. He was a firm believer in the future of the electricity supply industry of this country; the demand for electric energy in the future for all purposes promised to be on an enormous scale, the extent of which very few of them were able to estimate to-day, and the golden age of electricity was not far distant.

THE WIRELESS EXHIBITION.

The First All-British Show.

Few [illegible] have aroused more universal interest than the [illegible] Improvements have followed one another in rapid succession, and "broadcasting" [illegible] development—because of its popular appeal, has created a widespread demand for authentic information on the subject of wireless.

No means could be found of dealing with this desire than the All British Wireless Exhibition and Convention at the Horticultural Hall, Westminster. The organisers, Messrs. Bertram Day & Co., Ltd., have secured the whole-hearted support of the trade, and this exhibition is undoubtedly the most representative gathering of wireless interests ever held in this country.

From the public point of view, this exhibition will provide a unique opportunity of obtaining a useful insight into the possibilities of wireless as a means of instruction and recreation. The most recent advances in the transmission of music, song, and speech are demonstrated, and the exhibits include a display—in many cases for the first time—of wireless instruments and accessories by over fifty well-known British manufacturers and suppliers.

In connection with this exhibition a convention is being held under the auspices of the Wireless Society of London. The latter is the official society for the promotion of wireless among amateurs, and has a large number of London and provincial affiliated societies and clubs. This society has arranged a series of daily lectures with the object of rendering the public all possible assistance in selecting the type of apparatus most suited to their requirements.

A special feature of the exhibition is a demonstration stand, where the public can "listen-in" to various transmissions originating at Marconi House on behalf of the British Broadcasting Co. and experience at first hand the pleasure to be derived from the forthcoming official broadcast programmes.

It is worthy of note that, with the exception of one or two stands devoted to technical publications, the exhibits are confined *exclusively to wireless apparatus* or machinery.

The exhibition was opened on Saturday by Sir Henry Norman, M.P., and will remain open for a week; the show, said Sir Henry at the inaugural luncheon, marked the advent of broadcasting. There were those who looked upon it as a fad that would amuse the public for a time and then be dropped like other "passing stunts." They were wrong. Broadcasting was destined to become as integral a part of our social life as the ordinary telephone and, so far from being a passing craze, he was convinced that few had yet imagined the scope and importance of its applications.

Following the announcement of the Postmaster-General, in May last, that a broadcasting scheme was to be instituted in this country, public interest in wireless telephony, stimulated by the Press and manufacturers, reached a pitch bordering upon excitement. This has somewhat subsided owing to the delay which has been inevitably caused by discussions between the authorities concerned, but there is no doubt that the actual commencement of the national broadcasting stations will cause a re-awakening of that interest. In the meantime, the activities of the manufacturers of radio apparatus would seem to have assured the full satisfaction of the present and anticipated demand. A number of the larger electrical manufacturing concerns have formed new departments, and have put down special plant to deal with what is practically a new industry; and numerous companies have been formed for that specific purpose.

The aim of all those who have embarked on this new venture has been to produce apparatus which, to employ the familiar *cliché*, "a child can use" and graded from the simple, inexpensive, crystal set to the elaborate cabinet of "classic" design. A large number of receiving sets are on view at the show, greatly varying in price, type, and radius of reception. With the cheaper sets, ear pieces are required, but the more expensive apparatus is provided with loud speakers, by means of which the received speech, music, &c., can be heard in any part of a room. Some of the loud speakers are elaborate devices, while others are simply horns to which ordinary ear [illegible] are attached easily.

Probably one of the most interesting of the 55 stands comprises the space occupied by the Mullard Radio Valve Co., Ltd., on which a good selection of receiving, transmitting, and rectifying valves is to be seen, as well as unassembled parts for making head sets, condensers, transformers and complete receiving sets are also shown and in addition to the various types and sizes of glass valves, examples of the new metal and silica valves are displayed. It is of interest to note that the largest glass valve yet made is probably the one used in the stand 1-kW transmitting and 4-kW rectifying valves for receiving silica valves are to be seen. These have been made experimentally in sizes up to 10 kW.

Two stands are occupied by Messrs. C. F. Elwell, Ltd., and the Ediswan [illegible] Co., Ltd., in order that one stand may be reserved for the heavier apparatus, such as the "Aristophone," whilst small sets and components are shown on the other. On the one stand are displayed outfits suitable for drawing-room use, having specially designed cabinets which are accurate period reproductions and contain the whole of the wireless apparatus, including batteries and the "loud-speaker." The latter has several novel important features, being hand moulded of a special wood fibre compound to proportions which have been scientifically ascertained for the greatest purity of tone, resulting in a shape resembling that of the human ear. The wireless receiver is characterised by extreme simplicity, great care having been taken to give efficient working with an almost entire absence of adjustments.

One particularly interesting exhibit is a lacquer-work china cupboard and bureau of 1722 into which wireless apparatus

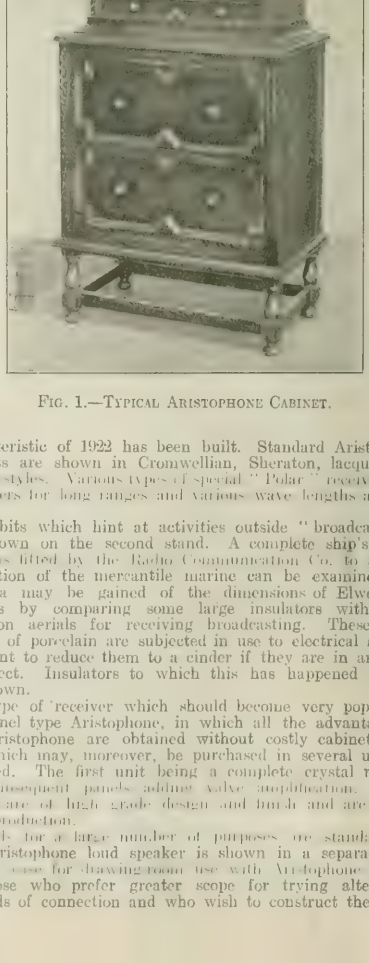


Fig. 1.—Typical Aristophone Cabinet.

characteristic of 1922 has been built. Standard Aristophone cabinets are shown in Cromwellian, Sheraton, lacquer and Adams styles. Various types of special "Polar" receivers and amplifiers for long ranges and various wave lengths are also shown.

Exhibits which hint at activities outside "broadcasting" are shown on the second stand. A complete ship's equipment as fitted by the Radio Communication Co. to a large proportion of the mercantile marine can be examined and an idea may be gained of the dimensions of Elwell land stations by comparing some large insulators with those used on aerials for receiving broadcasting. These large masses of porcelain are subjected in use to electrical stresses sufficient to reduce them to a cinder if they are in any way imperfect. Insulators to which this has happened in use are shown.

A type of receiver which should become very popular is the panel type Aristophone, in which all the advantages of the Aristophone are obtained without costly cabinet work and which may, moreover, be purchased in several units as required. The first unit being a complete crystal receiver and subsequent panels adding valve amplification. These panels are of high grade design and finish and are not a mass production.

Panels for a large number of purposes are standardised. The Aristophone loud speaker is shown in a separate mahogany case for drawing-room use with Aristophone panels. To those who prefer greater scope for trying alternative methods of connection and who wish to construct their own

sets without going into an unnecessary amount of bench work the "Radiocraft" exhibits will appeal. In these every part is substantially made and carefully finished.

Particularly deserving of inspection are the Elwell amplifying unit, "Bull-Dog grip" fittings for telephone cords; plugs and jacks specially designed for wireless purposes; an adapter for making use of a gramophone as a loud speaker; "Airspace" coils; and a beautifully moulded ball for variable couplings.

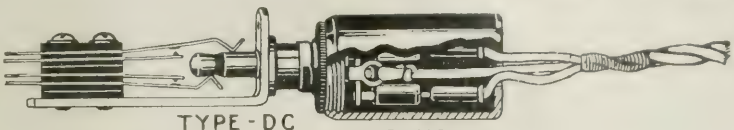


Fig. 2.—"Bull-Dog Grip" Fitting.

A typical "Bull Dog" fitting is shown in fig. 2; the grip plug enables the ends of standard telephone cords to be put into or taken out of the plug which fits both Elwell jacks and standard telephone jacks. This range of fittings has great usefulness in making off telephones and connecting them in series. Messrs. Elwell's products are of a superior nature and their cabinet receiving sets make excellent pieces of furniture in various woods. A useful device is produced by which a receiving panel may be connected to a gramophone tone arm; it replaces the sound box by an extra sensitive receiver unit in an aluminium body.

On the stand of the Chloride Electrical Storage Co., Ltd., will be found a range of batteries for every wireless purpose. A large series of low-voltage Exide batteries in celluloid boxes are on view. Of great interest to many wireless experts and amateurs are the various high-voltage sets. These comprise complete 24, 30, 50 and 60-volt sets in strong and neat wooden trays. Examples of individual h.p. cells are shown in ebonite, glass, and celluloid containers. Other exhibits of special interest include 6-volt 40-ampere-hour and 2-volt 40 ampere-hour celluloid sets as supplied to Messrs. Marconi's for the operation of Marconiphone sets—unspillable type accumulators—ship's wireless batteries, type PW, as supplied to Messrs. Marconi's. An interesting battery is the special XR type, supplied to the colonies for use with a new automatic wireless 'phone. In this new invention, the caller, on lifting his receiver, automatically rings his neighbour's call bell (perhaps some 30 miles distant) through the medium of this battery. Wireless enthusiasts should also make a point of seeing the special h.p. battery, fig. 3, the long thin plates of which are contained in a number of glass test tubes mounted on a wooden framework. This is a particularly neat and ingenious battery of a type that promises to become popular in the near future.

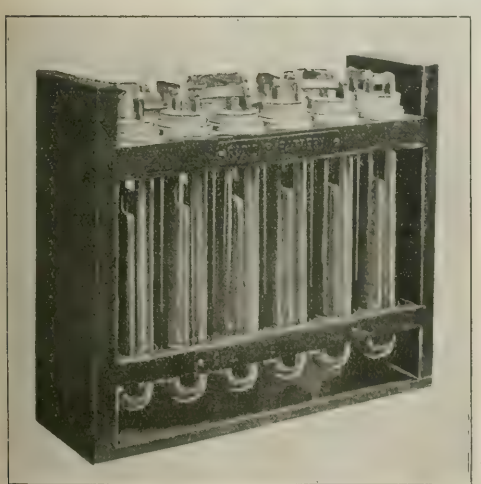


Fig. 3.—A 12-V Battery with Glass Test-tube Containers.

Sterling Telephone & Electric Co., Ltd., is exhibiting "Magnavox" loud speakers, power amplifiers, "Marconiphones," telephone head receivers, crystal receiving sets, accumulators, transformers, condensers, buzzers, valve sets, the tele-phonograph for transmitting gramophone [illegible] and the telemegaphone outfit for transmitting speech [illegible]

The [illegible] is a cheap and [illegible] about 10 miles with an external aerial and a suitable head telephone [illegible] A [illegible] designed for [illegible] as it has a range of [illegible] for the reception of matter from the proposed broadcasting stations. The [illegible]

A 1-valve set having a 100 mile range, for wave lengths of [illegible] valves operated by dry batteries are used, and the apparatus is so arranged that reception of other wave lengths than those specified can be provided for. A larger multi-valve, 100 mile range set is also supplied. The "Sterling No. 1" crystal receiving set has been specially designed for broadcasting programmes and has a tuning [illegible] and fine adjustments. Its range is 25 miles. The Sterling



Fig. 4.—"Magnavox Junior" Loud Speaker.

Co. has also brought out special telephone headgear for wireless purposes, with resistances ranging from 60 to 1,000 ohms per receiver. The firm also supplies "Magnavox" loud speakers and power amplifiers, by means of which wireless concerts, &c., can be given to audiences of several hundreds. The "Magnavox Junior" loud speaker is illustrated in fig. 4.

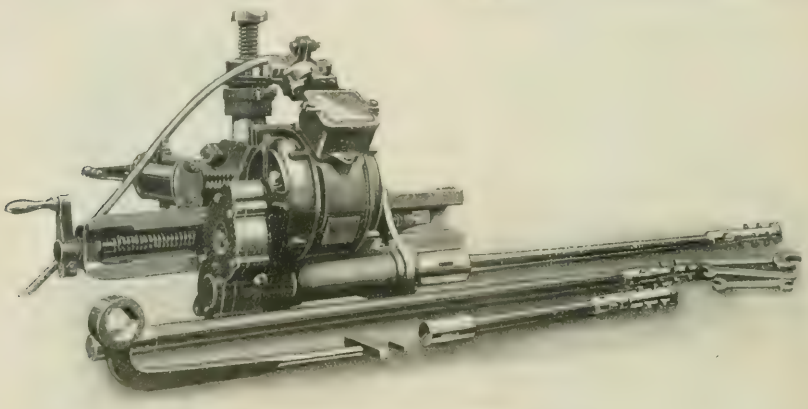
(To be continued.)

Lighting Plant in Mexico.—In view of the development of a number of local industries in Mexico, such as those devoted to fish canning, the manufacture of guayule (natural rubber), &c., this Republic offers a favourable field at the present time for small lighting plants. Among other towns which are in the market for such supplies is Puerto Vallart, in the State of Jalisco. The municipality is ready to [illegible] an installation of such a plant provided it can be shown that it would give a good return on the investment. The town is small, the population not exceeding 2,000, but a large number of industries are carried on locally, including [illegible] of coffee, corn, sugar cane, cocoa-nut and bean [illegible] The development of a fish-canning factory and other industries would be greatly encouraged, it is thought, were a suitable electric lighting and ice plant established.—*Reuter's Trade Service* (Mexico City).

A NEW ELECTRICAL COAL-CUTTER.

Since the advent of coal cutting by machinery many attempts have been made to devise a small machine for "heading" purposes, but previous to the introduction of the Hardy-Bedford electrically-driven machine, shown in the accompanying illustration, the only satisfactory "heading" machines were driven by compressed air. These worked by percussive action, and attempts have been made to utilise electricity by transforming the rotary motion of an electric motor into the reciprocating motion of the cutter by various means, but without much success. The main objection to compressed air driven heading machines is the enormous power consumption, as each machine requires approximately 25 h.p., which, allowing for compression losses, leaking pipes, and joints, may easily mean a total of from 30 to 50 h.p., whereas in the machine shown, which does exactly the same work, a small motor of *one-and-a-half* horse-power is all that is required.

In considering the problem the inventors abandoned the attempt to obtain a percussive action, and applied themselves to utilising the rotary motion of the motor, and the result is for all practical purposes the standard type of heading machine fitted with revolving cutters driven by a small electric motor, instead of percussive cutters driven by an air cylinder and piston. The machine is fixed to a column or standard provided with a screw jack and toothed head and foot, by means of which it is secured firmly between the roof and floor. Upon the standard is fixed a worm-wheel, and about this is clamped a patented ball-bearing attachment carrying the machine, and provided with a worm, gearing with the worm-wheel, which swings the machine in a circular motion. The motor and cutting rod is separately attached to a slide, fitted with a feed-screw, which moves the motor and cutters forward into the coal for cutting, or backward away from the coal, when the cut is completed. To start a cut the short bar fitted with cutters is fixed to the motor and fed forward by hand into the coal, and is then driven round by means of the worm and worm-wheel, thus cutting an arc-shaped undercut in the coal. When the cut is completed the cutter is withdrawn and brought back to the starting position, and driven forward into the coal again, and another cut is made with the aid of the worm and worm-wheel, until the depth of the undercut is equal to the length of the rod, after which a longer rod is fitted and the operation repeated, and so on until a depth of 4 ft. 6 in. is reached. The machine is then moved forward and another cut is started; or if only one cut is required longer rods are provided for the purpose of squaring out the corners, until a space of about 12 ft. to 15 ft. long by 4 ft. 6 in. in depth has been undercut.



The "Hardy-Bedford" Coal-Cutter.

Three cutting rods are usually provided, the first used being long enough to undercut to a depth of 1 ft. 6 in., the next to 3 ft., and the third to 4 ft. 6 in. The rods are fitted with cutters of various lengths, the newest type of cutter being shaped like the well-known "milling" cutter, and undercutting the coal to a height of about 3½ in.

As previously mentioned, the motor is of 1½ h.p., three-phase, and is made with a suitable voltage and periodicity to suit the colliery supply. It drives the main cutter shaft through a train of machine-cut gearing at a speed of 350 revolutions per minute. All the gearing runs in an oil bath, and is fitted throughout with ball-thrust and line bearings, thus reducing to a minimum the waste of power in friction.

The work done by this machine varies, of course, with the nature of the material [illegible], but in moderately hard coal a space of 60 sq. ft. can be undercut per hour, and in favourable ground as much as 120 ft. has been cut in the same time. This work is quite equal to that done by an air-driven machine, and considering the enormous difference in the cost of power, there can be no question as to which machine is the preferable to adopt; there is undoubtedly a great future before it. The weight of the complete machine is about 280 lb., and it can easily be dismantled, fitted, set up, and operated by two men. During cutting one man operates the machine whilst his assistant, with the aid of a scraper, removes the cuttings from behind the cutting tool.

The machine is manufactured by the Hardy Patent Pick Co., Ltd., of Sheffield, to whom we are indebted for the particulars embodied in this article, and who state that a number of these machines have been in regular use for from 18 months to two years, and have cost practically nothing for repairs, which conclusively proves that they are already beyond the experimental stage.

THE MACINTOSH SURFACE-WIRING SYSTEM.

The Macintosh Cable Co., Ltd., has put on the market a new and interesting surface-wiring system, which possesses a number of advantages which may appeal to the large body of engineers who frankly admit the demand for surface-wiring systems, to meet present-day conditions, but intensely dislike some of the features of the existing systems, and particularly the necessity for, and difficulty of, obtaining proper bonding.

The new system requires *no bonding*. It consists of two or more strands (or single wires) as required, embedded in a specially moulded strip of the Macintosh Cable Co.'s dielectric "Maconite"; the strip, which is illustrated in cross section in figs. 1 and 2, is so formed that the insulated conductors are held apart by a web, also of "Maconite."

The cable strip is secured in position by means of wood supporting bead strips, which are made to fit into the recess formed by the web, as illustrated. These supporting beads are drilled at stated intervals to take small nails or screws. There is no risk of the nail or screw penetrating the insulation of a conductor. The cable is protected throughout its length, and the beads can be painted, stained, or polished, to match any form of decoration, or can be supplied in fine woods to match natural wood decorations.

The supporting bead affords protection from injury, adds neatness, and obviates that bugbear of surface wiring, namely, sag between supports.

The junction box for the Macintosh wiring system (fig. 3) is made of non-hygroscopic, non-conducting, fire-resisting material, and contains four fixed connectors. To enable the cables to be taken in, four channels are left on the inside of the base, and these channels are arranged with thin blank ends, which can be removed as required with an ordinary penknife. It will be seen that holes need only be cut when they are actually required for the entrance of the cables, and when the box is fixed to the ceiling or wall the cables are firmly clamped in position. The lid of the box screws on in the ordinary manner.

It is claimed that the "Maconite" dielectric referred to above possesses some remarkable properties which previously have not been found in combination in any one substance; cables insulated with it have been in use for some years by the principal railway companies in this country in long tunnels where corrosive fumes and fluids are always present.

Briefly, it is stated that "Maconite" is a compound of

specially-selected materials scientifically blended, and is the outcome of many years' experiment and research on the part of the Macintosh Cable Co., Ltd., and the parent firm, Messrs. Chas. Macintosh & Co., Ltd., Manchester, the original patentees of vulcanised india rubber. In appearance and texture the material resembles a black rubber. In toughness it varies from something rather stronger than ordinary vulcanised insulating rubber up to a point not far short of that possessed by the tough rubber used for sheathing. It must not, however, be confused with these productions, in which mechanical strength is the predominant factor. It also possesses elasticity and durability to a marked degree.

Whilst the measurable insulation of "Maconite" is lower than that of some vulcanised rubbers, it is claimed that this insulation resistance is constant, and is unaffected by prolonged immersion in water or even in a saturated solution of caustic soda. Furthermore, its dielectric strength, *i.e.*, resistance to breakdown pressure, is high under ordinary, and many extraordinary, conditions of use.

In addition to the experience and information as to the value of "Maconite" obtained during the last few years through

Fig. 1.

Fig. 2.

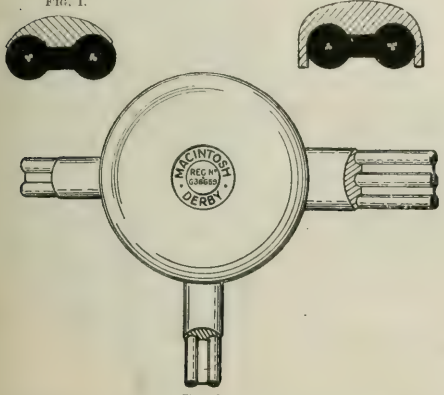


Fig. 3.

Fig. 1.—Section of Twin Cable and Bead.
Fig. 2.—Section of Channel to Switch.
Fig. 3.—Junction Box.

its exposure by various customers to conditions which have destroyed v.i.r. and v.b. cables, even when specially protected, the Macintosh Cable Co., Ltd., in order to satisfy itself, has carried out during the last 12 months a series of experiments to determine the conditions, if any, under which "Maconite" will break down. These include the immersion, while carrying direct current at 250 volts or whilst exposed to an a.c. pressure of 1,000 volts, of samples of "Maconite" in some 25 selected chemical solutions, oils, and spirits. These tests have been combined with other tests of a physical nature, and the results have been so uniformly satisfactory that the company is able to predict with some certainty how the dielectric will behave under given conditions and to offer substantial guarantees that "Maconite" will give long and satisfactory service under conditions whichwould be quite impossible for some of the older types of insulation.

CORRESPONDENCE.

Letters received by us* after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Status of the Electrical Contractor.

This article is excellent, as far as it goes; but surely the matter hardly rests where Mr. Taunton leaves it.

Whilst admitting that, alas! the electrical contracting trade is at present over-run with irresponsible cheap-jacks, and the sub-department of the large "Universal Store," all of whom, if removed in some way, would be doing the cause of "Electrical Utility" a favour by going—yet there remains a very large class of persons, who are, perhaps, by no means incompetent. These have, owing to a slight disturbance in the earth's crust in 1914, since their return been quite unable to get a look in, owing to the general suspicion with which all newcomers are treated.

You must admit, Sir, that many a man who, in 1914, was a trained engineer, has now, owing to Army service, very little hope of picking up the old threads, and practically the only outlet for his services is as an electrical contractor.

Someone has said, I think, that "heroes are forgotten six months after peace is signed"—and unfortunately there has been a lamp almost continuously from that period to the present time.

Chas. P. Morris,
Major.

Ministry of Pensions,
The Prince of Wales's Convalescent Centre,
Barry, South Wales,
September 25th, 1922.

I am glad to see that Mr. Taunton, in his reply to my letter, published in your last issue, recedes greatly from the tone of the article complained of.

I do not regard that article as an attack on the E.C.A., but had it been, only one with Mr. Taunton's facility with the pen could have made it more damaging. It is the careless effort of a friend from which we would be saved.

I contend that before writing on this subject and dealing in such scathing terms with the membership and organisation of the E.C.A., the writer should have made some more personal acquaintance with that body than simply through its "Year Book."

For qualifications for membership he should refer to the articles of the Association or obtain an application form for membership. I enclose one herewith.

Neither the Bank of England nor the honest intelligent wireman he specifies is eligible or could become a member: nor are "side-line houses," except such as come under certain defined conditions applying to some of the best contracting firms in the country.

The qualifications for membership are not pious aspirations as Mr. Taunton suggests, but hard-and-fast rules which are rigidly enforced.

Mr. Taunton's distinct implication that our members do not pay E.T.U. rates is untrue. The number of members of the E.C.A. who are not members of the N.F.E.A. is 123, and each has his particular reason, but it is not in order that he may pay lower wages and so compete unfairly with his fellow members. That could not be tolerated. These members are paying the N.F.E.A. agreed rate or the builders' rate, which is in many cases higher.

I am very pleased to see that Mr. Taunton's desire is to help the Association on its way. His great ability as a writer will enable him to do much to raise the status of the contracting trade, but first he must come and learn the present position—not set the E.C.A. back fifteen years without inquiry; to this end I cordially invite him to a "housewarming" at the new offices in the Institution Building, where the E.C.A. will be installed at the end of the month.

H. Marryat,
President,
Electrical Contractors' Association, Inc.

London, *October 2nd*, 1922.

The Sayers Dynamo.

With reference to the article in your issue of September 8th, it may interest your readers to learn that thirty years ago a man, whose name, I believe, was Lawrence, who had been a fellow student at the Central Technical College, South Kensington, and who was then a partner in a business at Westminster, took me to see a somewhat similar dynamo which his firm was constructing.

There was this difference—that the armature was a disk instead of a cylinder, the iron and copper conductors being spiral, and it was unnecessary to have anything corresponding with the stationary core. I do not know whether it proved a success or not.

Archd. H. Finlay.

Holywood, Co. Down, *September 26th*, 1922.

Do Motors "Go Bad"?

I am in trouble, and hasten to seek your advice. My very existence is in grave danger. It so happens that I am a stockist of electric motors, and I have just learned of a "fact" which may upset my business entirely. A business friend outside the electrical trade has informed me that he is buying no more electric motors unless they are guaranteed to be absolutely "fresh." I at first thought that my friend was thinking of some "tinned meat scandal," but the story which he unfolded upset me completely.

It seems that all motors and generators deteriorate in stock just like dry batteries, and that when anyone buys a motor he should deal direct with the manufacturers and not the stockists throughout the country, as by dealing direct the motors are all guaranteed to be quite "fresh." This part of the story was certainly interesting to me, and I asked my friend to carry on. He then informed me that a motor which he had recently installed had broken down, and on calling in the makers' expert he was informed that the motor must have been lying in stock and had deteriorated. A new motor was sent along, but my friend has asked my advice as to what he should do when [illegible] off to the fishing and for his holidays. Of course, I have only had 20 years or so at the trade, I am not quite

[illegible] experts whether to advise my friend to [illegible] to use hot-water bottles.

Now, Sir, [illegible] that I am behind the times in not [illegible] that profits do deteriorate, or is it another case of leading [illegible] astray? If the latter, then, when [illegible] am to teach the public the simple [illegible] matters and to stop all this "mystery [illegible] But may I, however, be another case of how the [illegible] factors of to-day employ "experts" who can [illegible] to suit the circumstances, whether it be at [illegible] those of whom called to see what's wrong.

[illegible] will be good enough to give me your remarks [illegible] the latter.

Auld Reekie.

September 30th, 1922.

Estimating for Internal Wiring Contracts.

Mr. Alan Kirk, in your issue of September 29th, replies to my correspondence which appeared on the 8th instant.

I quite agree that electrical bills of quantities rule out my third basic reason for price difference, but I cannot agree that they eliminate the first reason.

A contract or sale of any description is composed of three things—quality, quantity, mode.

Bills of quantity satisfy quality and quantity but not mode, which can only be satisfied by specification and supervision. I fully appreciate Mr. Alan Kirk's opinion that the proper carrying out of a contract needs a joint liability shared by the adviser and the contractor, but I would respectfully point out to your correspondent that business is not yet ethically perfect. This is what Mr. Alan Kirk apparently asserts.

To substantiate my claim of need for supervision—supervision to prevent scamped work—I would put forward the views of one of your correspondents, that the low price of estimates is due to the employment of boy labour, and surely the employment of boys has a great tendency to lead to scamped work.

Does Mr. Kirk realise that to-day there are numerous embryo contractors, properly plumbers, ironmongers, electrical storekeepers, and wiremen, to compete with a fully-qualified contractor? It would be redundant to detail the negative properties of this type of contractor which is prevalent to-day. In my twenty years' experience I have been called upon to examine and inspect numerous installations, and some of the work I have seen is disgraceful.

Recently I quoted for a small job, the specification for which was that usually received. I lost the job to a contractor who quoted 30 per cent. lower. I later had an opportunity of seeing the finished job, and was appalled by the wretched way in which it was carried out.

I have been fortunate enough to carry out many large contracts running well into four figures, and with this class of work the factors under discussion do not enter to any extent. It is the smaller work to which I refer my three basic reasons, and in spite of Mr. Alan Kirk's astonishment I still maintain the views I put forward on the 8th instant.

My second basic reason, "the failure of proper supervision," I attach much importance to. The prevalence of scamped and shoddy work is well known by those engineers in constant touch with contracting work; only in this week's ELECTRICAL REVIEW it is mentioned in an article. Admitting the fact, proper supervision by the purchaser or his agent would stop this, and the *bona fide* contractor would have more healthy competition.

Do you think that I and [illegible] are not merely opinions but [illegible] and painstaking observations submitted to analysis and synthesis.

Lodestone.

Manchester, *September 30th*, 1922.

How to Buy.

[illegible] reference to the comment on my article "How not [illegible]." I should point out that the remedy for the present unsatisfactory state of business will be correctly given if [illegible] "Not buy from the factor" to your correspondent's suggestion of "Not buy at all."

It would be to the ultimate benefit of the electrical industry as a whole if the potential consumer is induced to buy more largely by the cheapening of electrical necessities, and—[illegible] it must be added that studious attention to the interests of the consumer is essential to recovery [illegible].

The chief obstacle to this necessary cheapening is the fact that [illegible] passes through too many hands, and [illegible] ought be eliminated by eliminating the factor. The live manufacturer—and more of them are coming to life every day—realises that the factor's sales organisation need cost him no more than it does the factor, and that it [illegible] the factor's profit. The [illegible] has already [illegible] the [illegible] of a thousand [illegible] household [illegible] toilet requisite, [illegible] trade. We [illegible] to the public.

Certain schools of thought would no doubt regard it as derogatory to the dignity of the industry to class electricity with such every-day necessities, but it is not until electricity is so regarded by the man in the street that real progress will be made.

Factors have, however, served one more or less useful purpose; that of flooding the country with foreign rubbish, with results that have been felt by every British electrical producer in his pocket and the scramble for German agencies still continues. It cheapens electrical goods, truly, but in the worst possible way, and with results ably shown by Mr. H. R. Taunton's articles on the jerry wireman, who could not, of course, exist without the jerry factor.

Although the facts of my article may have been elliptically expressed I am sure of them, and I think it obvious that your correspondent's wrath has been aroused not by my lack of knowledge but because I know too much.

In conclusion, I would add that "I consider his letter in very bad taste and one which should not have been written, as it is not helpful either to the manufacturer, factor or contractor"; though it has pretty well served the purpose of obtaining a little free publicity for his firm. Here is some more, and I hope he will appreciate it.

Walter Shandy.

September 30th, 1922.

Electric Washing Machines.

Referring to correspondence in your issue of February 10th, 1922, p. 202, re "Electric Washing Machines," a statement was made to the effect that it was impossible to make these machines "fool-proof."

This statement may have been and probably was correct at that time; it will, however, be of interest to many of your readers in general and Mr. J. S. Sewell in particular, to know that this disadvantage has been overcome in the new Bell electric washer, the guard of which positively prevents the fingers being trapped. In our opinion prevention is better than cure.

Previously, devices have been arranged to release the fingers when trapped, which is obviously equivalent to locking the stable door after the horse has been stolen.

The Bell Washer Co.
J. H. Iveson.

Blackburn, *October 2nd*, 1922.

Overhead Distribution.

I should be pleased if any of your readers could furnish me with the name of any corporation or supply company which has a model village or small town equipped with a low pressure network consisting entirely of overhead lines for distribution purposes, preferably *a town in the Midlands*. The idea is to incorporate street lighting with ordinary power and lighting distribution.

Overhead.

September 29th, 1922.

[Several examples have been fully described in our pages, notably Earl's Court-Humber (ELEC. REV., December 12th, 1919), Dowlais (ELEC. REV., October 14th, 1910, and May 19th, 1911), Ballater (ELEC. REV., March 31st, 1916), and Balderton (ELEC. REV., September 8th, 1911) all of which embody the features referred to.—EDS. ELEC. REV.]

Calculating Currents in a Mesh-connected Three-phase Circuit.

I enclose copy of letter to Mr. Borden which explains itself. I much regret that the article you were good enough to publish was subject to this just criticism. With an altered title the proof would be quite correct. It is a special case of a general problem.

A. Still.

Purdue University, Lafayette, Indiana.
September 17th, 1922.

[*Copy.*]

Percy V. Borden, Esq., Hydro Electric Power Commission Laboratories, Strachan Avenue, Toronto.

With further reference to yours of August 19th, it is quite clear that the proof given in my article in the ELECTRICAL REVIEW of July 21st, 1922, is not of general application, and I am very glad that you have taken the trouble to call my attention to this fact. I greatly regret the mistake which is due to my having prepared and sent in the article hurriedly without giving the matter sufficient consideration. As a matter of fact the proof was developed when working with some students who were measuring the currents in the three-phase lines and also in the armature circuits of a mesh-connected three-phase generator. That is the special case for which my proof is correct, and I committed a blunder when I said that the sum of the currents in the mesh (assuming a mesh-connected load) was necessarily zero.

Thanking you again for having pointed out my error.

Yours very truly,
(Signed) A. STILL.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Tok Interlocking Switch-Plug.

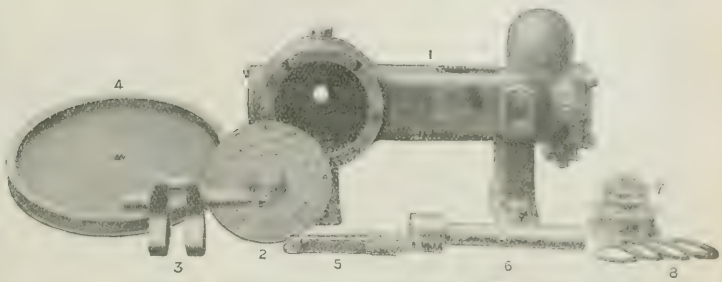
The desirability of ensuring that a plug carrying a heavy current shall not be removed from the socket until the switch has been turned off needs no demonstration; it is also desirable that the switch shall not be capable of being turned on until the plug has been inserted, so that the socket contacts, which, if not exposed, are at least accessible to scissors and hair-pins, and are a standing temptation to investigating youngsters, shall always be dead when the plug is out. These objects are attained in a new 15-ampere, 250-volt Tok rotary snap switch and plug which has just been placed on the market by Messrs. Tok Switches, Ltd., of Granville House, Arundel Street, London, W.C.2. As illustrated in fig. 1, the switch is provided with an external indicator showing whether it is on or off, and the key cannot be turned in the wrong direction or unscrewed. The switch has a rapid make and break, and is double-pole. The plug and socket conform to the B.E.S.A. 15-ampere standards, and the plug has a hand shield, an earthing terminal, and a device for gripping either thick or thin cable without permitting any strain to come on the connection. The casing is of black, unbreakable fireproof material, taking a fine polish.



Fig. 1.—Tok Interlocking Switch-Plug.

The "Pulsometer" Ring Pump.

A centrifugal pump is not the most satisfactory appliance for raising small quantities of water, especially when the head is considerable. In such a case the efficiency is low, and the pump will cease to deliver water should the speed of the motor fall below the rate necessary for the particular head. There are a number of other drawbacks inseparable from this type of pump which the Pulsometer Engineering Co., Ltd., of Reading, claims to have avoided in its new type of ring pump (fig. 2)—a high-speed reciprocating pump in four sizes with a delivery of from 250 to 2,000 gallons per hour for heads up to 100 ft. The high speed of these pumps—from 300 to 500 r.p.m.—makes it possible to drive them by belt or gearing from any motor running at any speed; a temporary fall in speed will only cause delivery of water at a slightly reduced rate. The pumps are fitted with the "Pulsometer" patent rubber ring multiple valves, working on gunmetal seats. The valve seats for both suction and delivery valves are made in one casting in the shape of a cage surrounding the plunger. This casting is retained in place by the end cover of the pump, and is readily withdrawn when the cover is removed. The suction valves are placed in internal grooves and work in compression, while the delivery valves are placed in external grooves and work in tension. As the water passages are very large, the movement, or lift, of the valves is very small, and as the movement causes only a [illegible] rubber, there is no momentum of the valves to overcome. This feature makes the high speed practicable, and the small movement and the soft material of which the valves are made render the pump absolutely silent in working.



1, Casing; 2, Cover; 3, Crank; 4, Fly-wheel or pulley; 5, Connecting-rod; 6, Plunger; 7, Valve seat; 8, Valve rings.

Fig. 2.—The "Pulsometer" Ring Pump.

"Ibrin" Daylight Lamps.

The endeavour to obtain a light approximating to daylight has produced yet another form of filter for use with electric lamps. This is the "Ibrin" lining, which is made in two types and numerous designs. The two types referred to are composed of (1) a glass which, it is claimed, gives the effect of clear sunshine, and (2) the same [illegible] opaline covering on the outside, which gives an approximation to diffused daylight. In both types a top reflector is usually fitted, so that in addition to the direct rays, the strength is added to by reflection. The principle is applied in a number of ways, as, for instance, to desk lamps, brackets, and pendants. Fig. 3 illustrates a handsome form of bowl fitting

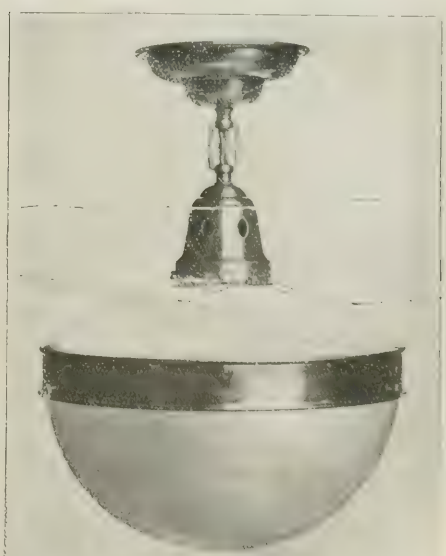


Fig. 3.—An "Ibrin" Daylight Lamp

made of "Ibrin" glass, which has a delicate blue tint when not illuminated. The sole concessionnaires [illegible] are Messrs. Jodd Bros., Cromwell House, Fulwood Place, High Holborn, W.C.1.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Complete specifications for this journal by Messrs. Sefton-Jones, O'Dell and Stubbs, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

[illegible] J. V. Hardwood. September 18th.

25,[illegible] Kent and [illegible] Pearson and B. Sutherland. September 18th.

25,[illegible] [illegible] telephone instruments and apparatus. [illegible] K. [illegible]. September 18th.

25,[illegible] [illegible] J. S. Whitwell. September 18th.

25,[illegible] Spark plugs. [illegible] Schlenger. September 18th.

25,[illegible] Automatic electromagnetic circuit-breaking and indicating devices." F. H. Adams. September 18th.

25,808. "Electrical condensers, &c." H. G. Bell, W. J. Brown, and Metropolitan-Vickers Electrical Co., Ltd. September 18th.

25,[illegible] [illegible] starting and controlling apparatus, &c." F. H. Mann and F. J. Moffett. September 18th.

25,[illegible] [illegible] Western Electric Co., Ltd. September 18th.

[illegible] [illegible] 20th, 1921.

25,[illegible] [illegible] British Thomson-Houston Co., Ltd. [illegible] [illegible] September 18th.

25,[illegible] [illegible] for electric accumulators. C. Gross. September 19th. (Norway, October 17th, 1921.)

25,[illegible] [illegible] Negative electrodes for electric accumulators." C. Gross. September 19th. (Norway, October 17th, 1921.)

25,288. "Tramway and electric railway [illegible]. J. W. Hodgson, W. Smith, [illegible] September 19th.

25,[illegible] [illegible] G. W. Weeks. September 19th.

25,[illegible] [illegible] M. J. Dowling. September 19th.

25,[illegible] [illegible] W. J. Mitchell & Co., Ltd., and A. J. Fenlans. [illegible]

25,[illegible] [illegible] Vickers, Ltd., Brown, Boveri et Cie. September 19th. (Switzerland, October 19th, 1921.)

25,[illegible] [illegible] Swivelling handles, &c., for portable electric drills, &c." A. E. White (Independent Pneumatic Tool Co.). September 19th.

25,381. "Device for preventing short circuits at sparking-plug points." J. W. Fox. September 19th.

25,[illegible] [illegible] &c." [illegible] Brown and Harris & Sheldon, Ltd. [illegible] 20th.

25,[illegible] [illegible] &c." [illegible] Brown and Harris & Sheldon, Ltd. [illegible] 20th.

25,[illegible] [illegible] [illegible] motor systems." Barr & Stroud, Ltd., and J. W. French. September 20th.

25,418. "Receiving apparatus for wireless telephony." R. L. Howard. [illegible] September 20th.

25,420. "Transmission and reception of pictures by telegraphy." P. A. Purton. September 20th.

25,423. "Transformers." H. W. Headland. September 20th.

25,427. "Portable electric lamp." L. Pexton and G. L. White. September 20th.

25,440. "Methods for insulating coils of static transformers." V. E. [illegible] September 20th.

25,445. "Electric [illegible] systems." British Thomson-Houston Co., Ltd. (General Electric Co.). September 20th.

25,451. "Means for controlling distribution of electric power to moving-picture projectors." E. G. Gard. September 20th.

25,458. "Transforming, &c., dynamos." A. H. Darker and J. Stone and Co., Ltd. September 20th.

25,471. "Electrical connectors." A. Parker. September 20th.

25,473. "Sound-amplifier for talking-machines." W. H. Newcombe. September 20th.

25,475. "Electric ranges." E. C. R. Marks (Walker & Pratt Manufacturing Co.). September 20th.

25,476. "High-tension coils." Akt. Ges. Brown. Boveri et Cie. September 20th. (Switzerland, October 11th, 1921.)

25,485. "Electrically-operated apparatus for advertising, &c." C. M. Brown and H. G. Cocks. September 20th.

25,487. "Electric discharge tubes." G. Hoist and Nederlandsche Vennootschap Philips' Gloeilampen Fabrieken. September 20th.

25,495. "Electric [illegible]." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). September 20th.

25,496. "Rectifying devices." A. R. Angus. September 20th.

25,520. "Armature-coil insulating hand machine." G. H. Allan. September 21st.

25,[illegible] "Sparking plugs." A. O. Hagzinger & I. Rosenmund. September 21st.

25,542. "Sparking plugs." W. Ellson and S. H. Short. September 21st.

25,547. "Combined high-tension ignition and low-tension starting, lighting and electric [illegible] systems for ships, vehicles, &c." W. P. [illegible] September 21st.

25,[illegible] "Lamp [illegible]." W. A. Coates, D. R. Dow, G. F. Gittins, and Metropolitan-Vickers Electrical Co., Ltd. September 21st.

25,570. "Insulators." E. Sweeney. September 21st.

25,578. "Electric switches." W. H. Le Breton. September 21st.

25,582. "Devices for testing electric sparking circuits." Edison Swan Electric Co., Ltd., P. Freedman, and E. Greetham. September 21st.

25,583. "Electric terminals." A. H. Curtis and Igranic Electric Co., Ltd. September 21st.

25,606. "Electric temperature-measuring arrangements for cooling plants, &c." P. Kastner. September 21st. (Germany, September 28th, 1921.)

25,621. "Variable condensers." F. K. Crowther. September 21st.

25,[illegible] [illegible] [illegible] [

THE

ELECTRICAL REVIEW.

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COMMERCIAL ARBITRATION IN FOREIGN TRADE.

WE were much impressed a couple of months ago on reading in foreign newspapers a report of a scheme which was said to be in progress for the constitution of an international court of arbitration in the matter of commercial disputes, but as no information confirming the report, as far as we are aware, seemed visible in the English newspapers, we dismissed the matter in expectation of possible future developments. But as the United States *Commerce Reports* of September 11th contains an article dealing with the question of the progress of commercial arbitration in foreign trade, it may be advisable briefly to reproduce the statements previously mentioned.

In the first place, *Norges Handels og Sjofartstidende* of August 7th, under the title of an international court of arbitration in commercial disputes, states that the lack of such a court is now to be remedied, inasmuch as the International Chamber of Commerce in Paris has made preparatory steps for the appointment of such a court of arbitration, which is shortly to begin its activity. In each country which is connected with the International Chamber, the national committee has appointed members as a permanent arbitration committee, which will stand in contact with the court of arbitration in Paris. After consultation with the Norwegian industrial bodies, the members of the Norwegian committee have been appointed as a permanent committee, and the names are given by the Christiania newspaper in question. It is added that it is not essential that the members of the court of arbitration in Paris shall be chosen from these national committees.

We have quoted so far from the Norwegian newspaper. By a coincidence a Finnish newspaper—the Helsingfors *Hufvudstadsbladet*—also of the date of August 7th, dealt with the same subject. This newspaper states that the proposed court of arbitration is to consist of from five to six members repreesnting different countries, and is due to the initiative of the International Chamber in Paris. The idea of the latter is that the court shall add to its awards certain "moral effects" which would compel the losing party to comply with the award. This pressure is to take the form of the publication of the award and the name of a refractory party in the bulletin of his native chamber of commerce, or if this should not prove to be a remedy, to expel him from the chamber of commerce or other commercial combination of which he is a member.

Experience has shown, the Finnish newspaper proceeds to state, that such moral pressure is of exceptionally great importance. Thus a firm which carries on international transactions prefers to submit to the award rather than to be branded as a firm which recognises no obligations of honour. Applications for an award have to be made to the national committee of the applicant. When an arbitration matter comes before the International Court, the latter, after an examination of the question, will decide in which country and in which city the arbitration proceedings shall take place, after which the arbitrators are to be appointed on the proposal of the respective national committee.

As has previously been mentioned, we have not seen any confirmation of the Scandinavian reports, but they are so circumstantial as to give the impression of accuracy. Even the United States *Commerce Reports* of a month later date does not refer to the reports, but it appears that the Department of Commerce sent out some months ago to the official representatives a list of

questions, asking for information concerning the attitude and facilities existing in foreign countries with regard to commercial arbitration. In addition, the American Bar Association in August adopted a resolution approving the draft of a treaty clause which it is suggested should be entered into with other countries, and the United States Secretary of State has since expressed his entire sympathy with the principle of commercial arbitration as set forth in the draft treaty clause unanimously adopted at a conference held in San Francisco.

It is not stated that the American Secretary of State proposes to endeavour to initiate legislation to give effect to the principle of the conclusion of mutual commercial arbitration treaties with other countries, or rather the enactment of such a treaty clause in reciprocity with other nations. But possibly this is a matter for future consideration. In the meantime there is no question that the settlement of private disputes in international transactions by means of arbitration is the best manner of honourably adjusting difficulties which arise between buyers and sellers in different countries. As the American official journal says, arbitration offers "an equitable substitute for protracted, expensive and friendship-destroying litigation; and it is in foreign trade that the need of such a system of settling commercial disputes is evident."

There is no doubt that in the near future the American Department of Commerce will learn from its Paris representatives some details concerning the International Court of Arbitration which is being engineered by the International Chamber of Commerce in that city. It would, however, be more to the purpose if some light could be thrown on the problem in Great Britain, which is represented on the Paris Chamber, as although information from Scandinavia is welcome, facts from English commercial interests would be of greater value respecting such far-reaching proposals as are credited to the Paris Chamber.

The Wireless Exhibition.

The *raison d'être* of an exhibition is usually self-apparent. In the present instance, however, particular comment is called for in that the All-British Wireless Exhibition and Convention was devoted exclusively to British products, and afforded an excellent opportunity of judging the present position of wireless telephony. The interest that is being taken in the subject may be judged from the fact that fully 25,000 people visited the show, and on some days large numbers were unable to gain admission.

Much apparatus of various types was to be seen, including several novelties of an interesting nature, and on what it was hoped was the eve of the introduction of systematic broadcasting in this country, the show was an opportune event. Nevertheless, it is regrettable to have to record that many visitors must have come away with an unsatisfied feeling. Is there not some danger of the whole thing being overdone?

The wide range of the apparatus that is being produced makes it difficult for an amateur enthusiast to select a set with complete confidence that it will fulfil expectations. The majority of potential users of receivers will have no, or very little, technical knowledge, and successful reception depends on so many factors—some of which are uncontrollable, while others require intelligent evasion or counteraction—that it is to be feared that much disappointment will be inevitable.

For instance, to mention only one of the many difficulties that can be foreseen, loud-speakers cannot be said to be altogether satisfactory; telephone receivers are much to be preferred. Another point that needs attention is the workmanship of the apparatus, which in some cases falls short of what is desirable. Good apparatus is, of course, obtainable, but in this country we are accustomed to high-class electrical work, and though manufacturers are undoubtedly within their rights in attempting to satisfy a popular demand that has arisen suddenly, in their endeavour to do so some of them have not devoted as much attention to detail and workmanship as might with advantage have been done.

It is to be hoped that as the conditions improve, matters will right themselves. It is realised, of course, that the position is a complicated one, but if the broadcasting scheme is to be a success, anything that will tend to shake public confidence in it, or that is not calculated to lead to the best results being obtained under the given conditions, should be studiously avoided.

Increase of Charges for Electricity.

Although the Electricity Supply Act, 1922, has now been in force a couple of months, the facilities afforded for increase of prices seem to be far from widely understood. For the benefit of those undertakings which do not know the provisions of this Act, we may say in the first place that all local authorities can now apply for a revision of their maximum prices. Previously to this Act, of course, the Local Authority Provisional Orders did not normally contain clauses for the revision of maximum prices. Also companies which had previously been limited in price by their own special Act or which had taken over a Provisional Order from a local authority (which, as we have said, contained no provision for revision of charges) are now free to apply for a revision. Seeing that previously the undertakings (municipal and company) mentioned above could not obtain revision of price under the Electric Lighting Acts, they had perforce to obtain increase under the Statutory Undertakings (Temporary Increase of Charges) Act. This Act, however, coupled certain limitations with the increased price in the case of municipalities and restricted the dividends of companies to three-quarters of the pre-war dividend. It is a great gain, therefore, to such undertakings that under the 1922 Act it is provided that all of these can immediately apply for a new Order (Section 22, subsection 5, Act 1922), giving them an increased price, but freeing them from the present restriction as to dividend or otherwise. The chief benefit of this section, therefore, at the moment is the transference of the price control from a Statutory Increase of Charges Order to an Order under the Electric Lighting Acts. In most cases, of course, this would not mean that the municipality or company asks for any actual increase of price, but merely that it seeks to charge the same prices without restrictions, these restrictions being merely a war measure.

Wireless Broadcasting.

It was announced last week that the British Broadcasting Co. had complied with all the stipulations of the Post Office authorities; from the Postmaster-General's point of view, therefore, there is now no reason why the company should not commence operations at once—but at the time of writing the company has not yet been registered.

In the United States, Canada, France, and Germany, wireless broadcasting has been inaugurated without much difficulty, but in England, of course, it is different. Nothing happens except the holding of conferences, a practice which in this case no less than in that of the Government does not inspire confidence. Caustic comments relative to the manner in which the negotiations have been conducted and the delay that has occurred in launching the scheme were made at the recent inaugural meeting of the Radio Association. True, semi-official broadcasting began in connection with the Wireless Exhibition, but even at this stage it would be optimistic to anticipate that the scheme was going through without any further hitch.

It is naturally difficult for the ordinary person to appreciate why there should be so much bother about what should be a simple matter of organisation, and it would not be surprising to learn that the *fons et origo*

of the trouble has been the rivalry of some of the manufacturers, or prospective manufacturers, of receiving equipment. Obviously there have been difficulties, but one was led to believe that the most serious had been anticipated; unless they are speedily overcome by the faith and zeal of those concerned in the venture, public enthusiasm will wane.

Much of the work will be necessarily experimental, but it is admitted that the provision of a high-class programme will be the foundation of the whole scheme. It can only succeed if first-class matter is received satisfactorily by means of good apparatus. An excellent opportunity has presented itself: we hope that those concerned will seize and make the most of it.

France as a Market.

As is fairly well known, the French Government is rendering active assistance to the development of electric power generation and distribution in the devastated areas of Northern France, so that when the work of restoration has been eventually completed, electric lighting and electric power will have become practically general throughout that region. Although the productive capacity of the French electrical manufacturing works has been largely increased as compared with 1913 and the actual output in 1921 is claimed to have been double that which was turned out in 1913, it is a debateable question as to whether French makers are in a position fully to meet the home demand for electrical machinery and equipment at the present time. According to the United States Consul at Nancy, American manufacturers who desire to compete in that market should establish depôts either in Paris or Lyons and engage a general agent with power to appoint subagents in those parts of the country where the demand would warrant such action being taken. By these means it would be possible to quote prices c.i.f. destination, effect quick deliveries, and at the same time grant credit with less risk. It is for these reasons, the Consul states, that representatives of British and Italian firms in the district of Nancy appear to meet with considerable success, whereas an American firm recently lost an important order in consequence of the difficulties incidental to negotiations conducted over a long distance.

Germany's Foreign Trade.

The imports of machinery into Germany declined from 800 tons in July to 500 tons in August, and those of electrotechnical products from 400 tons to 300 tons in the two months respectively. On the other hand, the exports of machinery increased from 36,400 tons in July to 42,800 tons in August, and those of electrotechnical manufactures from 7,800 tons to 8,100 tons in the two months respectively. Despite these figures, complaints are made by the electrical firms that foreign competitors are offering shorter terms for delivery in external markets, and are actually delivering more promptly than the German industry, which is affected by strikes and the refusal of the men to work overtime. We have already alluded in our news columns to the labour disputes that have lately occupied the attention of the A.E.G. and the Siemens-Schuckert concerns.

The Situation in Russia.

It appears that Herr Zausmer, who was formerly on the board of management of the Russian A.E.G., is now acting as manager of the Soviet Electro Trust. According to a statement published in Berlin and attributed to the manager, the trust comprises also works which produce electrical porcelain, carbons, brushes, &c., in addition to those which turn out electrical articles. The Russian electrical manufacturing industry is said to have already again reached a stage of considerable efficiency, and the products are claimed to correspond to normal requirements. In many parts there is a scarcity of engineers and of skilled workers. A large hydro-electric works is now in course of construction at Volchow, which is 62 miles distant from Petrograd, and which is to supply the latter city with current. During the war the General Electric Company (American) is said to have got well into the Russian trade.

At present the greatest field of activity for German industry is asserted to lie in the delivery of glow lamps, brass instruments, heating apparatus, installation materials, &c., of which there is a scarcity.

It was recently reported that the Siemens-Schuckert Works Co. had granted a credit to the Soviet Electro Trust in the form of the supply of materials, and the report was subsequently contradicted. Now, however, it is again announced in Berlin that such a credit has been given by the company in question; the amount is stated to be from 100 to 400 millions of marks, and is represented by installation materials to be delivered.

The Economic Council has decided shortly to begin the works for the electrification of the region of Kharkoff and Krivoi Rog.

As many consumers in Petrograd have not paid their accounts for the supply of energy, the electricity works managers have decided to interrupt the supply to these particular customers, so that a number of industrial undertakings will be brought to a standstill.

The Gennevilliers Visit.

The Electrical Review engineering tour in the North of France, which commenced on Friday last, ended on Tuesday evening amid a chorus of congratulations and expressions of satisfaction, the visit having proved successful and enjoyable in every respect.

The party numbered about 70 members, drawn from all parts of the British Isles, and representing many branches of the electrical industry; naturally the representatives of municipal electricity supply were in the majority, owing to the numerical strength of this class of undertaking and to the official support of the Incorporated Municipal Electrical Association to the tour. Most of the members went the whole round, visiting Paris, Béthune, Pont-à-Vendin, Lille, Armentières, Ypres, and Hazebrouck, but a small proportion took part only in the Paris programme—the principal object of the visit. The various power stations that were inspected, and the numerous transmission lines that were seen, were subjects of the greatest interest to the engineers; their more notable features were keenly debated during the tour, and will afford material for discussion for weeks to come. But these were by no means the sole attractions of the visit; the itinerary lay through the battle areas for many miles, and excellent views were obtained of the devastation wrought in the war, as well as of the works of reconstruction which have been carried out—and, alas! of the numerous cemeteries where our glorious dead rest from their labours.

Time was also available for recreation and sightseeing, and the opportunity was fully utilised. Many old acquaintanceships were renewed and new friendships formed. Lastly, perhaps the most important element of all, but certainly the least subject to control or evasion—the weather—which at the outset was dull and unpromising, was afterwards most favourable throughout the whole period.

The story of the tour must be left to later issues, but we cannot defer expression, on behalf of the party, of our deep indebtedness to all our French friends, whose courtesy and cordial co-operation made the visit possible and ensured its success. Of this more hereafter—for the moment we shall only record the fulfilment of the visit, which several members of the party declared to be the most interesting and enjoyable that they had ever spent.

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LABOUR POLICY: FALSE AND TRUE.

This is one of the most noteworthy books* on the Labour problem that has appeared for many years, and in writing it Sir Lynden Macassey set himself a task calculated to daunt any less well-equipped author. That task, as the preface tells us, was threefold, and covered:

1. The setting out of the policy of the Labour Party for the solution of the problem and the examination of its fundamentals;

2. The description and consideration of the Labour policy of the Government, so far as it has been declared or evidenced in departmental practice; and

3. The outline of what, in amplification of the Government policy and in opposition to that of the Labour Party, Sir Lynden conceives to be the true solution, and the one most calculated to promote the interests of the nation.

To this formidable task the author has brought the necessary but far from universal attributes of experience, understanding, and ability. Those who are connected with the engineering industry will scarcely need reminding of the manifold activities of Sir Lynden Macassey during the war as Director of Shipyard Labour; as Board of Trade arbitrator in shipbuilding and engineering labour disputes; in connection with the dilution of labour, and in many other directions. The reaction of this experience on a trained and acute mind has given him an understanding of the labour problem which we could wish to see shared more widely by those who, whether as statesmen, employers, or leaders of labour, are intimately concerned with it. And finally he has the ability to set forth his matter in clear and cogent English admirably adapted to the work in hand. There is no worse, nor, unfortunately, more usual fault, than that of attempting to score mere debating points in discussions of such problems as that now before us; of tying labels to opponents, and setting up a target misrepresenting them, for the purpose of demolishing it afterwards. From all such unworthy devices this book is free, and it at once takes its place as a real contribution to clear thinking.

Parts I and II are mainly historical. The recapitulation of Labour's own policy is substantiated by documentary evidence, and no room is left for misapprehension as to the facts. Labour's exposition of its policy suffers somewhat from vagueness, but in this attribute it is not alone. It must be admitted that there is considerable difficulty in avoiding some lack of clearness of outline in adumbrating a system which is to remould "this sorry scheme of things," particularly when it is remembered that the scheme, sorry though it may be, is itself changing from day to day. Vague or precise, the declared policy of Labour must be considered, for only in that way can defects be corrected. The record of the actions of the Government, although, as Sir Lynden points out, those actions were too often opportunist, ought to be readily available, as they cannot fail to have their effects upon future labour policy.

It may be wondered whether the advocates of proportional representation realise, what is mentioned on p. 22 of this book, that at the 1918 general election, out of a total vote of nearly 9.7 millions, Labour polled nearly 2.4 millions. This means, if we understand it aright, that one quarter of the House of Commons would consist of Labour members. The whole history of England is a record of emancipations from successive varieties of unfair predominance or tyranny. There were the tyranny of the Crown, the tyranny of the Church, the tyranny of the landed oligarchy; and on the other side there were Magna Charta, the Petition of Right, the Civil War, the Revolution of 1688, and the various Reform Acts. It is more than questionable whether the rule of the big battalions, at any rate in our present state of education and enlightment, would be preferable to autocracy or plutocracy. The Labour Party, however, is divided into a number of groups, each having its own policy, differing in many important respects from the policy of any other group. There would thus seem to be as much, and as little, coherence about the policy of a Labour Government as there would about that of a Liberal, a Conservative, or the present Coalition. There is a good deal of hot air in much of the Labour propaganda, but in this respect, too, they are not alone, for we seem to remember something about "Punish the Kaiser," "Make Germany Pay," and many other pie-crust-like promises made by successive Governments. There are, however, certain things which appear to be common ground between the various sections constituting the Labour Party. The national ownership of land is one of them; nationalisation and democratic control of at least some industries is another. To these powerfully-advocated projects Sir Lynden Macassey devotes much painstaking attention. His demolition of an unsound case is not of the nature of assault and battery, with a mine explosion thrown in to complete the ruin. He unbuilds as carefully as the propounder builds up, shows what would be the consequences of this or that course of action, and avoids all vain generalities and high-sounding phrases whose meaning disappears on examination.

The Labour Party wants to abolish capitalism. This term has always seemed to us a misnomer. It must be obvious to all that capital cannot be abolished, for capital is not money. It is not gold, nor silver, nor paper, but land, and mines, and coal, and oil, and buildings, and engines, and metals. It is, in short, the accumulated resources of Nature, and we have to work with it and upon it to produce our income, which again is not gold nor silver, but food and clothes, and houses, our daily necessities and pleasures. Income, when accumulated, becomes capital, that is to say, a means whereby development may go on. If those who make use of capital are capitalists, then so soon as a man has received his wages and begins to spend them, he is a capitalist. Judging from a paragraph from Mr. Sidney Webb's *A Constitution for a Socialist Commonwealth of Great Britain*, quoted by Sir Lynden, "the central wrong of the capitalist system is . . . the power which the mere ownership of the means of production gives to a relatively small section of the community over the actions of their fellow citizens and over the mental and physical environment of successive generations." Certainly the unregulated development of industry since the discovery of the steam engine has landed us to-day with some very ugly towns and some very insanitary slums; and the fact is that the great majority of people are not sufficiently broad-minded to be able to take hold of more than one thing at a time. It is true that Lord Leverhulme saw the need for building good houses and arranging them in a well-planned town to house his workers, and so did the firm of Cadbury; but where shall we find the like in the engineering industry? We have seen enormous undertakings launched in undeveloped districts, but apparently the promoters regarded the amenities of the district, as regards housing, sanitation, and paving, as none of their business. No doubt their answer would have been that the law of supply and demand would operate, and that if houses were wanted, some builder or other would turn up in due course and set about building them for his own profit, and when there was someone to pay for dedication of the roads, the various local authorities would adopt them. During the last twenty years or so this policy may have appeared to have been justified by its results, for the spread of education among all classes of the community has made it impossible that such abominations as the back-to back houses of Leeds and Birmingham could be erected to-day; but its operation is too slow.

It is, then, the misuse of power over the welfare of

* "Labour Policy—False and True: a Study in Economic History and Industrial Economics." By Sir Lynden Macassey, K.B.E., LL.D., D.Sc., Assoc. Inst. C.E. Pp. 320. London: Thornton & Butterworth. Price 7s. 6d. net.

others that must be done away with. So far, there is not likely to be any disagreement. As to what constitutes misuse, and the methods of prevention of the misuse of power, there is more room for discussion. The method of plain revolution, of sweeping away everything that exists and replacing it by communal ownership, has been tried, and its utter failure, in Russia, is there for all who will to mark. But, say some, if communal ownership of everything be impracticable, should not the land and all its rights be national property? Sir Lynden Macassey considers the different schemes of land nationalisation in detail. There are three classes of schemes. In the first, the land remains under private ownership, but the rent of the land is confiscated. To put it another way, land values are taxed at twenty shillings in the pound. Henry George appears to think that this would encourage owners to make the best use of the land; but why should anybody trouble to make any use of that which profits him nothing? That men act at all times and in all circumstances for their own maximum advantage is the foundation of all theories of political economy, and the inherent falseness of it is only now beginning to be understood, and that by but few. Education again, though a slow process, is showing more and more people every day that prosperity does not consist only in being able to pay dividends to shareholders, though that is an outward and visible sign of prosperity. The maintenance of employment itself acts as an indirect means of promoting a prosperous condition generally. Indeed, "indirect" is hardly the word, for the process may act with some rapidity. If by accepting work for the export market at any price above the actual cost of labour and material, without loading it with overhead charges, a shop can be kept full of men, the spending of the wages of those men in the town in which they live will increase the trade of that town, to the immediate and direct advantage of the town's industries. We recognise, of course, that there must be a substantial foundation of profitable business, and that overhead charges must be met, but it ought to be more generally realised by the captains of industry that it is sometimes advisable to take on low-priced business for its flywheel effect as well as for its advertising value. It does not seem likely, however, that the confiscation of the whole of the income derived from any source would act as a stimulant to increased activity in the production of more income to be confiscated, and so, apart from Sir Lynden's pertinent question as to whether there is any special justification for confiscating an income derived from land as compared with other incomes, there is the still more searching question of whether, after a short time, there would be any income left to confiscate.

In the second scheme of land nationalisation, the land would be purchased by the State, and the present owners would receive bonds of such value as to produce an annual interest equal to the rent. This avoids the penalisation of the present landowners, but it may reasonably be argued that if the nationalisation of land is a general advantage, they will actually share in that advantage through being dispossessed. The disadvantages of State ownership of land, while difficult to set forth in concise form, are fairly obvious on consideration. Production would not be increased, and the inelastic administration of a bureaucracy would add to the difficulties by which land management is already surrounded. The third class of schemes involves the expropriation of the present owners, either for small compensation or none at all. Here we are confronted at once with the whole question of the taxation of capital. Capital is the means by which industry lives, and Shylock was right when he said:

"You take my life
When you do take the means whereby I live."

There are circumstances in which it becomes right to place, for certain purposes, direct taxation upon capital. The national debt is a debt only in the sense in which the shareholders' capital is a debt. This is obvious in the case of moneys borrowed by municipalities for the financing of profit-bearing undertakings, such as electricity works. For purposes of reconstruction, capital may be reduced, with the consent of the shareholders. The direct taxation of capital represented by the death duties is justifiable, but the present position has always been that the money so derived ought to be devoted in its entirety to the reduction of the standing debt. A national debt cannot be left unredeemed. The assets purchased with it become obsolete, and after a time pass out of existence. It is only sound that the value of them should be written off. Other revenue should also be devoted to the same purpose, but capital should be raised *only* for investment. Much is heard in these days about the need for the international cancellation of debts contracted during and for the purpose of the war. Such debts cannot be cancelled; all that can happen is that the onus of payment of interest and repayment of principal is borne by a community other than that which had the money and used it. If a loan is raised in England, out of the savings of English people, for use in, say, Austria, and the British Government afterwards cancels the debt, it only means that the taxpayers in general have to find the interest for some of themselves instead of drawing it from the Austrian taxpayer; and of course the same argument applies to the principal.

The policy of the Labour Party with regard to unemployment is to a great extent obvious. The root of the problem of unemployment lies, they say, in the revival of industry and of commerce abroad. We have often said that the solution of the problem was the increase of our sales, and that necessarily involves increase in the ability of customers to buy from us. The Labour Party would have us provide large long term credits for unspecified countries, the money so rendered available being spent largely here. But at the present time we are afraid there is no money available for such purposes. America may have it. If she has, it would be wise to invest some in this way, for it cannot have been forgotten that investments abroad helped this country, in pre-war days, to pay for her imports.

Sir Lynden Macassey's survey of industrial events and the action of the Government of the day with regard to them is sufficient in itself to make the book one of outstanding value. It is not too much to say, for instance, that the present position in the coal trade cannot be properly understood unless the whole course of events since 1915 is borne in mind. The same is true of the railway position. The history of all this is set out dispassionately here. Although Sir Lynden does not hesitate to criticise the Government's frequent lack of policy in stumbling from one expedient to another, it is clear that it was absolutely necessary for action to be taken; and as regards the policy during the slump, he speaks with emphasis: "In my judgment," he writes, "one thing is certain: if the national unemployment scheme had not been administered, as it has been, by the Ministry of Labour through the past and present dark days of depression, there would have been a serious upheaval in this country. The very fact that a worker could go and discuss his position with a sympathetic official of the Labour Exchanges helped to soothe his feelings of resentment against his unhappy lot. The receipt of benefit over the counter of a State institution encouraged him to believe that the State took an interest in the welfare of himself and his dependents." Where's your "rigid bureaucratic administration" now? (p. 105). Sir Lynden thinks, and there is much to be said for the view, that all the functions of all the departments that have anything to do with industrial matters should be brought together under the Ministry of Labour, and added to as might from time to time be found necessary. We would add that it would be better to make it a true Ministry of Industry, and to call it so. How much more useful it would be to have one really expert government department to consult in all questions relating to industry than to have this or that Cabinet Minister taking a hand and so getting away from any definite line of policy. One

need only mention the famous 12½ per cent. as an example of a good [illegible] that caused literally endless trouble.

A reference to the staff in the book should go home like a spear-thrust to those concerned. This is it: "The Administrative Staff has not attained to a true conception of their great part in industry." The grammar of this sentence is not beyond reproach, but there is a nasty sting in it: for it is perfectly true. What part has the staff ever taken in industrial matters, except to act as the catspaw of the employer? Has any staff union, with the exception of the E.P.E.A., ever got right down to brass tacks and set seriously about the improvement of the lot of its members? If so, we have not heard of it; and on the other hand, we could mention some that, like the inhabitants of Meroz, have done nothing, and have been cursed in consequence. If, then, they cannot look after their own material interests, what hope can be entertained of their future as leaders of industry?

We count it no reproach to Sir Lynden Macassey that, to quote from the *Westminster Gazette's* review of his book, "he has his feet very firmly planted in the realm of things as they are." The solution of the labour problem is not going to be reached by flying to it or rushing to it. It is education, and education alone, that must bring about the permanent improvement of the position. As we said before, education is a slow process, and if we are to walk to our objective, it is just as well to have our feet on the ground, and pretty firmly too.

Generally, the book is well written, well arranged, and well printed. The index is a joy, and Sir Lynden states that he owes its preparation to his secretary, Miss K. I. Toogood. As a rule, Sir Lynden writes, as his great experience entitles him to, in the first person singular, but he opens Chapter IX with "we"; on p. 78 he is "the writer," and on p. 216 "the author." On p. 196 "recipient" should be in the possessive case, and so should "material" on p. 200. On p. 182, line 21, the word "he" is omitted.

There is much more that could be written upon the numberless points of interest that arise from a perusal of this book, but we must draw to a close. We will conclude by recommending this remarkable work (remarkable also in its cheapness) to the careful attention of all our readers. Employers and employed, technical, administrative, commercial, and operative workers, all will alike find an exposition of the principles of industry, amply illustrated by the application of those principles to concrete facts within the knowledge of every one of them.

A METHOD OF ELIMINATING THE CARRIER WAVE IN WIRELESS TELEPHONY.

By R. HEATHER.

The methods of modulating wireless telephone circuits at the moment in general use, whilst all attaining their objectives to a greater or lesser degree, are comparatively inefficient when we come to review the attendant circuits of most of these methods of control, and the loss of energy involved. The writer has produced a combination of circuits—a schematic diagram of which is attached—wherein there are no sustained oscillations until such time as, by the impinging of sound waves on the microphone, the system is caused to oscillate, and ultimately radiate energy in the form of wholly modulated ether waves. The practical usefulness of a system entirely eliminating the surplus carrier wave is very great, particularly if the adoption of the system does not call for the use of delicately-balanced circuits and difficult adjustments. The circuits necessary for the system about to be described are not, for ordinary change-over work, at all complicated, and the adjustments are by no means difficult. Very good results have been obtained with powers from approximately two watts up to 50 watts with a radiating aerial, but for higher powers tests have only been carried out on a dummy aerial. The quality of received speech is excellent, and is not affected by the amount of power generated at the transmitter; that is to say, the same circuits and the same modulating valve will handle high powers or low, depending upon the capacity of the power valve only. Naturally, the insulation of the circuits must be sufficiently high to insure against breakdown in cases where high voltages are used. This "condenser-leak" modulation lends itself very effectively to simple telephony, and with proper modification of the circuits shown here, the writer has been able to carry out conversations in the same way as with an ordinary telephone line without any switching whatsoever for "receive." The clearness of speech, music, &c., is exceptionally good. The system will now be briefly described.

The main valve A is connected through the inductance c_1, which may be coupled to the coil f or the aerial F, to a suitable source of high potential, such as direct current, from the primary or secondary battery B, or a dynamo, or rectified alternating current from an alternator or transformer. The filament a of the valve is connected to the negative side of the current supply, which may have a condenser b connected across it to provide an easy path for the flow of oscillatory energy when the valve A is in operation. The oscillatory circuit C comprising the inductance c and condenser c_1, and suitably coupled to the inductance G of the main circuit H, is connected to the grid a_1 of the valve A on one side, and at the other is connected to the filament d of the modulating valve D and also to a condenser d_1, the other side of which is connected to the anode d_2 of the modulating valve, which anode is in turn connected to the tapping b taken off the main supply, or to a separate

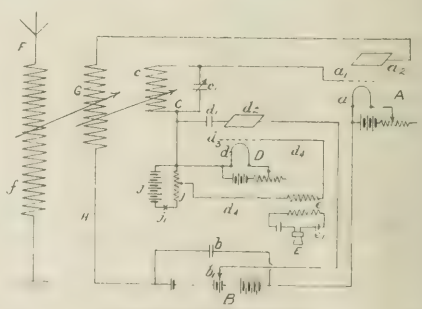


Diagram of Connections.

battery connected to the filament of the main valve, according to the type of modulating valve D employed.

The grid d_4 of the modulating valve may be connected up to the secondary of the step-up transformer e, in the primary of which is the microphone E and battery e_1, or the microphone E may be placed direct in the grid circuit d_4, the grid d_3 being kept normally at a definite negative potential with respect to its filament by means of a battery i and potentiometer j. With the valve circuits as above described, on adjusting the negative potential on the grid d_3 of the modulating valve D and the positive potential on the anode d_2 by tapping from the main current source B (or separate battery)

connected to the filament a of the main valve A, the system can be arranged to oscillate continuously, assuming that the oscillatory circuit connected to the grid a_1 of the main valve is turned to the frequency of the main circuit H. If, however, the negative potential on the grid d_3 of the modulating valve D is increased by the potentiometer j to such a value as just to cause the oscillations through the main valve A to stop, the system is very unstable, and any external disturbance impressing a positive charge on the grid of the modulating valve D will cause the system to oscillate to a greater or less amplitude according to the amount of the charge.

If, therefore, a microphone, such as E, is employed for the purpose of speech, the speech currents produced will affect the grid d_3 of the modulating valve D, which will in turn control the main valve A and cause variations in the oscillatory energy in the main circuit H corresponding to the wave form of the speech current; or telegraphic signalling may be effected, for example, by a Morse key j_1 in the potentiometer circuit, alternately throwing in and cutting out the negative potential on the grid of the modulating valve.

The operation of this system is based upon the fact that with a sufficient negative charge on the grid d_3 of the modulating valve D, the space between the anode d_2 and the filament d becomes non-conductive, and the grid a_1 of the main or power valve A with its oscillatory circuit C, including the microphone transformer e, is insulated from the filament a of the power valve A, so that the negative charge on the grid a_1 of the power valve becomes so great as to reduce to a minimum the energy passing to the anode a_2 of the valve, oscillations therefore ceasing.

If, however, the negative charge on the grid d_3 of the modulating valve D is reduced, for example, periodically as the effect of speech currents, a greater or less amount of the negative charge is allowed to leak off from the grid a_1 of the power valve A through the filament d and the anode d_2 of the modulating valve back to the power valve filament a, thus setting up oscillations in the main power circuit H, having an amplitude determined by the decrease in the negative potential of the grid a_1 of the power valve. If no speech is impressed on the microphone E, the system is non-oscillating; or, if the system is used for telegraphy, it remains non-oscillating as long as the charge on the grid of the modulating valve is maintained at its normal level, but if, by a switch or key j_1, or any other means, the potentiometer battery J is disconnected or its potential altered so as to reduce the resistance through the modulating valve D, the system immediately starts oscillating.

The condenser d_1, placed between the anode d_2 of the modulating valve D and the oscillatory circuit C connected to the grid a_1 of the power valve A, provides a path for the passage of the high-frequency currents, the modulating valve D providing a variable high-resistance leak across the condenser d_1, which limits the value of the negative charge on the grid a_1 of the power valve A.

This system economises the amount of high-potential energy normally consumed, as only the power valve A itself has impressed upon it the source B of high-pressure current, and an ordinary receiving valve of comparatively low vacuum can be used for modulating purposes. When used for telephony, the power employed in the main circuit H is a minimum when no speech is being transmitted, and the carrier wave present in many systems is entirely suppressed until brought into existence for the purpose of transmitting speech or telegraphic impulses. This is of special advantage for diplex or multiplex telegraphy or telephony, since the carrier wave is entirely absent at all "no speech" periods, and listening-in on the same wave length is therefore possible. A further advantage of the suppression of the carrier wave is the elimination or reduction of interference with other stations. Also, it may be pointed out that no unnecessarily high voltage is allowed to reach the transmitting key j_1 when the system is used for telegraphy.

COSTING APPLIED TO THE FACTORY.

By F. W. POPE.

Writing on the Ford factory, Mr. Henry Ford says: "I think one hundred dollars would buy all the office equipment in the factory outside, of course, the cost department."

The exception is significant, and is eloquent of both the necessity and the importance of costing. It emphasises the fact that if you would produce cheaply, you must first know your costs.

What this super-manufacturer implies is accepted by manufacturers generally; the difficulty arises when the attempt is made to apply it to the practical every-day work of the factory. What is needed is the laying down of certain broad lines along which a costing system may be developed.

What constitutes the cost of an article? Cost is the sum total of labour, material, and overhead charges expended to carry out and complete a particular job.

The first two items represent the "prime cost," and are comparatively simple to deal with if you have a good shop system.

To obtain accurate labour costs, a reliable time recorder is necessary, so that a workman may clock on and off each job. Time sheets written up at odd moments by the men themselves are not to be relied upon, and even with a time recorder provision must be made against the possibility of a man forgetting to clock on. Many a system has failed only because it depended too much upon the memory of workpeople.

All material should be kept in the stores and only issued upon a requisition signed by the foreman. The information compiled from these requisitions is passed to the cost office, for entry in the stores ledger.

Overhead charges represent, of course, all items of expense which cannot be charged direct to the job, such as rent and rates, light and power, general labouring, administrative expenses, &c. These are usually allocated by adding a certain percentage to labour cost. This, however, gives erratic results, and the best method (in the writer's opinion) is by fixing hourly rates for each machine and for fitters. Power, floor space, and the original cost of the machine all have to be taken into account in fixing this hourly rate (one of the advantages gained by grouping machines of the same class is that it simplifies these calculations). But machine-hour rates can only be fixed upon records kept for this express purpose over a period.

As a substitute, until accurate figures can be arrived at, the productive hour rate may be recommended. It is calculated in this way: Make a total of productive hours over a period and divide the number into the overhead expenses for the same period, which, incidentally, should not be less than three months. If, for instance, your productive hours are 300 and your overhead expenses £15, then the P.H.R. will be one shilling.

The secret (and, moreover, the fascination) of efficient costing is analysis. Analyse the product, analyse the operations, analyse the factory.

Analyse the cost, and you will then know at what price you can sell—other interesting discoveries will follow.

Local Electrical Exhibitions. We would bring before the notice of supply undertakings or contractors who are proposing to hold electrical exhibitions the request that they should notify the British Electrical Development Association prior to fixing the date of the exhibition. During the past few months valuable propaganda by means of local exhibitions has been carried out. Where the promoters may desire to [illegible] opportunities to obtain displays from manufacturers, it is essential, in their own interest, that the earliest notice has been given, and, so far as possible, the date of the [illegible] in connection with other and similar bookings in order to avoid overlapping. The latter, as may be readily understood, sometimes prevents manufacturers from assisting in making those exhibitions to the full extent which they would desire.

FRANCE REVISITED.—III.

Developments in the South.

By THEODORE RICH.

(*Concluded from page* 479.)

Traction Overhead Equipment.

As the overhead equipment was begun over 10 years ago and its completion was delayed by the war, one can see along the line the development of the design of the supports. The material required for 1,500-volt traction differs, however, very little from that required for single-phase working. At first a number of supports were constructed out of double-headed rails braced together; they have a somewhat flimsy appearance, and it looks as if they might be improved by having some concrete cast round them. The newer sections are being equipped either with zig-zag lattice angle supports or with armoured concrete supports lightened out with "windows." Fig. 9 shows some of the latter, outside Pau, on what is for the moment the works construction 60,000-volt feeder. Bracket arms to support the traction catenary will be attached to these supports later.



Fig. 9.—Reinforced-concrete Poles.

Fig. 10.

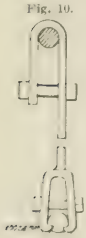


Fig. 11.



Fig. 12.

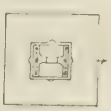


Fig. 10.—Section of Catenary Conductor.
Fig. 11.—Catenary Construction on a Curve.
Fig. 12.—Base for Concrete Pole.

The catenary conductor (fig. 10) is double; it is made up with two grooved wires fastened together with clips, each wire being 100 mm.² in section (0.155 sq. in.), and on the straight run is suspended from the supporting cable at points between the clips, thus giving a contact which will be satisfactory at a speed of 120 km. per hour (74 miles p.h.). The earlier single-conductor catenary was suspended by a short length of chain to give the necessary upward movement, and then a steel strip and a clip. On the newer sections, a steel strip suspender is used with a loop round the suspending cable to allow of a slight vertical movement. On curves both conductors are clipped together and suspended from the combined suspension and pull-off cable by means of a side-pulling strip. Fig. 11 is a rough sketch of the arrangement. The line follows the curve very closely. The arms across the lines to which the catenary insulators are attached are made of tube, stiffened by suspension bars and wire ropes. Fig. 13 shows a section with steel supports on a curve; the 60,000-volt line is supported on the large insulators on the left. The anchor supports are heavily stayed in some cases with a length of round bar.



Fig. 13.—Transmission Line and Catenary Construction.

Armoured Concrete Supports.

A long stretch of main line in the South-Eastern section is being equipped with concrete supports similar to those shown on fig. 9, but with the 60,000-volt circuit supported on pin insulators. It can be well understood that the great disadvantage of armoured concrete posts is their weight, with the consequent difficulties of transport to the site, and the heavy tackle required for their



Fig. 14.—Depot for Casting Concrete Poles.

erection; on the Midi Railway the contractors for one section have got over the difficulties in an interesting way. A gang proceeds to the site to dig out or blast out a rectangular hole. A special train equipped with concrete mixers and other apparatus for the rapid mixing and pouring of concrete follows when traffic allows, and a rectangular base is cast with a hole cored out, of a rectangular wedge shape to fit the base of the concrete support, with a slight clearance (fig. 12). When these are set, a train is made up of flat cars containing supports, one bogie car being arranged on each side of a high-powered steam crane with a long arm. The steam crane lifts the supports, weighing something like five tons each, one by one from the flat car, and they are then tipped up into a vertical position and dropped into the prepared base, where the support is lined up and temporarily fixed by wood wedges to await the filling and grouting-in party; the whole operation, from the flat car to the wedging-up, takes in some cases little more than two minutes. In order to turn out these supports cheaply a depôt has been laid out near the railway station at Pau; concrete mixers, stone breakers, heavy cranes, and special testing gear have been arranged so that they can be cast, seasoned for 40 days, and shipped with a minimum of labour. Fig. 14 is a view of part of this depôt. In France many of the armoured concrete power line posts and supports erected in the past have shown flakes and rust cracks because, to cut down the weight and cost, insufficient concrete has been put outside the steelwork. The supports on the Midi Railway will certainly not suffer from this defect.

A British Traction System.

The equipment of the rolling stock is being made at the works of a comparatively new company, the Constructions Electriques de France, on a system developed by the English Electric Co., Ltd. As the bulk of the electric traction equipment running in this country has so far been little less than slavish imitations of foreign designs, it is refreshing to hear that a Continental railway company has found a British electrical system worthy of adoption. It may be that now some of those who, in the past, thanks perhaps to organised persuasion, came to the conclusion that our engineers could not turn out or genuinely design motors or contactor gear suitable for heavy traction equal to the work in Schenectady, Pittsburg, or Berlin, will sit up, take notice, and act accordingly.

The Midi Railway will before long have at work what will probably be one of the longest continuous stretches of heavy electric traction in Europe; it is to be hoped, as electrification is in the air, that the technical and commercial results will be watched by engineers and directors over here, and that the people of one of the most picturesque parts of France will benefit from a development which has received so much financial and other backing from the French Government.

THE AMERICAN TARIFF AND BRITISH ELECTRICAL ENGINEERING EXPORT TRADE.

By W. POLLARD DIGBY.

A first and hasty consideration of the new Fordney Tariff from the point of view of those interested in general engineering manufacturing in Great Britain would result in the remark that as previous American tariffs of a prohibitive character had reduced our engineering exports of many of our finished products to the United States almost to vanishing point and left us only a small trade in certain very high grade products plus occasional spasmodic trade in certain semi-finished materials, the new tariff only makes a very bad case into one a little worse. Further consideration would indicate that owing to the inter-relation of industries, any factor having an adverse effect, say, in the Sheffield trade in tool steel or high grade cutlery would have a minor adverse re-action on the electrical industry. When to the effect on the Sheffield industries allowance is made for the effect on the textile industries of Lancashire and Yorkshire, the immediate minor adverse reactions are cumulative and the effect is amplified. Pursuing a wide subject yet further, other considerations present themselves. The more remote effects are often of great interest. A stone dropped into a pond causes expanding wavelets to wash and dislodge particles of matter at the shores. If the stone is big and the distance small, the thrower may get very wet. A projectile fired from a heavy gun may (or may not) reach its object. This depends on a number of causes.

The extent of the damage done on the impact of the percussion type of projectile depends primarily on the fuse. But if the gun mounting is obviously defective, the gun recoil may make things quite unpleasant for the gun layer and crew.

Until the League of Nations Assembly evolves (if it ever does) from an amiable debating society with recommendatory powers into the United Nations of the World with a constitution and the power to enforce its conclusions, any free country must be admitted to have the right to manage its own internal affairs and to come to such agreements as circumstances permit with its neighbours.

In the case of tariffs and tariff wars, nations have been known to impose duties on manufactured imports from other protectionist countries. As the act of cutting off one's nose to spite one's face is not usually regarded as a strictly rational procedure, Lancashire is hardly likely to clamour for a retaliatory duty on American raw cotton or copper. What then of the immediate situation? It may well be that the conventional advice to grin and bear it is not wholly vain, and that the forced grin may become a smile. The situation is by no means devoid of humour. In pre-war days, Great Britain and the Continent generally purchased American cotton, copper and machinery. Payment was effected in a number of ways direct and indirect. The direct payments were small—these consisting of exports of luxuries and manufactured goods of European production.

The indirect payments were in part met by the earning power of British shipping, and still more by indirect payments in raw materials. Metallic tin, raw jute, rubber, tea and coffee from various parts of the world poured into the United States, thus adjusting the trade balance. But those overseas commodities of non-European production reaching America either by direct shipment or by way of Liverpool, London, Antwerp or Hamburg had all to be, and were, paid for by the exports of manufactures from Europe, or else were one of the stages by which the interest on previous investments, say, in India, Australia, or Argentine, were indirectly paid to the lending country.

The problem of 1923 is greater and more complex than that of 1913. Then the American export surplus was in part a payment of interest, in part an investment abroad of American capital, and perhaps even in part a repayment of British capital invested in the United States. To-day we have not merely to finance the purchase of essential imports from the United States, but to meet interest and sinking fund charges of an amount not yet precisely defined, but probably in the neighbourhood of £50,000,000 sterling annually, on a certain indebtedness.

These purchases and payments have to be met by exports from the United Kingdom. As it is now from quartz reefs and alluvial deposits, we can each year

scrape up a little more bullion.* We can perhaps, in spite of the Fordney Tariff, still send, but in diminished quantity, certain very highly specialised manufacturing products. In the main, payment will have to be made in raw materials of tropical or semi-tropical origin, for which we and the other debtor nations will pay by our exports to the countries producing rubber, coffee, tin, juice or wood as the case may be. This will tend—so long as the prohibitive tariff remains in force—to increase British and other European exports of all classes to these countries and to cut off American exports thereto of machinery and so forth. Therefore, as said, the forced grin of compelled adoption may become in time a quite natural smile—that is to say, when readjustment follows the immediate dislocation.

We sorely need a stimulation of our internal and external trade—one of the means which will facilitate this is increased purchases by the non-European countries producing the commodities which cannot be obtained within the United States. Sheer economic pressure will render it easier (always provided that we can reduce our cost of manufacture sufficiently) for us to supply these needs than for the United States to do so. As a country exporting manufactured goods, the last-named seems to be threatened with impotence. A large proportion of her export trade may become the heritage of her present creditors.

One last word as to exchanges. Before 1914 these were not of very great moment between countries having a gold currency standard and whose national credit was unimpaired. To-day exchange problems beset us at every turn—the new United States tariff merely threatens to extend this quagmire in which the nations are floundering. We were well on the way to establish the pre-war parity between the dollar and the pound sterling. A reduction on our part of non-essential imports would have brought this desired end even nearer. At the moment we frankly confess that the final rectification of the London-New York exchange may be a matter of a quarter of a century unless something approaching the seemingly miraculous happens. We said "seemingly miraculous." We can eliminate the wholly miraculous and omit from the equations of possibilities any such element as international charity. The introduction of common sense may permit the solving of the problem. The reaction must come first.

INDIAN NOTES.

(From Our Special Correspondent.)

Calcutta Electric Supply Corporation.—The citizens are somewhat disturbed over a notice of a 30 per cent. surcharge on supply bills which has recently taken place in Calcutta. For some time previously the surcharge was 15 per cent., which most people accepted without cavil as fair; but the additional 15 per cent. levied a few weeks ago was considered a little stiff, and some protest has been made. The agent was interviewed by the representative of a local newspaper and explained that the additional charge was due mostly to the steadiness with which coal prices remained at a high level, also to the increase of wages and salaries, and in addition the low rate of exchange acted unfavourably on the company's finances. The company's prospects appear extremely favourable. At present there is a waiting list of over 15,000 kW, due to the rapid growth of the city both in population and in area of supply. The capacity of the present generating station is said to be 21,000 kW, and the present extension provides for an equal load. In addition to this extension is being made for a still further extension of about another 21,000 kW. These figures, if correctly reported, show that an extraordinarily successful [illegible] for this company.

Bengal Telephone Company.—Here again a big increase in subscribers' [illegible] has taken place which has given rise to an acute opposition by the public concerned. Government, having given sanction to the enhanced rates, could not help, without going back on its word, and the battle goes on. The company has recently put in a very fine modern exchange, but subscribers complain that the service is no better than formerly—in fact, it is not as good, they say—and there seems to be no justification for the big increase just imposed.

Kabul Wireless.—The recent Dobbs mission presented a wireless field set to the Amir which worked satisfactorily for a time. Now it has broken down, much to the inconvenience of the users, especially as the conservative Kabul people were beginning to appreciate the value of easy communication with the outside world. This sudden stoppage has isolated both the Italian and the British mission at present in Kabul. Efforts are being made to restore speedy communication again.

Upper India.—Considerable developments are reported from Upper India. The Cawnpore Supply and Traction Co. have found it necessary to extend their power house. In addition to the two 4,500-kW sets recently started, the company is said to be ordering two further sets of 9,000 b.h.p., together with the necessary boiler and switchboard equipment.

Orders are about to be placed for a large power house at Renala, Punjab, for the utilisation of hydro-electric power from the Lower Bari Doab Canal.

The Punjab Electricity Board has recommended to Government that the Municipal Committee of Gujranwala be permitted to finance a public supply company for providing electric energy to the town.

Naini Tal Hydro-electric Scheme.—This new undertaking is now at work, having been in hand since 1920. It consists of three 150-kW Mather & Platt alternators driven by Pelton wheels, with three sub-stations in Naini Tal, the generator house being at Durgapur. The transmission voltage is 3,300—a feature of the job being the huge spans across valleys, some being 1,200 yards across!

* According to the old [illegible] Midas did not find his corner in bullion very comfortable.

LEGAL.

Pre-War Debts to German Firms

The Controller of the Clearing Office, Stamford Street, Southwark, is bringing a number of actions in the Southwark Court with reference to debts arising from business transactions with German firms just prior to the war, and claiming interest at the rate of 5 per cent. on the outstanding amounts. The first was heard by Judge Sir Thomas Granger on Friday last, when the controller of the Clearing Office brought an action against Mr. R. Simmons, of B. and R. Simmons, opticians, of City Road, E.C., to recover £5 14s. 3d. interest due on a debt of £19 15s. 10d. paid on July 7th, 1920. The dispute was as to the amount of interest, if any.

Mr. Meadow, for the Controller, said that, according to the Treaty of Peace Order, debts incurred with firms in Germany were liable to interest at the rate of 5 per cent. Messrs. Simmons originally owed £463 to a German firm for goods supplied in August, 1914, and that amount had been paid in July, 1920. The question was whether interest should be paid between the period of the Order and the date when the debt was discharged.

Mr. Rowland Smith, for defendant, said the goods were ordered by his firm, but the war brought an end to their business, which was wound up in July, 1918. Between the period of the outbreak of war and 1918 defendant never received one penny interest on the money, and now he was called upon to pay 5 per cent. interest from August, 1914, to July, 1920. He argued that the debt was not payable unless there was somebody who could have legally enforced payment of the debt at the time. From September, 1914, to July, 1920, nobody existed who could have enforced payment of the money in a court of law. He submitted that the amount was not due, inasmuch as it could not have been sued for, or was not payable until arrangements for the liquidation of such obligations had been set up by the Treaty of Peace. People in this country were forbidden by the law to have any business transactions with the enemy, and consequently it would have been an offence to pay the amount due to Germany. The fact that the firm had been dissolved had been brought before the Controller, and he had decided to sue one member of it, whereas he should have brought an action against the partnership.

Mr. Meadow said he relied solely upon the Treaty of Peace Order, which gave him the right to charge 5 per cent.

interest on any debt which fell due on the outbreak of war or during the war. The money could have been paid to the Public Trustee.

Judge Sir Thomas Granger said he was very much afraid that the war had placed a great many people in positions of serious difficulty. There might be hardships, and no doubt there had been, but in the present case it was perfectly clear that the Controller was entitled to recover interest. He gave judgment for the Controller, but dated the interest from September 19th, 1914, instead of August 4th, 1914.

A Johannesburg Dismissal Claim

Mr. Justice Gregorowski delivered judgment in South Africa on September 20th in the High Court in the case in which A. Matthews sued the Municipal Council of Johannesburg. He said that plaintiff was engaged by the Municipality in July, 1915, as a blacksmith at the power station, on daily pay, and continued so until July, 1921, when he was promoted to the position of foreman at a salary of £45 per month plus an allowance for cost of living. Plaintiff said he was wrongfully dismissed in March, 1922, and claimed from the defendants £229 18s. 4d. The defence was that the plaintiff was not dismissed, but that he deserted from service when the recent strike was proclaimed. There were further defences that the strike was unlawful. The Judge held that the ballots were not lawfully conducted and that Matthews was not bound to obey a strike call which was not in accordance with the rules of the trade union to which he belonged. Moreover, the Council was justified in summarily dismissing him. Judgment was given for plaintiff for the amount of defendant's tender, being the amount he had paid into the pension fund, and for the rest judgment for the defendants with costs.

Former Partner Liable, Although Partnership Dissolved.

Judge Cluer gave a decision in the Shoreditch County Court last week, holding that a former partner was liable for a debt, although the partnership had been dissolved. The plaintiffs were the Universal Machinery Corporation, Ltd., 326, Old Street, E.C., and they sued Mr. Gross, of Leeds, and Mr. Robertshaw, of Messrs. Curtis, Holt & Co., Leeds, to recover £22 10s., the value of an electric tool-grinder supplied on sale or return. Mr. Howard appeared as counsel for the plaintiffs, but of the defendants only Mr. Robertshaw appeared, although Mr. Gross had been served with a summons.

It was explained by Mr. Greenwood, the manager to the plaintiffs, that, following an interview in August, 1920, it was decided to appoint the firm of Messrs. Gross, Son and Robertshaw their agents for Yorkshire for the sale of their electric tool-grinders. One of the grinders was sent as a show sample in December, 1920. Later they got a letter from the firm saying that Mr. Robertshaw was leaving the firm at the end of the month, but Messrs. Gross & Son offered to carry on the agency in the collieries of Yorkshire. Finally they decided to demand the return of the sample, but their letters had had no effect on Gross. The defendant Robertshaw claimed that as the firm were told that he had gone out of the partnership, he could not be held liable.

Judge Cluer: How does it stand; does he remain the agent for all time for a partner in a dissolved partnership?

Mr. Howard: Perhaps not, but he is liable for acts committed while he was a partner.

After carefully going into the law on the subject, Judge Cluer held that when there was a dissolution of partnership, it did not release the outgoing partner from liability for anything that had occurred while he was a partner unless he saw to it that a letter was sent by himself to every customer, saying he would not be held liable further. It would then have been for the plaintiffs to enter into a fresh agreement with Messrs. Gross & Son if they wished. As it was, Mr. Robertshaw was liable for the return of the grinder, and he would make an order for its return in three days, or its value, £22 10s. "You will have to get the half of it out of Gross," added his Honour to Mr. Robertshaw.

Kreikeman *v.* Roysentul.

In the Shoreditch County Court last week, before Judge Cluer, Mr. Simon Kreikeman, of 6-7, Radsworth Street, City Road, E.C., fancy leather goods manufacturer, sued Mr. J. Roysentul, of 46, Balls Pond Road, N., electrical engineer, to recover £29 4s. Of this, £18 was claimed as damages for the stoppage of the business for a day, £8 14s. was for the repair of an electric motor, and £2 10s. a half-year's fee paid for the maintenance of the motor by the defendant. Mr. F. J. De Verteuil appeared as counsel for the plaintiff, and Mr. Lemon for the defence.

The plaintiff said he ordered an electric motor costing £54 for the running of his sewing machines to make fancy leather goods. It kept breaking down, and finally, on June 28th, broke down completely. Defendant was 'phoned to, but did not respond, so Messrs. Cordingley & Mills were called in, and they put it into going order. The defendant had agreed to keep it in order for £5 for the first year, and had been paid £2 10s. on account of this. In cross-examination, he denied that he ever agreed to buy a second-hand motor. His forewoman gave evidence that the defendant sent to the firm and then left a card with a telephone number so that he could be called up if it went wrong again. It did, and she telephoned once only to the defendant, but could not get hold of him, so Messrs. Cordingley were called in.

Mr. Lemon submitted that there was no warranty of the motor being installed, so that there was no warranty at all. As to the repairs, if the plaintiff chose to call in someone else, and only troubled to telephone the defendant once, that was his fault.

Judge Cluer agreed with this view, and decided that the plaintiff was only entitled to recover the £2 10s. he had paid for the motor to be looked after.

REVIEWS.

Sparking Plugs. By A. P. Young and H. Warren. Pp. xii + 102, 61 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

"There is a lack of sound technical literature on this subject, and the authors have endeavoured, therefore, in this little book to meet a long-felt want by dealing fully with the difficult problems associated with sparking plug design, indicating, at the same time, the direction in which advances are being made." The foregoing extract from the preface to "Sparking Plugs" gives a good idea of the aim and scope of the book, and it may be said at once that the authors have succeeded remarkably well in their effort. An immense amount of useful and interesting information is contained in the 100 small pages; this information, moreover, being easily assimilated on account of the clear manner in which it is presented. The book is fully illustrated, and many diagrams are included, giving the results of original research made by the authors in the laboratories of the British Thomson-Houston Co.

Of the five chapters into which the book is divided, the first is on the subject of "Electric Ignition." After reviewing briefly the original systems of ignition, interesting descriptions follow about spark generators and their characteristics, spark energy and the process of ignition, leading up to a discussion on the topic of the components of a spark.

In this connection one point may be mentioned. On the vexed question of magneto *v.* battery, Mr. Young has always appeared as a "whole-hogger" on the side of the magneto. On pp. 12 and 13 diagrams are shown comparing the results given by "modern British magnetos" and "an American battery-coil igniter"—to the evident disadvantage of battery ignition. This, of course, may represent an unbiased test, but at the same time, no indication is given of the type of coil igniter used, and it is quite possible that a manufacturer of modern British coil apparatus would put up a system showing far better results than those indicated in the diagrams referred to. It is one of the advantages of the battery system that the components are not so limited as to size as in the magneto system, and the coil may be designed according to requirements, instead of being confined to the narrow dimensions of a magneto armature. In addition, the coil, being stationary, is not subject to the stresses of centrifugal force, an important fact, which is not mentioned in comparing the two systems. The question of battery ignition is very much to the fore in these days, and the fact that it has been adopted on the new Rolls Royce car in addition to the Wolseley, Daimler, and other high-class British cars is sufficient indication of its importance.

The second chapter deals with the mechanical problems in design of plugs, especially the question of gas-tightness, and various methods of sealing are described. An interesting illustration is shown in fig. 13, indicating a larger and more substantial type of plug, which might well have become standard in the days when engines were generally made with valve caps instead of detachable heads. Much greater mechanical and electrical safety could be obtained with plugs incorporated with the valve cap.

Chapter three is the most interesting, and forms the main feature of the book. In it are discussed all the factors which influence the character of the spark discharge between the electrodes of the plug—the material and shape of the electrodes, the direction of the current, the pressure and temperature of the gas, &c. It is shown that the apparently simple spark is in reality a very complex phenomenon, depending on many variable factors. Four standard plugs, chosen because of the difference in design of the electrodes, were used in the tests with the gaps all adjusted to .016 in., and three types of magneto, the results of numerous tests involving alterations in the variable factors affecting the spark being demonstrated in diagrams and tables. Here again, it would have added considerably to the interest if a modern battery and coil system, with corresponding plugs set to the wider gap required, had been tested at the same time.

It is shown how large is the influence of temperature, reducing the sparking voltage in the ratio of about three to one as between ordinary atmospheric temperatures and the normal temperature of a working engine.

Another feature clearly brought out in these tests is the marked difference in sparking voltage dependent on the polarity of the electrodes. This difference is often 1,000 volts or more, being largest with electrodes of the true "point and plane" type, and non-existent in a perfectly ammular gap. In the case of a magneto spark generator, which, of course, gives alternating impulses, the effect might be important under certain conditions.

In chapter four the composition and properties of the various plug insulators are fully discussed. Descriptions of some standard plugs are given in Chapter 5, and three pattesters are mentioned. A useful feature is the Bibliography which follows, giving a key to the literature on the subject, an index being also provided.

"Sparking Plugs" can be confidently recommended to all those interested in the subject. It contains a mass of condensed information carefully collected, skilfully arranged, and clearly presented.

F. H. Hutton

Elements of Radio Telephony. By William C. Ballard, Jr., M.E. Pp. x+128; figs. 58. London: McGraw Hill Publishing Co., Ltd. Price 7s. 6d. net.

The author, who is assistant professor of Electrical Engineering in Cornell University, U.S.A., wrote this book mainly, no doubt, for the American "radio fan" who wishes to get a good grip of the subject, but who has not sufficient mathematical training to take advantage of the regular text-books, and there are many similarly-placed enthusiasts in this country to whom the book should certainly be useful. Mathematics, in fact, are entirely avoided, with the exception of a few fundamental equations which are given without proof, and those readers who are interested in the numerical constants of the circuits are referred to a circular of the Bureau of Standards, though it seems unlikely that the book will appeal widely to that type of reader.

The fundamental principles of the transmission and reception of messages by radio telephony are clearly explained, and the apparatus required is simply described, with the help of 58 illustrations and diagrams.

It is interesting to find the author in America contemplating the thermionic tube as the one universal type of radio apparatus, and we only wish that we could go as far with him in another one of his prophecies, *viz.*, that the spark system for ship work will be superseded by a continuous wave system in the *near* future. His statement, too, that with ground antennæ atmospheric strength is reduced in a greater proportion than signal strength, is one that we should like to be able to consider a practical suggestion for the reduction of atmospheric troubles.

The price of the book, for its size, may seem at first sight rather high, but the printing and general get-up are of the best, and a useful little index is included.

BUSINESS NOTES.

Bankruptcy Proceedings.—Frederick Hungate Dennis, 124, New London Road, and 21c, High Street, both Chelmsford, late 20, High Street, Chelmsford, electrical engineer.—The receiving order in this matter was made on August 19th on debtor's own petition. The statement of affairs shows liabilities of £841, while the assets are estimated to realise £615, from which preferential claims of £42 have to be deducted, leaving net assets of £573, or a deficiency of £269. Debtor attributes his failure to insufficient capital and general depression in trade. It appears that in 1894 he received between £3,000 and £4,000 under the will of an uncle, and took over from his father for approximately £2,000 an electrical and general engineer's business at 20, High Street, Chelmsford, which had been established in 1854. In 1914 he had to consult his creditors, but ultimately paid his debts, amounting to £976, in full. In June, 1921, he sold the business for £1,500, out of which he paid all his debts, with the exception of one, and continued to trade at 21c, High Street, of which he already had the lease, but business latterly has been very bad. The following are creditors:—

	£		£
Avery, Ltd	10	Lumleys, Ltd.	25
Baldwins, Ltd.	25	National Radiator Co	10
Essex Weekly News	15	Payne, H., & Son	10
Essex Chronicle	10	Raddatts, F.	10
Falk, Stadelmann & Co.	25	Siemens Bros. & Co	10
Fuller's Elec. Mfg. Co., Ltd.	10	Thorn & Hoddle	10
General Elec. Co., Ltd.	35	Taylor, L.	10
Gowers, J.	20	Wenley, Ltd.	25
Kent, George	10	Wood Russell, Ltd.	10
Luckin & Sheldrake	15	Wray & Fuller	10
Bankers	15		

The public examination of this debtor was held recently at the Shire Hall, Chelmsford. The liabilities were returned at £841, against assets of £573. Debtor attributed his failure to insufficient capital and general depression in trade. It appeared that in 1894 he received between £3,000 and £4,000 under the will of his uncle, and purchased from his father for approximately £2,000 the electrical engineer's business at 20, High Street. In 1914 he had to consult his creditors, but eventually paid his debts in full. In June, 1921, he sold the business for £1,500, out of which he paid his debts, except £400 owing to his sisters. He continued trading at 21c, High Street, but business latterly had been bad. The examination was adjourned.

Matthew Octavius Heckels, 643, Welbeck Road, and Star Buildings, Northumberland Street, both Newcastle-on-Tyne, electrical wholesaler and agent.—The receiving order in this matter was made on September 8th on debtor's own petition. The statement of affairs shows liabilities of £1,858, while the assets are estimated to realise £672. There are fully-secured creditors for £396, the securities held being valued at £685. The first meeting of the creditors was held on October 4th at the Official Receiver's office, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne. The following are creditors:—

	£		£
Baxter, S. &	29	Fields	456
Fergus, [illegible]		Griffiths, Isaac & Sons	660
[illegible] Ltd	14	Heckels	115
Bertram, [illegible]		Hughes's Telegraph Works Co.,	
Cables, Ltd.	24	Ltd	37
Cable Accessories, Ltd.	288	Miller & Castlemaine	14
Callender's Cable & Construction		Perfecta Seamless Steel Tube Co.	87
Co., Ltd.	90	Pordoes, T. & Sons	12
Purdie Conduits Fittings, Co.	20		

Mr. W. Brittain was appointed trustee on October 6th.

Frederick William Williams, Gradua Works, Porthcawe Road, Sydenham, and the "Retreat," County Oak Grove, Crawley, Sussex, engineer.—The receiving order in this matter was made on August 22nd on a creditor's petition. The statement of affairs shows liabilities of £19,013, while the assets are estimated to realise £35,966, from which preferential claims of £93 have to be deducted, leaving net assets of £35,873, or a surplus of £16,860. Debtor attributes his failure to insufficient capital to provide for the period (about six months from January, 1920), during which no remunerative work was done, and heavy outlay and expenses were incurred for machinery, in wages on experimental work, and in connection with patent rights at home and abroad, and failure from July 1st, 1921, of the sole agents employed by him to carry out their contract with him to take minimum weekly supplies of electrical switches at agreed prices, which showed a good margin of profits. It appears that from 1914 to date he has carried on, with another, an electrical contractor's business at Finchley. In December, 1919, when he had about £4,000 capital, he purchased for £1,200, certain rights in a patent and sundry stock and tools relating to the manufacture of electric switches. Improvements of the original invention were made and further patents taken out in Great Britain and abroad, and the total cost incurred in respect of all the patents was £3,100. In January, 1920, he purchased for £4,750, of which £3,000 was raised on mortgage, the freehold factory known as Gradua Works, and commenced trading there as an electrical engineer. The alterations to the premises were carried out at a cost of £600, of which £504 is still owing, and the machinery was installed at a cost of about £3,200, which has been paid. It was not until June, 1920, that the first switches were sold, and, in addition to the above outlay, his wages bill had been heavy, mainly in respect of non-remunerative experimental work on switches. His capital proved to be insufficient, and he had recourse to his friends and others for loans. On July 1st, 1921, he entered into an agreement, appointing a firm sole agents for 12 months for the sale of the electric switches, in consideration of their taking agreed weekly quantities at certain fixed prices, which showed a good margin of profit. Owing to the acute depression in the electrical trade, the agents only took a small proportion of the agreed quantities. On February 10th last he agreed to sell the Japanese patent rights, when obtained, for £3,000, of which £1,000 was to be paid down, and £2,000 immediately upon the patent being granted. £500 was received by him on account in various sums, but until the balance of the deposit was paid he refused to release the necessary documents to enable the Japanese patent to be obtained. The following are creditors:—

	£		£
Associated Newspapers, Ltd	85	Minima, Ltd	15
Baker, S.	150	Mallett, E. A.	300
Beck & Pollitzer, Ltd.	40	Nesbitt, A.	510
Butcher & Co.	20	Oldfield, J.	365
Burleigh, D. S.	110	Pattison, Miss E	30
Cox, W. E.	50	Richards, E.	220
Curwen & Son	10	Royal Sovereign Pencil Co.	15
Derry, A. D.	1,250	Rose, F. G.	505
Dawson, H.	300	Stening, E.	50
Forrester, H. J. C.	700	Stenning, A	25
Hearn, E.	35	Sun Electrical Co.	25
Hales, W. H.	110	Taylor, H.	10,570
Hassler, J.	320	Thomas	300
Hallewell, Dr. T.	50	Williams, Mrs	600
Jones, H.	15	Wake, H. C.	165
Jenks, M.	355	Wardell, A.	100
Kerman, H	730	Patteson	150
Bankers	92		

Joseph Ernest Rollinson, 5, Tavistock Chambers, Beastmarket Hill, Nottingham, electrical engineer and contractor.—The public examination of this debtor was held recently at the

County Court House, St. Peter's Gate, Nottingham. Debtor stated that he commenced business in Manchester in 1919 with £50 capital. Two years later he was joined in partnership by a man who paid £400 for a half share. Debtor blamed the coal strike for the greater part of his difficulties. The liabilities were returned at £980, and there was a deficiency of £624. He had insufficient capital, and had suffered, in addition, through trade depression. After further questions, the examination was closed.

Horace John Albert Mullin, 206, Lozells Road, Hockley, Birmingham, house painter, and also trading as the Wilton Engineering Co., 124, Devonshire Street, Birmingham, electrical engineer.—The first meeting of the creditors of the above was held on October 5th at the Official Receiver's office, Ruskin Chambers, 191, Corporation Street, Birmingham. The liabilities were returned at £234, and there was a deficiency of £209. Debtor attributed his failure to bad trade. It appeared that he commenced business in 1890 as a house painter with £900 capital, and the business of electrical engineer was commenced in February, 1921, with the idea of providing employment for debtor's two sons. The whole of his capital of £400 was expended on plant and machinery for this business. Debtor had no knowledge of the business, and was joined by a prospective partner, who, however, actually became manager. Debtor got into financial difficulties, and efforts were made to sell the business, but without success. The matter was left in the hands of the Official Receiver as trustee of the estate.

Charles Johnson Haxby and Edward Brady, trading as Haxby & Brady, 1a, East Parade, Harrogate, electrical engineers.—The receiving order in this matter was made on September 22nd on debtors' own petition. The statement of affairs shows liabilities of £508, while the assets are estimated to realise £345, from which preferential claims of £31 have to be deducted, leaving net assets of £314, or a deficiency of £194. Debtors attribute their failure to insufficient capital, keen competition, bad debts, and law costs. It appears that they commenced business in September, 1920, at Harrogate, in partnership as electrical engineers. No deed seems to have been prepared. Their joint capital amounted to £70, the balance of their Army gratuities. Haxby states that an uncle has given him £100, and gifts from other relations have amounted to £120 since September, 1920, all of which has been put into the business; and E. Brady states that he has subscribed in all from £35 to £40, in addition to the capital he first put in. Debtors allege that they were not aware of the position until an execution was levied four days before they filed their petition. First meeting, October 16th; public examination, November 3rd, both at the Court House, Harrogate.

Herbert Garniss, 3, Madison Gardens, Park Avenue, late 107, Beverley Road, both Kingston-on-Hull, electrician.—The receiving order in this matter was made on September 12th on debtor's own petition. The statement of affairs shows liabilities of £98, against assets of 10s. The first meeting of the creditors was held on October 2nd at the Official Receiver's Offices, York City Bank Chambers, Lowgate, Hull, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

Fred Arthur Watkins, 57, High Street, Hythe, Kent, electrical engineer.—The receiving order in this matter was made on debtor's own petition. The statement of affairs shows liabilities of £1,017, against assets of £310. Debtor attributes his failure to want of capital, heavy fall in the value of his stock in trade, and insufficiency of his business profits to meet living and household expenses. The public examination was held on September 23rd at the Guildhall, Canterbury. The following are creditors:—

	£		£
Alliance Wholesale Electrical Co.	35	Bankers	177
A. & A. Electrical Co., Ltd. ...	12	Metropolitan-Vickers Electrical Co.	52
B. & T.T. Electric Lamp and Accessories Co. ...	10	Pope's Electric Lamp Co. ...	13
Belling & Co.	20	Seabrook Builders ...	24
Credenda Conduits Co., Ltd. ...	42	Steam (?) Electric Lamp Co., Ltd.	18
Dwyer & Co., P. L. ...	21	Sloan Electrical Co.	69
Emanuel & Sons, Ltd.	49	Smith, J. & W., Ltd.	30
Ellis Sampson & Saunders ...	16	Ever-Ready Co., Ltd.	11
Vulcan Electric & Mechanical Eros & Sons, Ltd.	29	Co.	47
General Electric Co.	13	Walsall Hardware Co., Ltd. ...	12
Hall, F.	21	Watkins, Mrs. L. B.	200

G. W. Humphry (Humphry Electric Co.), electrical engineer, 24, Broad Quay, Bristol.—Receiving order made October 3rd on debtor's own petition. First meeting, October 18th; public examination November 17th.

E. Durden (E. Durden & Co.), electrical engineer, 13, Queen Street, Liverpool.—First meeting October 13th at the Official Receiver's offices, Liverpool. Public examination, October 31st, at the Court House, Liverpool.

V. B. Worthington, electrical and mechanical engineer, Ellesmere Yard, Walkden.—Trustee, J. G. Gibson (Official Receiver), Byrom Street, Manchester, released July 24th.

T. Carter, electrical engineer, 2, South Street, Dorchester, and High Street, Swanage.—First dividend of 2s. 6d. in the pound payable October 20th at the offices of Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C.

W. R. White, electrical agent, 29, Great Pulteney Street, London, W.—Receiving order made September 28th on creditor's petition. First meeting, October 11th; public examination, December 12th, both at Carey Street, W.C.

W. E. Ogden, electrician, 3, Princes Street, Stockport.—Receiving order made September 28th on debtor's own petition. First meeting October 18th; public examination October 31st.

E. Powles, United Electric ... Manufacturers, ... Christopher Street, London, E.C. ... Trustee, Mr. E. E. ... kins, 4, Charterhouse Square, E.C.1, required ... for proofs.

R. T. Sloan, ... engineering contractor, ... Lane, Bradford. Last ... for proofs for dividend, ... 18th. Trustee, Mr. ... Bowman, Official Receiver, 12 ... Street, Bradford.

G. M. Hallett, electrical engineer, 7, King Street, Frome.—Last day for proofs for dividend, October 21st. Trustee, Mr. J. P. Emett, 18, Nicholas Street, Bristol.

F. J. Gill, electrical engineer, 26, Hardwick Street, Buxton.—Last day for proofs for dividend, October 18th. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

J. H. Rigby, electrician, 22, Higher Hodgate, Stockport.—Receiving order made October ... on debtor's own petition.

F. C. Jinks (trading in partnership with H. Rothwell and S. J. Watson as the Vireo Magneto Co.), 11, Long Acre, W.C. Application for discharge to be heard at Carey Street, W.C., on October 31st.

J. Owen (trading as J. Owen & Sons), ... engineers, 186, Westcombe Hill, and 3, The Circus, Greenwich.—Last day for proofs for dividend, October 25th. Trustee, Mr. J. Goudjay, 29, Russell Square, W.C.1.

Company Liquidations. John Electrics, Ltd.—A meeting of creditors was called for October 9th. Liquidator, Mr. M. Wilkie, 22, Darlington Street, Wolverhampton.

Rapid Submersible Ship Cleaner Co., Ltd.—A meeting of creditors was called for October 6th. Liquidator, Mr. T. F. Wild.

Associated Electric Traders, Ltd.—A petition for the winding-up has been presented to the High Court by Super Lamp, Ltd., of 197, Old Street, E.C., a creditor, and will be heard in London on October 17th.

Watson's Electric Co., Ltd. Winding up voluntarily. Liquidator, Mr. A. H. Stevens, 6, Dowgate Hill, E.C. Meeting of creditors, October 16th, at the Society of Incorporated Accountants and Auditors, 50, Gresham Street, E.C.

Amalgamated Radio Telegraph Co., Ltd.—A meeting of members is called for November 7th at 58, Coleman Street, E.C., to hear an account of the winding-up from the liquidators, Messrs. Pixley and Allen.

Swift Electrical, Ltd., London, W.—First meeting of creditors, October 20th, at 33, Carey Street, London, W.C.2. Proofs to Mr. H. E. Burgess, Senior Official Receiver and provisional liquidator, by October 19th.

Trade Announcements.—The Union Cable Co., Ltd., Dagenham Dock, Essex, have appointed the following agents:—Messrs. Alston, Scott & Co., 50, Wellington Street, Glasgow (for Scotland); Messrs. Coulston & Co., 5, Cross Street, Manchester (for the North-Western Counties); Messrs. H. Hopkinson & Co., 14, Park Square, Leeds (for Yorks. and North Lincs.); and Messrs. Inniss & Riddle, 86, New Street, Birmingham (for the Midlands). Stocks of Union rubber cables will be held at these addresses.

We are informed that Mr. G. H. Batley, who has hitherto represented Messrs. Mann, Egerton & Co., Ltd., for the sales and agency of "Electolite" country house plants, will in future represent Messrs. Boulton & Paul, Ltd., of Norwich, the makers of "Electolite" sets, in the same capacity, consequent upon the altered conditions of distribution throughout Great Britain and Ireland.

In order to handle their West of England business more efficiently, Messrs. Brook, Hirst & Co., Ltd., have arranged for their representation in that area by Messrs. T. Hood & Co., Ltd., 7, St. Stephen's Avenue, Bristol. Mr. Hood has had considerable experience in the application of Brookhirst switchgear.

Owing to the lease having been disposed of, Messrs. Webster & Sons, electrical engineers, are shortly vacating their premises at 48 and 50, Rendezvous Street, Folkestone.

Messrs. Hall Bros., electrical engineers, have removed the electrical sales department of their business from Edith Walk Works, Malvern, to 5, The Promenade, Worcester Lane.

Messrs. Lumens, of 11, Cathedral House, Long Millgate, Manchester, have joined the Priory Electrical Engineering Co., as agents for the Lancashire district.

Messrs. Ashford, Dunn & Co., makers of enamelled slate, &c., have removed to Ryde Street, Hull.

Messrs. D. O. Williams & Co., Ltd., of 9, St. Mary Street, Swansea, and High Street, Clydach, are opening new showrooms at 4, Union Street, Swansea, and they desire to receive catalogues and lists of fittings, heating and cooking apparatus, wireless and other manufactures.

Messrs. Clyde & Co., Ltd., have removed from Broad Street Buildings, E.C., to 61, Fore Street, London, E.C.

Catalogues and Lists.—A.C.E.C., 56, Victoria Street, London, S.W.—Stock list (October 1st) of their motors and dynamos, of which over 1,100 for a.c. and d.c. are in stock.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.4.—Booklet No. 1,249, giving the ... features of the "Mazda" advertising campaign for the ... suing season. It includes advertising in many newspapers ... trade papers, the preparation of publicity literature and ... cards, window displays and outside signs, postal ... reaching the general public in such a way as to ... contractors, dealers, &c., in promoting the sale of "Mazda" lamps.

Messrs. Bayliss, Ltd., Redditch.—An illustrated and priced leaflet (list No. 4), emphasising some of the advantages of the NI-FE electric hand lamp, including instructions for use.

The Waltham Manufacturing Co., 2, Jackson Road, Holloway, London, N.—Illustrated price leaflet of Waltham auto lamps for projection and other work.

Messrs. Tramway Supplies, Ltd., 93, Cannon Street, London, E.C.4.—Publication No. 103/1, giving an illustrated description of their h.t. and l.t. oil switches for voltages up to 3,300 volts and capacities up to 300 amps.

The General Electric Co., Ltd.—New edition of "C" section (12 pages) of their catalogue, containing revised (reduced) prices of "Geekoduct" conduits and accessories.

The London Fittings Co., Ltd., 57, Albert Road, Aston, Birmingham.—A number of lists showing various designs, and giving prices, of classic desk fittings, alabaster bowl fittings, glassware bowl fittings, ceiling plates, switchplates, galleries, lanterns, &c.

The Hotpoint Electric Appliance Co., Ltd., 21, Berners Street, Oxford Street, London, W.1.—New 20-page list (317) of "Falco" electric fires, including their latest development in this line—the new rustless steel fires.

The Burkl Electrical Manufacturing Co., Ltd., 6, Frances Street, Westminster, London, S.W.1.—Stock list, with prices, of motors, cables, fans, and accessories.

Messrs. Justus Eck and S. Brook, 4-12, Palmer Street, London, S.W.1.—Priced stock list of "Garbe-Lahmeyer" (or *Lahmeyer*, as it is printed on the front page) d.c. and a.c. motors.

For Sale. By direction of the Disposal Board, Messrs. G. Nichols, Young, Hunt & Co. will sell by auction on November 1st, at Portbury; Chittening and Radnor Road, November 2nd, Frampton-on-Severn, November 3rd; Yate, November 7th; Quedgeley, November 8th; Beachley, November 9th and 10th; machine tools, plant, boilers, electrical material, motors, dynamos, &c.—By direction of the Disposal Board, Mr. M. Marshall will sell by auction, on Wednesday, October 25th, at H.M. Dockyard, Rosyth, and on Thursday, October 26th, at H.M. Airship Station, East Fortune, near North Berwick, plant and machinery, &c., including petrol-electric generating sets, electric motors, &c.—By direction of the Disposal Board, Messrs. H. & R. L. Cobb will sell by auction, on October 31st, at H.M. Cordite Factory, Cliffe-at-Hoo, and on November 1st and 2nd, at the Aerodrome, Kingsnorth, near Rochester, plant, machinery, &c.—Halifax Corporation Electricity Department has for disposal two Babcock and Wilcox water-tube boilers, complete with chain-grate stokers.

Stepney Corporation electricity department has for disposal one 1,000-kW and two 1,500-kW generating sets, &c. (See our advertisement pages to-day.)

Book Notices.—"The Nitrogen Industry," by J. R. Partington and L. H. Parker. Pp. xv+336; 19 plates. Price 21s. net. "Water Power in the British Empire."—The reports of the Water Power Committee of the Conjoint Board of Scientific Societies. Pp. x+54. Price 3s. 6d. net. London: Constable & Co., Ltd.

"Steam Turbine Theory and Practice," by W. J. Kearton. Pp. xvi+456; figs. 249. London: Sir Isaac Pitman & Sons, Ltd. Price 15s. net.

"Automotive Repair," by J. C. Wright. Vol. II. Electrical service work. Pp. xii+418; 164 figs. London: Chapman and Hall. Price 15s. net.

"Practical Applications of X-rays," by G. W. C. Kaye. Pp. viii+136; 96 figs. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

"Year Book of the Michigan College of Mines, 1921-1922," with the calendar of the courses for 1922-1923.

Russian Orders for Germany. — According to the *Inversencourier*, the Siemens Schuckert works have concluded an agreement to deliver installation materials to the general electric works in Moscow. The agreement is considered important because this is the first time that a German consortium is supplying goods on credit to the Soviet Government. The sum involved is said to be up to 100,000,000 marks. The *Inversencourier* also mentions that, according to a telegram from Petrograd, a Russian order for 25,000,000 marks' worth of spare parts for turbines has been received by the Siemens [illegible] works. (*Reuter* (Berlin).)

Wages in the Electrical Contracting Industry.—The National Federated Electrical Association has issued instructions to its members to put into effect the agreement arrived at at York on July 27th last, on the first pay-day following October 8th. The new rates were announced in our issue of August 4th (p. 165), and involve a reduction of a further 5 per cent. on the April, 1921, rates, making a total reduction of 27 per cent. The revised rates under the agreement will, therefore, be as under: Grade A, 1s. 10d.*; Grade B, 1s. 7¾d.; Grade C, 1s. 6¼d.; Grade D, 1s. 4¾d. The above rates will remain current up to and including the period covered by the first pay-day in December, 1922.

*This rate includes a travelling allowance.

Casual Employés and Annual Holidays.—Glasgow Corporation Special Committee on Wages considered an application by the Municipal Employés' Association, on behalf of watchmen employed in the Electricity Department, asking that they be granted six days' holidays per annum, with pay, after 12 months' continuous service. It was explained that the great majority of the employés referred to are casuals only, and attend at the head office daily in order to obtain employment. The Committee agreed not to entertain the application.

Tramwaymen's Wages.—The result of the national ballot of the tramway workers on the question of acceptance or rejection of the provisional terms of settlement of the wages dispute was officially announced in London on October 9th, as follows:—

	£
In favour of settlement	22,436
Against	10,541
Majority in favour ...	11,895

33,076 members of the union voted, and there were 99 spoilt papers, 55 per cent. of the members who were eligible had voted, which was considered a good percentage. The National Trade Group Committee of the Transport and General Workers' Union met in London to consider the result of the ballot, and they decided that the settlement terms should be endorsed, and instructed the secretary to sign the agreement in conjunction with the representatives of the tramway employers' organisations. Under the settlement there will be a reduction this week of 4s. per week. Future adjustments of wages will be made every three months by the operation of a sliding scale based on the cost of living, the men losing or gaining 1s. for every four points fall or rise in the official index figure. There will, however, be no further adjustment until January, the next change, if any, operating from the beginning of February.—*Daily Telegraph.*

The terms represent a compromise. Instead of the employers' proposal to abolish the sliding scale and reduce wages by 12s. in three cuts of 4s., the sliding scale has been retained. —*Daily Mail.*

Emergency Battery for India.—Following the recent Moplah rising in India, accommodation was required for a large number of prisoners, and over 6,000 of these prisoners were located at Alipuram Jail, Bellary Cantonment, Southern India. It was immediately decided to install a plant for lighting the hospital attached to the prison, and, as the matter was urgent, the order for the battery of 230 cells was cabled to the Hart Accumulator Co., Ltd., of Stratford, London, and at the same time the dynamo was ordered from Calcutta. In spite of the time taken by the sea voyage, the battery was delivered on site before the dynamo arrived from Calcutta, and Moplah prisoners assisted in the unpacking and erection. In addition to lighting the hospital, arrangements are made so that in case of an outbreak the barbed wire surrounding the enclosure can be made "live" at 460 volts to act as a deterrent to would-be prison breakers.

A Midlands Trade Report.—Our Birmingham correspondent writes:—"The electrical accessory industries of Birmingham and the Midlands have been much better employed during the last few weeks, although there is still a very irregular tone about the trade. The brass manufacturers who specialise in electrical illumination fittings have lately been doing much better time (German competition is stated by the factors to be much less acute), but that trade, as a whole, is not by any means well occupied. The effect of the end of 'summer time' is already to be seen in large purchases of electric bulbs, and the manufacturers of electric lighting sets for motor vehicles are more optimistic. Ordering has received an impetus, but the general complaint is that orders lack bulk. Some of the larger engineers report an increase of business in private installation plants for residential houses in rural and semi-rural districts, but in the absence, comparatively speaking, of building operations they are unable to make their plans much ahead, demand being so uncertain."

Portuguese Import Duties.—The *Diario do Governo* (Lisbon) for September 25th, contains a Law (No. 1373) which provides that machines for generating electric current (continuous or alternating), static or rotary transformers and electric motors of less than 20 h.p., shall be dutiable under Tariff No. 570 at the rate of 30 per cent. *ad valorem*.—*Board of Trade Journal.*

Copper and Lead Prices.—Messrs. F. Smith & Co. report, October 10th:—Copper (electrolytic): bars, £71 10s., 20s. dec.; ditto ditto, sheets, no change; ditto ditto wire rods, £81 10s., 20s. dec.; ditto ditto h.c. wire, 10 3-16d., 1-16d. dec.

Messrs. James & Shakespeare report, October 11th: Copper bars (best selected, sheet and rod), no change; English pig lead, £26 10s., 5s. increase on last week's quotation.

A.E.G. Labour Dispute Ended.—*Die Zeit* reports that the 10,000 workers locked out by the A.E.G. owing to a dispute regarding wages have been reinstated, a satisfactory agreement having been reached.—*Reuter's Trade Service* (Berlin).

The Australian Tariff.—It is reported that the following tariff decisions have been approved of by the Customs Department:—Insulators, brown glaze, pin type, 33,000-volt Insulators, string, with clamps and arc horns and spare disks, 33,000 volt. Item 174: free under the British preferential tariff, 5 per cent. under the Intermediate tariff, 10 per cent. under the General tariff. Insulators, pin type, 35,000 volt. Item 174: free, 5 per cent., 10 per cent. Insulators, suspension type, each consisting of a string of four insulators, 33,000 volt. Item 174: free, 5 per cent., 10 per cent. Shafting, flexible. Item 156 (A): free, 5 per cent., 10 per cent.—*Reuter's Trade Service* (Melbourne).

The Duty on Trade Catalogues for Australia.—The *Argus* says that a request made to the Minister for Customs (Mr. Rogers) for the free admittance of trade catalogues issued by British manufacturers has been referred to the Tariff Board for consideration. The request was submitted to Mr. Rodgers by Mr. R. H. Butler, Secretary of the Australian Association of British Manufacturers, and their representatives, who pointed out that the existing duty of 8d. per lb., or 35 per cent. ad valorem, was actually a revenue duty, as it was not economically feasible for British manufacturers to have printed in Australia the comparatively small number of catalogues required for the Commonwealth. Speaking generally, manufacturers issued attractive illustrated catalogues, and the minimum number printed at a time would be probably from 5,000 to 10,000. It had been proved on many occasions that the cost of printing a limited number for the Australian market would be prohibitive, and therefore the duty imposed did not in the slightest degree benefit the Australian printing industry. Mr. Butler mentioned that the Interstate Commission in 1916 recommended that the Minister should have power to exempt from duty any catalogues which, in his opinion, could not be printed in Australia.—*Reuter's Trade Service* (Melbourne).

The Electrical Contractors' Association.—We learn that an interesting proposition brought before the London section of the Electrical Contractors' Association consists of a scheme of decentralisation. London is so large as compared with provincial centres that it is felt that one central committee and meeting place is hardly sufficient to adequately meet the need of the many members who have their places of business beyond the three-mile radius. In fact, it is found exceedingly difficult to get members outside this radius to attend the London meetings. The scheme proposes to set up a number of sub-branches in the principal suburbs, each with its secretary and local organisation, the central organisation remaining and members retaining the right of attending the central meetings. Each of the proposed sub-branches would have the right of nominating a delegate or delegates to the central committee.

Electricity in Advertising.—On Monday, 30th instant, Mr. Ernest Morison, manager, Outdoor Publicity, Ltd., London, will deliver an address to the Publicity Club of London at the Hotel Cecil, at 7 o'clock, on "Electricity in Advertising," tracing back some 65 years to present day remarkable developments.

The Peruvian Electrical Market.—A demand has sprung up in Peru for electrical equipment and accessories, the outcome of the wide programme of economic development advocated by the Government. This has disclosed the fact that stocks of electrical goods of almost all descriptions have fallen very low, those in many of the wholesale warehouses being depleted. Since the decision to nationalise water-power in the Republic was announced, considerable activity has manifested itself in regard to the adaptation of hydraulics for manufacturing as well as for lighting and heating purposes. Further wide developments are confidently anticipated in the immediate future; and even where water power is not available, internal-combustion engines are being installed either to operate directly on crude oil (found in abundance locally) or on producer gas made from the oil. Electric motive power is also being gradually applied to sugar-mills, of which a large number are crushing all the year round, but which now make use of the bagasse, or cane-refuse, to generate steam. Generators driven by steam engines are only to be found, however, where electric plants are put in, whether these are for lighting alone or for power and lighting combined.

It is understood that within the next few months considerable orders for electrical machinery, such as motors and generators, will be placed, principally in the larger cities of Lima, Arequipa, and Cuzco, apart from the requirements of the mines, textile mills, and other power-using industries. Several existing establishments, such as the Cachapoal power plant, belonging to the Braden Copper Co., the Empresas Elétricas Asociados, the Sociedad Elétrica de Arequipa and the Oroya hydro-electric plant of the Cerro de Pasco Mining Co., contemplate extensions to their present plants; while the recent widespread concessions granted to the Robert William Dunsmuir (Canadian) interests and the important contract entered into by the Government with Marconi's Wireless Telegraph Co., Ltd., will eventually result in substantial orders for electrical plant, machinery, and accessories being placed.

In the smaller towns of the Republic over 40 per cent. of the inhabitants use electric light. With few exceptions, house-lighting is furnished by single drop lamps suspended from the ceiling by flexible cord, neither bracket lamps nor chandeliers or table lamps having as yet been generally introduced. It is thought that here alone a good opportunity exists for manufacturers who can offer moderately-priced wall brackets, clusters, and similar fixtures for indirect or semi-indirect lighting. Hitherto little effort has been made to introduce any improved system of lighting; but there is little reason to doubt that such efforts would prove successful if persevered in.

Lima, with nearly 17,000 consumers of its own, is the central distributing station for all up-country dealers who, in turn, sell to the smaller dealers or to the consumer direct. In other centres, such as Cuzco, Huancayo, Casapalca, and Junin, where hydro-electric plants have been some time in operation, the sale of fittings and equipment, although small at present, promises development in the near future. As yet, the field for house and store and window lighting, as well as for municipal lighting and the supply of electric signs, has not been touched, while favourable opportunities for plant and accessories may be found in connection with the larger power-using industries, such as transport (railways and tramways), textiles, breweries, &c. With the exception of some cheap German manufactures, little effort has been made to create a market for medical apparatus, meters, instruments, electric fans, and other household and office devices, such as vacuum cleaners, cooking ranges, ironing machines, radiators, &c.—*Reuter's Trade Service* (Lima).

French Electrical Companies.—Under the style of Société pour le Développement des Applications de l'Electricité has been formed at Puteaux (Seine) (3, Rue Voltaire) a company with a capital of 1,200,000 fr. for the objects indicated in its name.

With a capital of 250,000 fr., Robert Delecourt et Cie. has been registered at Lille (16, Rue Léon-Danel) for the manufacture and sale of electrical apparatus.

De Loye et Touzot is the title of a company formed at Saint Etienne (17, Rue Thimonnier) for the manufacture and sale of electric accumulators, especially for electric and petrol motor-cars.

There has been constituted at Lyons (5, Rue Tronchet) a company entitled Durand et Paillasson, with a capital of 100,000 fr., for the manufacture of industrial porcelain, and more especially insulators.

An extraordinary meeting of the Société Anonyme d'Eclairage, de Chauffage et de Force par le Gaz et de l'Electricité has modified its statutes and confirmed the acquisition of certain assets from the Compagnie Provinciale des Eaux, du Gaz et de l'Electricité, for which its capital has been raised to 6,900,000 fr., of which 1,800 500-fr. paid-up shares have been allotted in payment of the said assets.

The capital of the Société Anonyme d'Eclairage Multicolore, of Saint Etienne (8, Place de l'Hôtel de Ville) has been increased from 800,000 fr. to 900,000 fr., with a view to purchasing certain patents of M. Eugene Hodges and notably an improved multiple filament electric lamp, a vibratory electric masseum apparatus, and a screw-driver.

At Montbrou (département de Charante) has been embodied the Société Hydroélectrique de la Tardoire, with a capital of 500,000 fr., for the construction and working of a generating station and electric supply networks. 400 100-fr. shares of the company are awarded to the Monbronnaise d'Electricité and 900 to the Société Bricq et Cie. as consideration for their assets.

"Unauthorised Persons."—Melbourne Prosecutions.—We reproduce the following interesting paragraph from the *Melbourne Age* for August 12th: "Strict official supervision is maintained over the making of electric installations, and the Electricity Commission insists that this work shall be entrusted to qualified electricians only. Plumbers who have sought to obtain licences have been refused, and over twenty prosecutions have been brought against unauthorised persons who have undertaken to make installations. On Thursday, at South Melbourne, John Chas. Smith, M'Gregor Street, was charged with having committed such a breach of the law. Defendant had contracted with George Joseph Bain to install 10 points in Bain's house, at 28s. per point, but Bain held that he had not satisfactorily completed the work, and consequently had not paid him for doing it. It was urged that there was a danger of fire from electrical fittings if they were not properly installed. Defendant, it appeared, had applied to the Electricity Commission for a licence in May, 1920. He was not given one, because it was considered that he had not had sufficient experience. The chairman of the bench (Mr. Ferguson) said great dangers might arise from unqualified people undertaking the work of electrical installation. Defendant was fined £5, with 12s. 6d costs."

Lead.—In their report, dated October 7th, Messrs. James Forster & Co. say:—"Although supplies are sufficient for the moment, we anticipate a considerable shortage of arrivals during the next two months. The position in America is exceedingly strong, and we cannot expect any relief from that quarter, as all native lead is needed for domestic demands."

Porcelain Insulators in Germany.—The Union of German Electrotechnical Porcelain Works of Berlin has increased the crisis supplement for low-tension porcelain products from 740 per cent. to 1,025 per cent. down to the middle of this month. In addition, it has been decided that payments must be made in a fortnight from the date of invoice, and at the expiration of this period interest will be charged for any additional time at bank rate, which is now stated at 15 per cent.

Swiss Prices of Machinery.—According to returns of the Federal Bureau of Statistics, the prices of various machines in Switzerland, compared with those ruling in 1920 and 1913, are as follows:—

	1913.	1920.	1922.	
Water turbines	1.0	3.1	2.0	fr. per kg.
Generators	1.5	7.8	2.2	.. ..
Transformers	2.0	4.3	2.4	.. ..
Electric motors and drives	2.0	8.7	6.0	.. ..

Reuter's Trade Service (Zurich).

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Any firms desiring to enter an objection to any of the applications have one month in which to do so from the dates given below. In the case of foreign firms, the address in this country to which objections are to be sent are also given.

Cosmos. No. 427,019. Class 8. Apparatus for wireless telegraphy and telephony.—Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. October 4th, 1922.

Gecohma. No. 428,146. Class 8. Apparatus for wireless telephony.—The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. October 4th, 1922.

Rolac. No. 424,486. Class 13. Electric irons, kettles, soldering irons, &c. No. 424,485. Class 18. Electric cooking stoves and electric apparatus for heating and warming.—Société Calor, 200, Rue Boileau, Lyons, France (Herbert Haddan & Co., 31-32, Bedford Street, Strand, London, W.C.). October 4th, 1922.

Venus. No. 425,812. Class 13. Electric lamps (ordinary)).—Ernest Clarke, 17, Buckingham Street, Strand, London, W.C. October 4th, 1922.

Patent Application.—Application has been made for the restoration of patent No. 115,030 (6,273 of 18), of April, 1917, granted to the Benjamin Electric, Ltd., for "Improvements in or relating to electric lighting apparatus."

Trade Revival at Sheffield.—The correspondent of the *Financial Times* reports that Sheffield trade has improved again. Big works which have had shops and furnaces idle for months have had the satisfaction of restarting them again. Not only have the heavy departments begun to move, but sections of the steel trade which have done nothing whatever for three years are beginning to get active. During the war, when the demand for high-class steels got beyond the capacity of the old crucible furnaces, the electric furnace was found to answer extremely well, and a large number of them were installed. Electric steel furnaces which had been planned for the making of stainless steel for the cutlery trades were called upon to produce munition steel. Since the war the furnaces have had little to do apart from meeting the declining demands of the cutlery trades. Now the electric furnaces are beginning to get active. Some in a leading works which have been idle for three years are this week working fully. The writer continues: "In ordinary crucible and high-speed steels there is not very much being done because of the operation of the Fordney Tariff. The belief here is that the tariff will not last long. Perhaps the wish is father to the thought."

New Spanish Companies.—With the title of Saltos del Rio Ondarroa and a capital of 1,450,000 pesetas has been formed at Jemein (Vizcaya) a company whose object is the production of electricity.

There has been embodied at Barcelona the Energia Industrial, with a capital of 500,900 pesetas, for the manufacture, installation, &c., of electric machinery of all kinds.

Electrical Exhibition at Douglas.—The Douglas (I. of M.) Corporation is arranging to hold an electrical exhibition for a fortnight, commencing October 26th, under the direction of Mr. Bertram Kelly, A.M.I.E.E., of the electricity department.

LIGHTING AND POWER NOTES.

Accrington.—New Plant.—The new plant for the power station has now been delivered, and the greater part of it has been erected. In addition to the existing two boilers, two Babcock and Wilcox water-tube boilers have been installed, and it is intended to seek sanction to install two more in the near future. Arrangements are being made for handling the coal and ash mechanically. The new steam turbine of 8,000 h.p. will be the third in operation at the works. Running at 3,000 r.p.m., it will generate electricity at 6,600 V, three-phase. When the new plant is in operation, the total output of the works will be 17,500 h.p.

Australia.—[illegible]. The Council has appointed [illegible] to prepare a scheme for supplying the district with electricity, at an estimated cost of £20,000. It is intended to obtain a bulk supply from the City Electric Light Co., Brisbane.

Axbridge.—Electricity Supply.—The North Somerset Electric Supply Co., Ltd., of Portishead, has informed the Rural District Council that it contemplates applying for a Special Order to enable it to supply electricity in the north-western half of the Axbridge rural district, which will include the following parishes:—Wick St. Lawrence, Puxton, Congresbury, Wrington, Banwell, Churchill, Butcombe, Compton Bishop, Winscombe, Shipham, Rowberrow, Burrington, Blagdon, Axbridge, Cheddar, and Charterhouse.

Boston.—Electricity Supply.—At a recent meeting of the Town Council, the town clerk reported the receipt of a letter from the engineer in charge of the electricity undertaking stating that the Special Order was now in the hands of the National Electrical Construction Co., Ltd., which proposed to start work in Boston very shortly, and it was hoped the supply would be available by the winter of next year.

Bradford.—Mains Extensions.—The Electricity Committee has recommended the Finance and General Purposes Committee to sanction further expenditure on extensions of electricity mains, &c., up to a total of £20,000.

Bristol.—Price Reductions.—The Town Council has reduced the charge for electricity for lighting from 6½d. to 6d. per kWh, for power from 2d. to 1½d., and for heating from 2½d. to 2d.

British Columbia.—New Hydro-Electric Project.—The British Columbia Electric Co., a corporation which continues to take a prominent part in the development of Vancouver and contiguous country, is about to undertake one of the biggest engineering enterprises ever attempted in the Pacific province—the connecting of Lilloet and Stave Lakes to provide additional electrical energy for the lower mainland. The tunnel will be 4,000 ft. long, and its construction will cost about one million dollars.—*Financier.*

Burnley.—Electricity Charges.—The Electricity Committee has agreed to the following charges for electricity supplied for traction purposes: From July 1st to September 30th, 1922, 1.09d. per unit; from October 1st, 1922, 1.8d.

Cannock Chase.—Street Lighting.—The mining villages of Cannock Chase have been equipped with electric street lamps by the Cannock Chase Colliery Co., Ltd. Current is derived from the company's power station at Chase Terrace, and as the power load between 2.30 p.m. and 11 p.m. is very low, energy can be supplied for public lighting at a very low price; the charge is to be £3 or £3 5s. per lamp, according to the locality, 60-W gasfilled lamps being used for ordinary streets and 100-W lamps at cross-roads, with automatic time switches in the sub-stations to switch them on and off. Overhead mains are used. Electricity is also supplied for private consumption, some £10,000 having been expended on the scheme, under the direction of Mr. Chris. Jones, M.I.E.E., electrical engineer to the Colliery Company.

Carnarvon.—Electricity Supply.—The Electricity Committee states that no supply can be guaranteed to fresh consumers until the plant has been extended, and that the advice of the Electricity Commissioners is being sought on whether additions should be made to the existing plant or whether a bulk supply of electricity should be obtained from the North Wales Power Co.

Clayton (Yorkshire).—Electricity Supply.—The District Council has received notification from the Bradford Corporation that, subject to the required sanctions being obtained, and the grant of a loan for the capital outlay involved, Bradford Electricity Department is prepared to supply electricity to Clayton on the terms of the agreement come to between the two authorities.

Connah's Quay.—Electricity Supply.—Connah's Quay Electricity Committee has under consideration a draft agreement with the North Wales Power Co. to supply electricity in the district. The Council at a previous meeting decided to support the application of the company for power to construct lines through Flintshire, outside its area, as defined in the North Wales Electric Power Act, 1904, and in particular the line from Rhuddlan to Connah's Quay, subject to the Council being placed under no obligation financially or otherwise.

Derby.—Power Station Extensions.—By carrying out extensions to the power station with the use of direct labour, the Special Works Committee claims to have effected a saving of £12,563. The total cost, based on the lowest tender, was £39,561, and the actual cost, including 50 per cent. depreciation on building plant, was £27,017. The works have now been practically completed, and are shortly to be inaugurated, following an official visit of inspection by the members of the Corporation.

Doncaster.—Loan Sanctioned.—The Town Council has received sanction to a loan of £23,300 for new feeders and other distribution work.

East Grinstead.—Loan.—The Urban Council has applied for a loan of £19,976 for plant, meters, services, mains extensions, &c.

Faversham.—Electricity Charges.—The Town Council has agreed to supply electricity for power to the shipbuilding works of Messrs. Pollock, Sons & Co. at 3½d. for the first 2,500 kWh, 3d. for the next 2,500 kWh, 2½d. for the next 10,000, and 2½d. beyond.

Gillingham (Kent).—Electricity Supply Extensions.—The Town Council has decided to make a canvas of Hempstead and Wigmore to ascertain the probable number of consumers of electricity for lighting, cooking and heating in connection with a proposal to supply electricity to the district.

Glasgow.—Supply to Gas Works.—Recent extensions to the plant at the Corporation's gas works at Provan have been made. The new plant is electrically driven, and a supply of electricity is obtained from the electricity works, which is transformed down to 440 V for power, and 250 V for lighting. The consumption of electrical energy will be two million kWh per annum.

Ilford.—Year's Working.—The income and expenditure account of the Urban District Council's electricity undertaking (engineer and manager: Mr. A. H. Shaw) for the year ended March 31st, 1922, shows that the total revenue for the year was £97,834, as compared with £96,579 last year; the total expenditure was £64,323 (£68,652), the balance carried to net revenue account being £34,511 (£27,778); 1,260,545 kWh were sold to the tramway department, and produced £9,762 (£9,892). The total energy sold increased by 32,377 to 5,160,089 kWh, and the total maximum demand increased by 335 to 3,155 kW.

Langholm.—Electricity Supply.—The Town Council has under consideration a proposal to light the town with electricity. A favourable report has been received on a proposed hydro-electric scheme.

Lincoln.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £105,582 for purposes of the electricity undertaking, to be repayable at periods ranging from 7 to 30 years, and have agreed to allow the suspension of the commencement of the provision for repayment until March 31st, 1925.

Lisburn.—Electricity Scheme.—The Rural District Council has under consideration an electricity scheme for Dunmurry, and has decided that before supporting the proposal a guarantee should be obtained that only the districts concerned should be liable for the expense entailed.

Liverpool.—Purchase of Undertaking Approved.—The Electricity Commissioners have issued an Order confirming the purchase by the Liverpool Corporation of the Liverpool District Lighting Co., Waterloo, which supplies electric light and power to Great Crosby and Waterloo-with-Seaforth.

London.—Hackney.—The Electricity Committee has recommended the purchase of a mechanical screen for use in connection with the new condensing water intake works, at a cost of £930, from Messrs. F. W. Brackett & Co., Ltd.

Wimbledon.—The following reductions have been made in the charges for electricity:—Lighting, from 8d. to 7d. per kWh; cooking and heating, from 2d. to 1½d. per kWh; power for motors, 2d. to 1½d. per kWh, according to hours of use.

Stoke Newington. — The new extensions to the substation were formally opened and the machinery set in motion, by the Mayor, Councillor E. H. Coumbe, B.A., on Tuesday last. A new 500-kW rotary converter and switchgear has been installed, the whole of the work being carried out to the design of Mr. C. H. Wordingham, consulting engineer. The new extensions will bring the total output of the station to 1,240 kW, and the cost of carrying out the work was £31,000.

Maidenhead.—Loan Sanctioned.—The Town Council has received sanction to a loan of £5,950 for the installation of a 250-kW oil-driven set.

Morley.—Price Reductions.—The Electricity Committee has reduced the charge for electricity for lighting from 10d. to 8d. per kWh, and for power by 20 per cent.

New Zealand.—Ashburton.—At a poll of the ratepayers, authority was given to the Electric Power Board to raise a loan of £296,500 in connection with an electricity supply scheme.

Penmaenmawr.—Electricity Supply.—A committee has been appointed to prepare a scheme and submit estimates for the supply of electricity to the district.

Rotherham.—Loan Sanctioned.—The Electricity Commissioners have approved of the borrowing of £45,000 by the Corporation to cover an accumulated deficiency on the electricity undertaking.

St. Annes-on-Sea.—Year's Working.—The annual report on the working of the electricity undertaking (chief engineer: Mr. J. H. Clothier)) shows a total revenue of £39,990, as compared with £35,833 in the previous year. Working expenses amounted to £31,459 (£27,800), leaving a gross profit of £8,531. After deducting capital charges, there was a net profit of £1,019. The number of units sold rose from 1,847,644 to 2,051,256, and the number of consumers shows an increase of 603 on the previous year.

Salford.—Glasgow Visit.—The members of a deputation from the Salford Borough Council who visited the Glasgow Corporation electricity works were received by the Town Council on October 5th. The Mayor of Salford (Alderman Barker) expressed the thanks of the deputation for the valuable information which had been placed at its disposal, which, he said, would be helpful to it in the erection of a new electricity station in Salford, estimated to cost about three-quarters of a million.

Southport.—Year's Working.—The county borough electrical engineer, Mr. E. Moxon, has submitted his report on the progress of the electricity undertaking for the year ended March 31st, 1922, this being the 26th complete year of working. He has been responsible for the management of the department for five months of the period under review. Prior thereto, under the management of Mr. A. S. Black, the new plant installed under his supervision was put into commercial service, and has been in commission throughout the whole of the year. The serious deficit on the year's working of £9,793, together with the debit balance carried forward for the previous year, makes a total of £14,858 to be carried forward into the appropriation account to be met out of any profits that may be made in the future. The total revenue for the year amounts to £69,556, a decrease of £3,162. The kWh sold increased by 196,425 to a total of 4,064,723. In spite of the fact that since November last the department has supplied electricity to the Birkdale section of the tramways, the total kWh sold for traction purposes during the year shows a decrease of 71,655, or 8.6 per cent. compared with the previous year, whilst the total revenue from this source is lower by £1,012, or a decrease of 15 per cent. From the beginning of October the charges for electricity were reduced, the special war increase of 25 per cent. being taken off. This reduced the revenue, which the financial state of the undertaking was not in a condition to allow. The total working expenses for the year amounted to £54,524, an increase of £2,715. The purchase of electricity in bulk from various sources amounted to £984, a decrease of £7,140. The expenditure under this heading ceased at the end of June. Large commitments on capital account during the year for electrical equipment, mains, sub-stations, &c., will be further increased during the next few years on account of extensions.

The applications received for electricity have been quite exceptional during the last 12 months, and the number of new consumers connected to the supply, totalling 683, made application for 409 kW of lighting, 167 kW for heating, and 32 kW for power purposes, which constitutes a record. This is a particularly encouraging sign, seeing that charges during a portion of the year were the highest that have ever been made in Southport. Early in the present year the whole of "Pleasureland" was equipped with sub-stations and a complete distributing network to supply all the shows with electricity for lighting and power purposes. At present there are 148 consumers in this area who have installed motors having a total of 536.5 h.p. and 245 kW for lighting, all of which is supplied direct from the new three-phase system; 11¾ miles of mains have been laid during the year.

Stretford.—Electricity in Bulk.—The Urban District Council is negotiating with the Manchester Corporation with a view to obtaining electricity in bulk from Barton power station.

Swindon.—Price Reduction.—The Town Council has reduced the charge for electricity for lighting from 7d. to 6d. per kWh.

Torquay.—Loans.—Application is being made to the Electricity Commissioners for sanction to the borrowing of £44,675 for generating, transforming, and converting plant, and £29,600 for steam-raising plant, including boilers required in connection with the new power station.

Turton.—Price Reduction.—The Urban District Council has decided that as from October 1st the charge for electricity for lighting be reduced by 2d. per kWh.

Wakefield.—Price Reductions.—The City Council has approved the recommendation of the Electricity Committee reducing the charges for electricity for lighting purposes for the December quarter, the charges to be as follows:—6½d. per kWh for 250-1,000 kWh per quarter, 6d. per kWh for all kWh above 1,000 per quarter; for churches and chapels a flat rate of 5½d. per kWh.

Waterloo-with-Seaforth.—Price Reduction.—The Urban Council has reduced the price of electricity by 12½ per cent forthwith.

Welwyn Garden City.—Special Order.—The Welwyn Garden City Electricity Supply Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity for public and private purposes.

West Ham.—New Show Rooms.—The Corporation electricity department has opened new showrooms at 84-86, Romford Road, Stratford, E.

Worthing.—Electricity Extensions.—The Town Council has decided to extend the area of supply to the northern part of West Tarring and to the adjacent parish of Durrington at an estimated cost of £6,000. The system proposed by the borough electrical engineer (Mr. Geoffrey Porter) is to generate single-phase alternating current at the works at a pressure of 2,200-2,000 V, periodicity 50 cycles, and transmit the electric energy by suitable feeder cables to two transformer stations from which it will be furnished to the consumer at 460 and 230 V. It is also proposed to rearrange and extend the feeder cables and distributing mains at East Worthing at an estimated cost of £1,920.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Railless Cars.—The first consignment of railless cars to be employed on the Nechells route were delivered to the Tramways Department last week. They are now being used for training drivers, and it is anticipated that the service will be in operation towards the end of this month. Twelve cars have been ordered, which will give a service equal to that provided by the rail-cars. The City terminus will be the Old Square.

Reduced Fares.—The City Council has reduced the tramway fares. The reduction consists chiefly of ½d. on long stages.

Blackpool.—Doubling of Track.—The Corporation Tramways and Electricity Committee has called the attention of the Town Improvement Committee to the serious congestion in Church Street and to the desirability of the tramway lines being doubled in the near future.

Bournemouth.—Track Renewals.—The Town Council has decided to reconstruct further portions of the tramway track, and application is being made to the Ministry of Transport for sanction to borrow £65,000 for this purpose. It is hoped to complete the work by the spring of next year.

Burnley.—Loan Sanctioned.—The Ministry of Transport has sanctioned the borrowing of £38,950, repayable in 20 years, for the reconstruction and doubling of certain portions of the tramway track.

Continental.—Sweden.—According to a report issued by the Secretary to H.M. Legation at Stockholm, use is to be made of the waterfalls in Lapland for generating electricity for the electrification of the railways. The line from Riksgränsen (Norwegian-Swedish frontier) to Boden, a distance of 398 kilometres, has already been electrified, and when the Norwegian section of 39 kilometres from Riksgränsen to Narvik and the Swedish section from Boden to Lulea (Gulf of Bothnia) are finished the entire peninsula from the Gulf to the Atlantic will be trayserved by an electric line. This line is almost entirely utilised for the transportation of iron ore from the mines in this part of Sweden, and it is claimed that electrification has proved of great advantage. Not only has speed been about doubled, but the train-loading capacity has also been considerably increased. Hitherto the largest type of steam locomotive was not able to draw more than 20 wagons loaded with ore, whilst electric trains are composed of as many as 40 wagons. Results show that a much more economical use is made both of labour and material, and although much of the electrical equipment has been installed at a somewhat heavy cost, it is anticipated that the venture will rapidly pay for itself owing to the enormous saving in coal.

Edinburgh.—Electrification of Tramway Route.—The Tramways Committee has recommended that the route from Canonmills to Tollcross, *via* the Mound, be electrified.

Keighley.—Year's Working.—For the year ended March 31st last there was a deficit on the tramway undertaking of £4,634, and on the railless vehicles undertaking a deficit of £5,367, making a total deficit on these undertakings of £8,047 and £10,689 respectively.

Leeds.—Accident.—A tramcar left the metals on the 4th inst. while running over a portion of the track which is under repair. Before it could be stopped, it tilted over into an excavation about a foot deep. Fortunately none of the passengers were injured.

Liverpool.—Penny Fares.—The Tramways Committee has decided to re-introduce penny fares. The present minimum fare is 2d., and it is proposed to divide the 2d. stages into three penny stages.

London.—Underground Traffic.—The Underground railways are operating considerably over 4,000 trains per day; the figures are made up as follows:—Hampstead and Highgate line, 992 trains; District Railway, 847 trains; Central London line, 815 trains; Bakerloo line, 758 trains; Piccadilly line, 712 trains. The recent accelerated services and longer trains have brought considerable relief to the traffic problem.

Middlesbrough.—Extension of Railless Car Services.—The Tees-side Railless Traction Board has submitted a proposal to the General Purposes Committee for the extension of its system. It is proposed to run a service from Grangetown subway to the Stockton and Redcar main road, and from there to the square at Eston. The Committee has approved of the scheme.

Newcastle-on-Tyne.—Track Renewals.—A scheme for widening the North Road, including the relaying of the tramway lines with side instead of centre pillars, has been approved by the City Council.

Southport.—Year's Working.—The report on the Corporation tramways (manager: Mr. T. J. Kendrew) for the year ended March 31st, 1922, shows that no expenses were charged to the capital account during that period. The income amounted to £78,944, against £80,999 last year, and the working expenses to £51,243 (£56,310), while the gross profit of £27,701 (a record for the undertaking) was appropriated as follows:—Interest, £9,365; sinking fund, £6,017; renewals fund, £6,628; income tax, £2,500; and last year's deficit £1,901. The receipts decreased by 2.6 per cent., and a saving of 9 per cent. was made on the working expenses; 9,266,712 passengers, or 296,097 fewer than last year, were carried.

Stockport. Through-running.—According to the *Daily Dispatch*, the 21 years' lease which was granted to Manchester to run tramcars through the borough along the Wellington Road to St. Peter's Square expires next June, and the Tramways Committee has notified the Manchester Tramways Committee that the lease will not be renewed, but in lieu mutual running powers will be exercised. A double line of tramways will be run from the Wellington Road between the George Hotel and St. Peter's Gate. Arrangements are also to be made with the Manchester Tramways Committee for the through-running of Reddish cars to Belle Vue.

Swansea.—Tramway Improvements.—Improvements which the tramway company contemplates include the relaying of the double track between the Palace Kinema and Cwmbria, also that between the G.W.R. station and the Albert Hall, which will be doubled. Two sidings at Landore are to be relaid, and the line between the Cooper's Arms and Hermon Chapel is to be doubled. Five more cars are to be converted into double deckers at a cost of £2,000. The total cost of the improvements is estimated at £40,000.

TELEGRAPH AND TELEPHONE NOTES.

Argentina. Wireless Telegraphy.—As a result of the working arrangement between four wireless telegraph companies, the wireless link—6,600 miles from Buenos Aires to England—will be completed shortly. So said Mr. Godfrey Isaacs, managing director of Marconi's Wireless Telegraph Co., to the *Evening News*, explaining the Exchange message from New York that the "Corporation of America has announced that the world radio combine, with New York as the centre, will include a British station at Carnarvon, and French, German, and Argentine stations, the whole representing a total invested capital of £34,000,000. Tests will be made within 30 days." The references to a "radio combine" arise, probably, said Mr. Isaacs, from the recent meetings in London of the four wireless companies representing England, America, France, and Germany. "The tests which are to be made in 30 days refer, presumably," he added, "to the Monte Grande station at Buenos Aires, which has been erected by the four companies conjointly, and will conduct telegraphic services from Buenos Aires to all parts of the world. The capital referred to, of £34,000,000, is probably intended to be the capital represented by the several corporations concerned. But there is no actual combine, and there are no new stations to be erected in Europe or England."

Australia. Telegraph and Telephone Extensions.—The Postmaster-General of the Commonwealth has made available particulars of the new works which are to be undertaken in Victoria during the current financial year, the sum allocated for the purpose totalling £861,000. This amount includes telegraphs, £59,523; telephones, £161,480; trunk lines, £113,148; switchboards, £229,206; pneumatic tubes, £3,500, conduit and cable, £274,143. A number of new lines will be constructed in country districts, and additional trunk telephone lines provided in both suburban and rural areas, while the equipment of numerous existing exchanges will be largely extended to cope with the long waiting list of intending subscribers. To meet the needs of the latter, two automatic exchanges are to be constructed in Melbourne, costing in all £108,000. Extensive conduit and cable work in the metropolitan area is also provided for in the estimates.—*Reuter's Trade Service* (Melbourne).

The Telephone Service.—Prolonged Use of Trunk Wires.—The Postmaster-General announces that increased facilities and reduced charges are now in operation for the prolonged use of trunk telephone wires during the less busy hours of the day. The minimum payment is for a period of one month, and Saturdays and Sundays may be excluded at the wish of the subscriber. Connection may be had to only one subscriber during each period; but arrangements may be made for different subscribers to be called on different dates. Further, between 6 p.m. and 6 a.m. the use of a trunk line may be had for any length of time at a uniform charge per mile per annum. The saving effected under the new arrangement will be of especial benefit to the newspaper Press and others by whom the trunk lines are mainly used at night.

New Exchanges.—The official opening of a telephone exchange took place at Thurso on October 5th. While confined to the county of Caithness, it is hoped that at no distant date a through connection will be established not only with the main trunk system, but also with Orkney and Shetland.—*Scotsman*.

The new Penarth exchange, which was opened on Saturday, is worked on the common battery system, and the subscriber is absolved from the trouble of ringing up the exchange, all the power being supplied by an up-to-date power plant in the exchange.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—January 31st. Victorian Electricity Commissioners. Back-pressure steam turbine, driving a 1,500-kW alternator (Spec. 308), four water-tube boilers and accessories (Spec. 317). (September 22nd.)

November 21st. Postmaster-General's Department. Telephone switchboard parts.*

Perth (W.A.).—November 15th. Postmaster-General's Department. 1,400 galvanised tubular poles.*

Queensland (Mackay).—January 31st, 1923. Boiler and generating plant, switchboard, and transformers. Messrs. Frew & Bridger, Queen Street, Brisbane, are the consulting engineers.

Belgium.—October 27th. Municipal authorities of Heppen and Tessenderloo, Province of Limburg. For the establishment of a low-tension electricity distribution system in the respective towns.

Dublin.—November 6th. Irish Postmaster-General's Department, 14,000 Leclanché cells, 3,500 dry cells, 8 tons chloride of ammonia, 40,000 Leclanché zinc rods, 3,500 Leclanché glass cells. (See this issue.)

Edinburgh.—October 17th. Tramways Department. 86 trucks, electrical equipment of cars, &c. Forms from manager.

Egypt.—Alexandria.—December 20th. Administration of Ports and Lighthouses. Eight travelling electric portico quay cranes, eight travelling balcony cranes, eight electric lifts, rails, &c.*

Cairo.—October 30th. Egyptian State Railways. Direct-coupled steam engine and alternator, switchboard, &c., for the power house, Gabbary, Alexandria.*

Holmfirth.—October 18th. Electricity Department. Additional conductor on existing poles for converting system of supply to a.c. (October 6th.)

London.—London County Council.—November 6th. Control panel and switchgear connections for No. 4 generator at Greenwich power station. (See this issue.)

Manchester.—October 24th. Tramways Department. Electric goods cage lift. Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

Neath.—Rural District Council Electricity Department. One 1,000-kW turbo-alternator, with condensing plant, foundations, switchgear, &c. (See this issue.)

New Zealand.—Auckland.—February 1st. Twelve 5-ton (and alternatively 3-ton) electric quay cranes. Four 5-ton (and alternatively 3-ton) electric roof cranes. Six 1-ton electric mono-rail cranes. Specifications from Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, E.C.

Carterton.—November 25th. Wairarara Power Board. Hydro-generating plant and steel pipe line.

Wellington. — November 28th. Public Works Tender Board. Two exciter transformers for the Waikato power scheme.*

January 9th, 1923. One electric travelling crane (capacity 27 tons) for the Waikato power scheme.*

Nottingham. — October 27th. Electricity Department. Two 650-kVA, 3-phase static transformers, two 900-kVA, 6-phase ditto, one 150-kVA, single-phase ditto, three steam-driven turbine boiler-feed pumps, four gravity bucket coal conveyors with crushers, accumulators, &c. (September 29th.)

Poth.—October 23rd. Rhondda Urban District Council Electricity Department. One 100-kVA, 3-phase static transformer. (See this issue.)

Portsmouth.—Electricity Supply Department. One 4,000-kW turbo-alternator, with condensing plant, one water-tube boiler (30,000 lb. per hour capacity), with steel bunker and economiser. (September 29th.)

Rochdale.—November 1st. Board of Guardians. Electric lift, &c., at Birch Hill, Dearnley. (See this issue.)

South Africa.—Johannesburg.—November 16th. Municipal Council. Four or more double-deck tramcar bodies or four or more single-deck ditto, 15 or more double-deck bogie tramcar complete with truck and electrical equipment, 15 single-deck ditto, complete, 28 gear wheels.*

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia. — Wagga (N.S.W.).—Municipal Council. Accepted:—

5-amp. meters (£1,039).—Australian General Electric Co.

Melbourne.—City Council. Accepted:—

Insulated copper cable (£7,163).—Metropolitan-Vickers Electrical Co., Ltd. Electricity meters (£1,135).—Warburton Franki, Ltd.; (£3,492).—W. G. Watson & Co., Ltd.—*Tenders.*

Belfast. The Corporation. Accepted:

[illegible]

Blackpool.—Corporation. Accepted:

[illegible]

East Grinstead.—Urban Council. Accepted:—

[illegible]
Switchboard (£762).—Park Royal Engineering Works, Ltd.
Mains (£7,351) [illegible]
Crane (£115) [illegible]

Glasgow. Tramways Committee. Accepted:

[illegible]
Cast-iron and "car stop" poles.—Walter Macfarlane & Co.
Rheostats (cars).—The Rheostatic Co.
Rubber-tired steel wheels.—Albion Motor Car Co., Ltd.
Iron and steel.—W. C. Yuille & Co., Ltd., and P. & W. MacLellan, Ltd.
D.c.c. wire.—Concordia Electric Wire Co., Ltd.; Connollys (Blackley), Ltd.
Steel gear cases.—Malleable Steel Castings Co., Ltd.
Street poles.—Stewarts & Lloyds, Ltd.
Steel-tired [illegible]
Steel tires for wheels.—Steel Co. of Scotland, Ltd.

Corporation. Accepted:—

Electric lighting [illegible]
Small & Macdonald.

Hull.—With a view to retaining an order for 1,000 tons of rails in the country, the Tramways Committee has decided to ask Messrs. Steel, Peech & Tozer, of Sheffield, to reduce their tender of £11,750, which was the lowest English tender received. The lowest tender received was submitted by the Equipment and Engineering Co., London, for rails manufactured in Germany, the amount being £9,500.

London.—Underground Electric Railway Companies of London. Accepted:—

Electrical equipment for new Piccadilly line rolling stock (£159,767).—Metropolitan-Vickers Electrical Co., Ltd.

Hackney.—Electricity Committee. Recommended:—

Mechanical screen for the condensing-water intake works (£930).—F. W. Brackett & Co., Ltd.

Manchester.—Electricity Committee. Accepted:—

Cable.—Macintosh Cable Co., Ltd.; British Insulated & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.
Isolating links in sheet steel cubicles for Oldham Road "B" sub-station.—Ferguson, Pailin & Co., Ltd.

Stores for 12 months. Accepted tenders:—

Adhesive tape.—L. Andrew & Co., Ltd.; Connollys (Blackley), Ltd.
Dry batteries.—Shenton & Co., Ltd.
Box compound.—British Insulated & Helsby Cables, Ltd.
Bittite tape.—Callender's Cable & Construction Co., Ltd.
Cables.—British Insulated & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Enfield Ediswan Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.
Carbon brushes.—Le Carbone; Morgan Crucible Co., Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Dynamo brushes.—W. Patterson, Ltd.
Fuse boxes.—Ironclad Switchgear Co., Ltd.
Insulating cloth.—L. Andrew; H. D. Symons & Co., Ltd.
Insulators.—Bullers, Ltd.; Taylor, Tunnicliffe & Co., Ltd.; Doulton and Co., Ltd.
Iron castings.—J. Needham & Son, Ltd., Richmond & Chandler, Ltd., J. Stubbs, Ltd.
Service boxes.—Forrest & Lyon, Hards & Padmore, Ltd., J. Stubbs, Ltd.; Siemens Bros. & Co., Ltd.
Auto-transformers and auto-balancers.—General Electric Co., Ltd.
E.h.p. trifurcating boxes.—British Insulated & Helsby Cables, Ltd.
L.p. trifurcating boxes.—Siemens Bros. & Co., Ltd.
Tubing and accessories.—Brotherton Ediswan Tubes & Conduits, Ltd.; Simplex Conduits, Ltd.
D.c.c. and D.s.c. wire.—London Electric Wire Co. and Smiths, Ltd.
Tinned steel and armature wire.—Bruntons.
Tinned copper wire.—F. Smith & Co.
Tin fuse wire.—L. Andrew & Co.

Tramways Committee. Accepted:—

Motor and controller parts.—British Thomson-Houston Co., Ltd.
Motor and controller parts, circuit breakers, lightning arresters, &c.—Metropolitan-Vickers Electrical Co., Ltd.
Controller parts.—English Electric Co., Ltd.
Electrodes for welding.—Alloy Welding Processes, Ltd.; Quasi-Arc Co., Ltd.
Steel girder tramway rails.—Wilkes Scott, Ltd.
Special track work.—Titan Trackwork Co., Ltd.; Edgar Allen & Co., Ltd., Hadfields, Ltd.

Gas Committee. Accepted:

Electrically-operated capstan.—T. Broadbent & Co., Ltd.

New Zealand.—Messrs. Johnson & Phillips, Ltd., have secured an order for approximately 200 miles of rubber-insulated and aerial cable from the Wairarapa Power Board, New Zealand.

Dunedin. City Council. Accepted:

Waipori Falls hydroelectric scheme.
Water wheels (£7,195).—Boving & Co.
Generators (£7,497).—National Electric and Engineering Co.
Transformers (£9,081).—Metropolitan-Vickers Electrical Co., Ltd.
Switchboard panels (£1,[illegible]).—National Electric and Engineering Co., and Metropolitan-Vickers Electrical Co., Ltd.
25-ton electric overhead travelling crane (£1,628).—[illegible] Chambers & Son, Ltd.—*Tenders.*

Salford.—Electricity Committee. Accepted:—

Two storage batteries and reversible boosters (£9,250).—Chloride Electrical Storage Co., Ltd.
One 100-kVA transformer (£135).—Ferranti, Ltd.
One e.h.t. switch cubicle (£197).—Metropolitan-Vickers Electrical Co., Ltd.
One 500-kVA transformer (£411).—Metropolitan-Vickers Electrical Co., Ltd.

Watford.—Urban Council. Accepted:—

Two alternators, wound three-phase, and two alternators, re-wound three-phase, to replace single-phase ones (£2,550).—Brush Electrical Engineering Co., Ltd.

Wolverhampton.—Tramways Committee. Accepted:

Reconstructing the tramway track between Bafford Crescent and the Wergs.—Mr. M. A. Boswell, Wolverhampton.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 13th. At 37, Victoria Street, S.W. At 7.30 p.m. Paper on "Artificial Ice-making," by Mr. I. West.

Friday, October 20th. Lecturette, "Profits From Waste Products," by Mr. G. H. Ayres.

Birmingham and District Electric Club.—Saturday, October 14th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Alternating Current Apparatus," by Mr. F. R. Unwin.

Institution of Electrical Engineers (South-Midland Centre).—Students Section. Monday, October 16th. Annual supper.

Faraday Society.—Joint Meeting with the British Coal Storage and Its Association. Monday, October 16th. At the Institution of Electrical Engineers, Victoria Embankment. Three sessions: 2.30 p.m. to 4 p.m., 4.45 p.m. to 6 p.m., and 7.45 to 10 p.m. Discussion on "The Present Position of the Generation and Utilisation of Coal."

Institute of Transport (Graduates' and Students' Section).—Tuesday, October 17th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6.30 p.m. Paper on "The Effect on Traffic Arrangements and Working Costs of Daily and Seasonal or Periodic Variation in Passenger Loads and Unbalanced Traffic Movement," by Mr. C. J. Selway.

Institute of Physics.—Wednesday, October 18th. At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. At 6 p.m. Lecture on "The Physicist in Electrical Engineering," by Mr. C. C. Paterson.

Chelmsford Engineering Society.—Thursday, October 19th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Payment by Results," by Mr. J. E. Powell.

Chemical Society.—Thursday, October 19th. At Burlington House, W. At 8 p.m. Ordinary scientific meeting.

Northampton Engineering College Engineering Society.—Thursday, October 19th. At Northampton Institute, St. John Street, E.C. At 5.30 p.m. Inaugural address by the president, Dr. R. M. Walmsley.

British Electrical Development Association.—Salesmanship Conference.—Friday, October 20th. At Caxton Hall, S.W. At 7.30 p.m. Paper on "Fires and Cookery (Small)," by Mr. R. Smith.

London Electrical Engineers' Old Comrades' Association.—Friday, October 20th. At the Bridge House Hotel, London Bridge, S.E. At 7 p.m. Smoking concert.

Institution of Mechanical Engineers.—Friday, October 20th. At the Institution, Storey's Gate, St. James's Park, S.W. At 6 p.m. Presidential address by Dr. H. S. Hele-Shaw, F.R.S.

Manchester Electro-Harmonic Society.—Friday, October 20th. At the Albion Hotel, Manchester. At 7.15 p.m. First concert of the season.

Institution of Production Engineers.—Friday, October 20th. At the Royal Automobile Club, Pall Mall, S.W. At 7.30 p.m. Presidential address by Mr. H. R. Lawrence.

Edinburgh Electrical Society. Saturday, October 21st. At 3.15 p.m. Visit to Brunton's Wire Works.

NOTES.

The E.S.C.A. Concert.—The London Division of the Electricity Supply Commercial Association opened its winter social season with a Bohemian concert, at Anderton's Hotel, on the 6th inst., the artistes being:—Miss Violette Harley (Scotch soprano), Miss Pattie O'Hanlon (Irish contralto), Miss Evelyn Hardy (cornet), Miss Norah Blakemore (comedienne), Miss Evelyn Baly (pianist and accompanist), Mr. Francis Wilmott (tenor), Mr. Archie Naish (humorist), Mr. Fred Curtis (entertainer), together with Mr. Sid George (musical director). The artistes gave of their best, and the audience was very enthusiastic in its appreciation. The concert arrangements were in the hands of Mr. G. S. Watts, and the undoubted success of the evening was largely due to his excellent management.

Among those present were Mr. D. C. Clark (chairman, London Division), who presided, supported by Mr. G. R. Smith (general secretary), delegates from the Electrical Trades Union, and the secretary of the National Federation of Professional, Technical, Administrative, and Supervisory Workers (Mr. W. C. Keay).

South African Electricity Act.—H.M. Trade Commissioner at Cape Town has forwarded the text of the Electricity Act, 1922 (Act No. 42 of 1922), which came into operation on September 1st, as announced by the Governor-General by proclamation in the *Gazette* of August 27th. United Kingdom firms interested may consult the text in question on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Light Up, Please!—Lighting material is coming into use again. It is probable that on October 9th in the offices and works of this country some hundreds of thousands of lamps were switched on for the first time after many months of disuse. It would appear that here is some business waiting for the energetic contractor. Probably many of the lamps and fittings are dirty, with shades broken, and the installation generally in a mild condition of disorder. Now is the time to introduce improved shades, alter positions of lights, sell lamps, and generally show the user how, for a small expenditure, he can improve his light.

In this connection a leaflet is being circulated by the Electrical Development Association amongst electricity supply undertakings and others in order to urge them to increase their local activities, whilst advertisements are appearing before the public. The leaflet is entitled "End of Summer Time," and contains a reproduction of two advertisements appearing in 40 of the leading London and provincial newspapers. Taking advantage of the occasion presented by the commencement of the dark season, public attention is drawn to the: "Convenience and economy of electricity"; "Recent movements in the electrical industry advantageous to the public"; "The definite and unalterable value of the unit of electricity."

If local advertising and individual effort are directed this winter to making more widely known the advantages of the electric method, there is little doubt that there will be secured for each and all engaged in the industry an ample share of the large business awaiting it.

Appointments Vacant.—Foreman mechanician ($300 a month, plus cost of living allowance), for the Government of the Federated Malay States; instructor in Electrical Engineering and Electrical Installation, for the Kingston-on-Thames Technical Institute; plumber-jointer, for the Wolverhampton Corporation electrical engineering department; electrical engineer (£1,250 plus bonus, at present £257), for the Salford Corporation. (See our advertisement pages to-day.)

Fatality.—In recording a verdict of "Accidental death" at a Leeds inquest on October 3rd on James Leslie Batty, aged nineteen, electrician's apprentice, the Coroner remarked that a valuable life had been lost through someone's carelessness. Whilst engaged in fixing an electric motor at Messrs. Whitaker's Ivy Mills, Beeston, Batty caught a flexible wire which connected an electric light fitting with a drill placed on a girder above his head. The drill fell on his head, and it was pointed out that this had been caused by someone leaving a loop hanging down.

Stoke Newington Electrical Exhibition.—On Tuesday last a very successful exhibition, under the auspices of the borough electrical department, was inaugurated by the Mayor, Councillor E. H. Coumbe, B.A. The exhibition, which closes to-morrow night (it is open from 3 p.m. to 10 p.m., not 8 p.m. to 10 p.m., as stated here last week), is intended to bring to the notice of the general public the numerous uses to which electricity can be applied for domestic purposes. In the course of his remarks, Mr. A. P. Starbuck, chairman of the Electric Lighting Committee, stated that in order to encourage the use of domestic electrical appliances, the Committee had decided to supply apparatus on the hire-purchase system.

On the proposition of the vice-chairman of the Committee, seconded by Sir W. A. Savory, the Mayor was cordially thanked for opening the exhibition. The visitors then went round the stands and inspected electric washing machines, sewing machines, electric cookers, ovens, &c. The following is a complete list of exhibitors:—The British Electric Transformer Co., Ltd., showing electric cookers and ovens, irons, kettles, &c.; Frank Feesey & Co., displaying the "Cascade" electric washer and ironer; Linzell, Dickenson and Co., electric sewing machines, A.B.C. washing machines, vacuum cleaners, &c.; R. Stephenson, electric bowl fires, electrical lamp standards and fittings, &c.; J. H. Golding, wireless receiving sets, &c.; the Hotpoint Electric Appliance Co., electric cookers, toasters, bowl fires, &c.; the Brompton and Kensington Accessories Co., electric ovens, bowl fires, toasters, irons, &c.; W. E. Westwood, wireless receiving sets, &c.; W. T. Henley's Telegraph Works Co., and the Russell Electrical Appliances Co., also showed a number of interesting devices for household use.

Manchester Electro-Harmonic Society.—We may remind our Manchester and district readers that the first concert of this Society for the present season will be held on Friday, October 20th, at 7.15 p.m., at the Marble Hall, Albion Hotel, Manchester. Further concerts will be held on the third Friday of November, December, and January, February and March. On Friday next the chair will be taken by the president of the Society, Mr. J. A. Robertson, M.I.E.E., and the following are the artistes:—Soprano, Madame Nellie Keighley; tenor, Mr. Arthur Wilkes; bass, Mr. Hamilton Harris; entertainer, Mr. Essler Kessen; pianoforte soloist and accompanist, Mr. Granville Hill. The Society extends a cordial invitation to electrical friends, and the hon. secretary, Mr. W. Kirkham, 196, Deansgate, Manchester, will be pleased to receive any applications for membership. Mr. W. J. Smith, as hitherto, is acting as musical director, and it is intended that the concerts shall be of a high-class as in the past.

The Zehnder Battery.—In the first instalment of our description of the exhibits at the Wireless Exhibition we illustrated a special h.p. battery in which the long thin plates are contained in a number of glass test tubes mounted on a framework. It should be pointed out, however, that a battery of this type has been imported into this country from Switzerland for the last twenty years by Messrs. Isenthal & Co. under the name of the "Zehnder" h.p. battery. Many batteries of this type are in use in the United Kingdom for h.p. research work, particular care having been taken in their construction to perfect the insulation from earth.

Gas Fires.—One of the London gas companies is at the present time circularising consulting engineers, offering them modern gas fires on trial for about a month free of cost after which they may hire, buy, or return them. This company claims that it has 3,000 medical men using modern gas fires. It also offers consultants to put in perfect order an gas fires which they may now be using free of charge and to repeat this attention annually. It further states that it is always prepared to install free, so far as fixing is concerned, any gas appliances for water-heating, lighting, cooking, or other purposes. This appears to be part of a well designed campaign to capture all those who, in the course of their business, are likely to advise or to influence public opinion

A Loud-speaking Feat.—At the Grand Rally of Boy Scouts and Wolf Cubs at Alexandra Park on October 7th to welcome the Prince of Wales, H.R.H. spoke to some 100,000 spectators through "Magnavox" loud speakers. At the Wolf Cubs' gathering the Prince addressed the cubs through a 4-button microphone, a two-stage amplifier, and one loud speaker. The speech is said to have been clearly heard by 15,000 cubs and thousands of spectators. At the Grand Rally he again spoke through the 4-button microphone (one 3-stage amplifier being fitted underneath the platform) and five "Magnavox" loud speakers erected 10 ft. from the ground on temporary towers, at convenient spots in the grounds. Again the address was clearly heard by some 60,000 boy scouts and approximately 40,000 spectators, over an area of 190 acres. The Prince spoke some distance away from the transmitter, so that the result achieved may be said to be noteworthy. A very curious incident may be mentioned: one of the Alexandra Palace attendants, who has been deaf for some years, heard every word of the speech in the grounds some 200 ft. away from the nearest "Magnavox." This was not the Prince's first acquaintance with the device, as he addressed an enormous audience through its medium at San Diego, California, during his visit there last year; it is therefore not surprising that he spoke into the microphone like an adept. The whole installation was carried out by Marconi's Wireless Telegraph Co., Ltd.

Birmingham and District Electric Club.—The forthcoming arrangements of this club include: first, the lecture to-morrow, Saturday evening (see our weekly calendar); second, the Annual Ladies' Night (whist drive and dance) on Friday, October 27th, at the Grand Hotel (6s. each single ticket, including refreshments); and, third, a snooker handicap (entrance fee 2s. 6d.), for which names have to be given to the hon. sec., Mr. F. S. Ette, 14, Harbury Road, Cannon Hill, Birmingham, by Monday next.

Batteries by Air.—The Chloride Electrical Storage Co., Ltd., recently received an urgent order by telegraph from Paris for some special motor-car batteries. These were packed and sent by passenger train to Croydon, loaded into an aeroplane of the Instone line, which carries the air mails, and delivered in Paris the day after the order was received.

Educational.—Training in Electrical Engineering.—The Board of Education is now able to announce that the Institution of Electrical Engineers has consented to co-operate with it in arrangements for the award of certificates and diplomas in electrical engineering to students in technical schools and colleges in England and Wales. Under the agreement which has been reached certificates and diplomas will be issued jointly by the Institution and the Board on the successful completion of approved courses. The scheme will provide for the issue of "diplomas" in connection with full-time courses and of "certificates" in connection with part-time courses. Certificates and diplomas will be of two grades, according as the courses to which they relate are classed as "senior" or "advanced." Detailed arrangements for the administration of the scheme will be shown in rules which are now in course of preparation and will be issued shortly. Meanwhile, should the authorities of any school in England desire further information, their inquiries should be addressed to the expert inspector in engineering to whom the courses of the school are assigned for inspection. Inquiries from the authorities of a school in Wales should be addressed to the secretary of the Welsh Department, Board of Education.

Electricity Extensions at Stafford.—On October 4th important extensions to the Corporation's electricity undertaking, which have been carried out at a cost of something like £100,000, were inaugurated by the Mayor (Ald. T. A. Dunn), who was presented by the contractors with a gold key for the purpose of unlocking the power-house doors. After the inspection, a large company sat down to luncheon under the presidency of Councillor R. E. Meade (chairman of the Electricity Committee), supported by the Mayor and Mayoress, members and officials of the Corporation, and several visitors, including Mr. Arthur Ellis, of Cardiff, and Mrs. Ellis; Mr. W. A. Jackson (West Bromwich Corporation); Mr. S. T. Allen (Wolverhampton Corporation) and Mrs. Allen; Mr. J. C. C. De Renzi (Newcastle, Staffs.); Mr. H. A. Tullock (Leek, Staffs.), and representatives of the contractors who had been engaged in carrying out the extensions.

The Mayor submitted the toast of "The Electricity Undertaking," and said he believed that the electricity undertaking would yet prove one of Stafford's best assets. They were fortunate in having two engineers at the head of affairs. They had as manager Mr. W. H. Robins, to whom no small portion of the success of the present movement was due, because he had designed the extensions. Then they had as chairman of the committee a qualified engineer, one who occupied the position which Mr. Robins held to-day, for some years.

Responding to the toast, Mr. R. E. Meade said that in the last few years there had been a most phenomenal advance in the application of electricity for practically all purposes. The scheme of extensions had been entirely instituted by the Electricity Commissioners, whose approval had been further emphasised by their saying that in future they would have an extended area of supply. The committee [illegible] the work of the [illegible] engineer (Mr. Robins), and the [illegible] engineer (Mr. Plant), who had had some very difficult work to do in connection with the extensions. In conclusion, Mr. Meade proposed the toast of "The Contractors."

Mr. A. G. Deverill, of the Brush Electrical Engineering Co., Loughborough, acknowledged the toast, and on behalf of those who had been concerned in the extensions presented Mr. Meade with a massive silver rose bowl as a mark of their appreciation "in having as chairman of the Electricity Committee an engineer."

Proposing the toast of "The Chairman," Mr. Arthur Ellis expressed the opinion that there was ample room for the development of both electricity and gas undertakings to the advantage of the community. If they could only get back to pre-war conditions, get rid of industrial unrest, and bring all parties in industry together for the benefit of the community, the demand for electricity would be increased by many hundreds per cent.

Leominster Trades Exhibition.—A large and well-equipped stall was held at the above exhibition, which closed on October 7th, by Messrs. Edwards & Armstrong, Ltd., engineers to the Stroud, Tewkesbury, Chippenham, Trowbridge, Melksham, Talgarth, Leominster, Cirencester, Abingdon, Ledbury, and Ruthin Electricity Supply Companies.

The exhibits included Eureka vacuum cleaners, Revo and Cosmos electric irons, kettles, toasters and fires, Osglim night lights, and a large selection of artistic lighting fittings. The stall was under the supervision of Mr. H. H. Spurrier, the Leominster manager and representative of Messrs. Edwards & Armstrong, Ltd. Mr. J. M. C. Field was specially sent from the head office at Stroud to demonstrate the various apparatus. Cooking, baking, toasting, ironing, water boiling by immersion heaters and boilers was actually performed on the stall. A special effort was made by means of practical demonstrations to show the many applications of modern electricity.

The people "in from the country" were particularly interested, and many of them expressed great surprise at electric cooking, some of them remarking that they thought "there was no heat in electricity."

An electric sewing-machine, controlled by hand or foot, was exhibited at another stall by Mr. H. Feasey, local manager of Messrs. Singers, Ltd.; a 6-bar Belling electric fire and also an ornamental standard reading lamp were included amidst realistic surroundings at the stall of Messrs Pennell and Stafford, furniture manufacturers, Leominster. Brisk trade was done, and the publicity value of the demonstration alone made the stalls an excellent business proposition.

Broadcasting Rules.—The British Broadcasting Co. has issued a list of conditions which broadcast receivers should fulfil to obtain Post Office approval. On September 20th the Postmaster-General suspended the issue of licences for the reception of wireless telegraphy and telephony (except in certain cases) pending the agreement on conditions then being negotiated between the various firms concerned. The conditions now announced are as follows:—

1. That all types of broadcast receivers may be constructed for the reception of signals of any wave lengths.

2. That the apparatus shall be so constructed that it is difficult to change the arrangement of the circuits embodied in the design by means of external connections.

3. The following units, each of which must consist of apparatus assembled, connected, and mounted in a single container, shall be approved:

(*a*) Combined tuner and rectifier,

(*b*) Combined tuner, high-frequency amplifier, and rectifier,

(*c*) Audio frequency amplifier (of valve or other type).

Any combination of two or three of the above separate units (*a*), (*b*), and (*c*) will be allowed.

4. No receiving apparatus for general broadcast purposes shall contain a valve or valves so connected as to be capable of causing the aerial to oscillate.

5. Where reaction is used on to the first receiving circuit it must not be adjustable, but must be fixed and incapable of causing oscillation.

6. Where reaction is used between a second or subsequent valve on to the anode circuit of a valve connected to the aerial and there is no specific coupling provided between the first receiving circuit and the first anode circuit the reaction may be adjustable.

7. Tests of sets will be made on two aerials, one 30 ft. long and the other 100 ft. long.

8. The sets will be tested for the production of oscillations in the aerial and for interference properties with a factor of safety, *i.e.*, increasing the high-pressure battery by [illegible] per cent., changing valves, &c., but not by altering any soldered connections.

9. The Postmaster-General must be satisfied that sets containing reaction can be reasonably repeated with consistent conditions.

10. After approval the type will be given a Post Office registered number, and makers must see that the sets fulfil the non-interfering conditions before they are sold. All sets

sold under the above list licence shall bear the registered trade mark of the manufacturing company and the Post Office registered number.

II. The instrument approved as the pattern instrument of a type shall not be varied without alteration by the maker. The Postmaster-General will reserve the right at any time to select any set of the approved type for test to see that the set is reasonably similar to the approved pattern. In the case of sets of an approved type employing reaction being found to oscillate the aerial, the Post Office may cancel the authorisation of the whole set of that type. No change in the design of any set of this type may be made after approval without the previous sanction of the Postmaster-General.

A New B.I.I.C. Magneto. The British Lighting and Ignition Co., Ltd., has introduced a new magneto, which we hope to describe next week, that appears to be a considerable advance in magneto design, possessing unusual features of considerable interest. It is known, of course, that cobalt steel is something like four times as efficient as a magnet, as compared with tungsten steel. The new magneto takes advantage of this fact; consequently its size and weight are considerably reduced. Moreover, by having a rotating magnet, it has been possible to introduce other advantages into the design of the new machine.

Chester Electricity Extension.—Special Order.—On September 27th the Chester City Council adopted the minutes of the Electricity Committee dealing with the above-mentioned Special Order. The Electricity Commissioners had decided to exclude from the area of supply under the Order a portion of the Hawarden Rural District, and informed the Committee that the Hawarden R.D.C., which obtained a Provisional Order in respect of part of the District in 1914, had had no real opportunity of exercising its powers; an application from the R.D.C. in respect of the remainder of the area was under consideration, and strong representations had been made to the Commissioners against the inclusion of any portion of the Rural District in the area of supply. The Commissioners were not satisfied that sufficiently strong grounds existed for over-riding the opposition of the Hawarden local authority. The Committee protested against this decision, which, it contended, was in contradiction to the action taken by the Commissioners with respect to the distribution of electricity in the Urban District of Ellesmere Port and Whitby, in which case the Commissioners made the Council surrender its order and placed the distribution in the hands of a power company. Moreover, strong representations had been made by the largest industrial concerns and ratepayers in the area in favour of its inclusion in the Special Order, and the Committee had been advised by its own electrical engineer (Mr. S. E. Britton) and by an independent consulting engineer that on technical, financial, and administrative grounds the portion of the Hawarden area should be included in the Special Order—otherwise both parts of the district would suffer. The Committee expressed confidence that Col. Ekin had so reported to the Commissioners, and requested them to reconsider their decision. The reply of the Commissioners, read at the meeting, was that they could not alter their decision.

It was explained that the question was purely one of distribution, and that if a bulk supply were obtained from the North Wales Power Co. for both Chester and the surrounding district, that would not change the situation with regard to distribution.

In his evidence at the inquiry held by Col. Ekin, Mr. Britton maintained that to take out of the Order that part of the area which was in the Rural District of Hawarden would destroy the value of the scheme as a whole; the capital expenditure would not be materially reduced, and the area of the Rural District Council, very long and narrow, largely mountainous and thinly populated, except in the north, did not lend itself to a reliable and efficient system of distribution, or to a cheap supply of electricity. He suggested, therefore, that the northern portion should be merged in the Chester area, and the southern portion in the Wrexham area. The district out'ined was particularly symmetrical, covering 72 sq. miles, all of which was within 6 miles of the existing lines, and containing a population of nearly 70,000. The scheme included a ring main at 6,000 volts, which would be seriously affected by the exclusion of the Hawarden area.

INSTITUTION NOTES.

Institution of Electrical Engineers.—South Midlands Centre.—Sheffield Section.—The programme of arrangements for the first half of the 1922-23 session of this section (Birmingham) has been issued. Mr. J. A. Cooper delivered his chairman's address on October 6th, and on the 16th the annual supper will be held, while on October 30th Mr. L. B. Francis is to read a paper, entitled "Energy Meters Used on a.c. Systems."

Western Centre.—The first meeting of the present session was held at Bristol on October 9th. After the transaction of routine business, Mr. A. C. MacWhirter made a presentation, on behalf of the members of the Centre, to Mr. and Mrs. A. J. Newman on the occasion of their recent marriage. He said that on the occasion of the Summer Meeting of the Institution in 1920 Mrs. Newman was responsible for the whole of the arrangements at Cheddar and Weston-super-Mare, and it was due in no small measure to her energies that the events at these places were so successful. Her marriage with Mr. Newman afforded the Western Centre the opportunity to show the appreciation they felt and the esteem in which Mr. Newman was held. The gift took the form of a very fine old oak chest and a silver card tray. Mr. Newman expressed the thanks of Mrs. Newman and himself for the beautiful gifts.

A hearty vote of thanks was accorded to Mr. MacWhirter, the retiring chairman, after which Mr. F. Tremain delivered his inaugural address, giving some very interesting personal reminiscences of the early research work he carried out when attached to the Post Office Engineering Staff. Mr. Tremain also suggested a method of thermal storage of electrical energy in the hot-water tanks now disused owing to the extensive substitution of gas and electric cookers for the kitchen range. These, he suggested, should be heated during the night by immersion heaters. This would tend to improve the load factor of the generating station and so realise to some extent a cheap and abundant supply of electrical energy.

Junior Institution of Engineers.—At the first meeting of the new session of the Institution, held on October 6th, Mr. W. A. Tookey dealt with the subject of "Engineering in Bacon Factories." This was the first meeting to be held in the new rooms which the Institution took possession of. The president, Mr. C. H. Wordingham, occupied the chair, and the president-elect, Capt. H. Riall Sankey, also attended.

The Institution of Civil Engineers.—It is announced that H.R.H. the Duke of Connaught has kindly consented to unveil the Roll of Honour which has been erected at the Institution of Civil Engineers to the memory of its members and students who lost their lives in the war. The ceremony will take place at 4 p.m. on Friday, October 27th.

Royal Philosophical Society, Glasgow.—At the first meeting of the Society for the 1922-1923 session, Prof. Richard Whiddington, M.A., D.Sc., Cavendish Professor of Physics in Leeds University, delivered a lecture on "Measurement by Wireless." The chair was occupied by Mr. Charles R. Gibson, F.R.S.E., president. Prof. Whiddington gave an account of a new apparatus devised by him two or three years ago, in which wireless circuits were made to oscillate at ten million frequency, or thereabouts, and harnessed to a device primarily intended to measure minute length changes. Until the apparatus was devised, the most sensitive arrangement was the so-called interferometer, which was, however, limited in its sensitiveness by the fact that light itself had a structure—being a form of wave motion. Such an apparatus, in fact, was only capable of indicating changes in length of the same order as the wave length of light. The new apparatus, he said, was not limited in this manner, and had been made to indicate changes many hundreds of times less. It was not very difficult, in fact, to measure changes in length so small as one two-hundred millionth of an inch, a distance of about the same magnitude as the diameter of a hydrogen atom. Experiments were shown with a rough form of the apparatus, only capable of indicating one ten-millionth part of an inch or so.

Finsbury Technical College Old Students' Association.—The eleventh annual dinner of the Association will be held at the Engineers' Club, Coventry Street, on Saturday, November 4th, when the chair will be taken by the president, Mr. W. G. Head, M.I.Mech.E. Old students of the College may obtain tickets (price 10s. 6d. each) and particulars of the Association from the hon. secretary, Mr. H. P. Guy, 74, Silver Street.

Edinburgh Radio Society. "Modern Telegraphy" was the subject of a lecture delivered by Major A. A. Gayne, D.S.O., Controller of Telegraphs at Edinburgh, at a joint meeting of the Edinburgh Radio Society and the Telegraph and Telephone Society. The development of line telegraphy from the earliest instruments to the present complex multiple apparatus and the Imperial cable was sketched.

Bradford Engineering Society.—Mr. Charles E. Allsopp, sales manager to the Bradford Corporation Electricity Department, in his address as president (for the second year) of the Society last week, spoke on "The Development of Public Electricity Supply," and indulged in some predictions as to the future. He outlined the early history of electrical discovery and working from 800 B.C., and remarked that the present resources of fuel were steadily being depleted, and if science did not disclose new sources of energy it would become necessary for the civilised people of the future, after exhausting their existing known sources of energy, to cluster again round the cradle of civilisation, the Mediterranean, with the sun as the direct source of heat and light. The doom of coal was at hand, and there was a frantic search for new fuels, as a result of which thousands of gallons of motor spirit had already been obtained from sawdust and wood pulp by the use of bacteria. Some eminent authorities were of opinion that atomic energy would supply the future needs, and that radium

pointed the way to a higher realisation of life. One of the joys of electrical engineering science was that one never knew what would come next. Considering the progress of science in other directions, it was not difficult to imagine that at no distant date wireless transmission of much larger volumes of electrical energy would be accomplished. He had been told that in Germany this had recently been done, and in France M. Maurice Leblanc had presented a scheme to the French Academy of Science for supplying power to railway trains without contacts. This proposal was only an idea as yet, but the inventor was to be congratulated on the remarkable breadth of vision he had displayed. Mr. Allsopp concluded by reviewing the creation and great development of the Bradford Corporation electricity undertaking.

Glasgow Corporation Electricity Department Engineering Society.—The first meeting of the Society for the 1922-23 session was held on October 2nd, when Mr. R. B. Mitchell, engineer and manager of the Electricity Department and president of the Society, delivered his annual address. Mr. Mitchell reviewed briefly the development of the department during the past year, and dealt with the difficulties to be overcome and the objects to be striven for in order to achieve the most efficient operation of the Glasgow undertaking. Mr. Mitchell recently paid a visit to Holland, and was able to show a film and a number of interesting lantern slides illustrating electrical developments in that country. He outlined the system adopted for the provision of electricity supply in the Dutch provinces and throughout the country. There was a large attendance of members.

Electrical Society of Glasgow.—The chairman of the Society for the 1922-23 session is Mr. Robert A. Ure. On September 19th members visited the works of the Falkirk Iron Co., Ltd., and on October 3rd a debate took place on the subject of "Are Cheap Installations Necessary?" The affirmative was taken by Mr. J. D. Mackenzie, and the negative by Mr. Alec. Lindsay, supported by Mr. Andrew Hutcheson. A keen discussion ensued, the members being of the opinion that the answer to the question was in the affirmative. The Society is in a flourishing condition, and now boasts 150 members.

Chelmsford Engineering Society.—Capt. H. Riall Sankey is the president for the 1922-23 session of the Society; he delivered his presidential address on October 5th, and Mr. R. Borlase Matthews was to read a paper on "Electricity Applied to Agriculture" on October 12th. An attractive programme has been arranged for the season.

Blackburn Technical Society.—Addressing the Society, on Friday, Mr. D. M. Hollins, of the British Northrop Loom Co., condemned the conservatism of the Lancashire textile manufacturer, which prevented the best use being made of the electric drive; it resulted in a lack of appreciation as to where and how to make use of electrical energy to the best advantage. Price seemed to be the predominant factor. If a better thing cost more, no matter what its saving, it was condemned as not worth having. Mr. Hollins predicted a great future for electrical energy as applied to industry.

Association of Mining Electrical Engineers.—At the recent annual assembly at Nottingham Mr. A. B. Muirhead, the president, referred to the compulsory examination of colliery electricians. He thought that the adoption of the Association's examination as a standard was not feasible, as there were many colliery electricians who were thoroughly capable of carrying out their duties while not possessing sufficient theoretical knowledge to attack the Association's examination. Members should realise that they ran a great risk of alienating the sympathy of a large number of the leading men of the mining industry if they looked favourably upon the question of official certification of colliery electricians.

Electrical Power Engineers' Association.—Southern Division.—The following lectures have been arranged by the Council for the session 1922-1923 at the Institution of Electrical Engineers:—November 3rd, "On the Application of Radio Methods to the Distant Control of Electrical Apparatus," Mr. P. R. Coursey. December 1st, "The Scope of Publicity in a Public Service," Mr. J. W. Beauchamp; January 5th, "Water Treatment as it Concerns Electricity Generating Stations," Mr. J. H. Paul; February 3rd, "Characteristics, Operation and Maintenance of Underground Cables," Mr. A. I. Tracey, chief electrician and assistant manager, Messrs. Johnson & Phillips.

Institute of Metals.—The programme of meetings of the Institute and its local sections for the 1922-23 session has been issued. The local sections are increasing in number year by year. For the first time the North-East Coast Local Section, with headquarters at Newcastle-on-Tyne, appears in the programme. The London Local Section programme is the second to be issued but the other sections have been running for some years. As a result of the recent very successful meeting of the Institute, held in Swansea, steps are now being taken to form a South Wales Local Section of the Institute in that town. As regards the meetings of the Institute, as distinct from those of the local sections, the next May lecturer has already been chosen by the Council, he being Dr. W. Rosenhain, F.R.S., head of the Metallurgy Department of the National Physical Laboratory. Teddington, who will deliver his discourse on May 2nd, 1923.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr Robert [illegible], A.M.I.E.E., M.I.E.E., the chairman of the Dundee Sub-Section of the Institution of Electrical Engineers, is the head of the electrical engineering department at the Dundee Technical College. He served his apprenticeship with the Fairfield Shipbuilding and Engineering Co., and with Messrs. Mavor & Coulson, Ltd., of Glasgow. He received his theoretical training at the Royal Technical College, Glasgow, [illegible] an associate, and was first electrical engineering student of the year. He then entered the [illegible] graduated in 1904 with special distinction in engineering and in natural philosophy. Afterwards, Mr. Archibald entered the works of the Electric Construction Co., Ltd., at Wolverhampton, as assistant tester, and after eight months was promoted to assistant designer, which post he held for three years. At the end of 1907 he was appointed chief assistant to Prof. Magnus Maclean, at the Royal Technical College, Glasgow, and in July, 1909, he took up his present position as head of the electrical engineering department at Dundee Technical College. In 1919 his classes were recognised as qualifying for the degree of B.Sc. (Eng.) in St Andrews



Mr. R. D. Archibald, Chairman of the Dundee Sub-Section of the I.E.E.

University. During the war Mr. Archibald served for over four years in the artillery and was in the fighting zone for over 2½ years. He rose to the rank of staff captain, and was mentioned in dispatches.

The Electrical World for September 16th contains a full account of a brilliant gathering which was held at the Hotel Commodore, New York, on September 11th, when a banquet was given by the New York Edison Co. to celebrate the starting of electric central station service in New York City 40 years ago. The guests, it is stated, included the largest array of Edison pioneers that had ever assembled, and many captains of industry. During the evening the original chandeliers wired by Edison were lighted, and contrast was made between the illumination of one of the original incandescent lamps and the latest and largest incandescent lamp yielding 100,000 c.p. The last-mentioned lamp is intended for motion-picture studio work, but is not yet commercially available. Souvenirs commemorative of the occasion were distributed by the company. Mayor Hulbert, who spoke for New York City, told what Edison had done for New York. "The electric light and the electric train made New York's subway possible. The discovery of the electric dynamo made possible those huge office buildings of which New York is so proud for without the electric elevator none of these structures could have risen. Can any one picture a Times Square [illegible] by gaslight?" And what would Broadway be with [illegible] light district? So the people of New York, both in their hours of work and in their hours of play, realise that Mr. Edison has in very truth made easier and more agreeable their path of life. And therefore, as acting mayor of [illegible] cipality, I know that in extending congratulations to Mr.

Edison I am giving voice to the sentiments of our six millions of people, and their feelings of appreciation and gratitude for his great work for the humanity of which they are a part, take the material form of this key, which carries with it the freedom of the greatest city on earth."

After the presentation to Mr. Edison by acting Mayor Hulbert of the key, Charles Edison was called upon, and responded for his father. He was followed by Samuel Insull, president of the Commonwealth Edison Co., of Chicago, who told in reminiscent vein how as a raw English boy he became associated with Edison; he also referred to some of the early financial struggles of the first Edison Lighting Co. and to the achievements which had followed upon the transcendent genius of Edison. Later speakers were Frederick B. Fish, patent attorney of the General Electric Co., and John W. Lieb, vice-president of the New York Edison Co.

A South African contemporary reported, under date September 9th, that Mr. H. W. Clayden, chief electrical engineer to the General Mining and Finance Group, had left on a six months' visit to England.

Mr. Francis Tremain, M.I.E.E., chairman of the Western Centre of the I.E.E., who delivered his opening address for the session at Bristol on Monday last, is a consulting engineer. He retired in August, 1915, from the position of superintending engineer of the South-Western District of the Post Office after completing 45 years in the service of the State. Mr. Tremain was a telegraphist at Plymouth from 1870 to 1887, and in the latter year was transferred to the Engineer-in-Chief's Department as engineer and technical officer, continuing there until 1905, when he became superintending engineer (at Newcastle-on-Tyne) for the Northern District of England. In 1909 he became superintending engineer of the



E. Chavers] [Bristol.

Mr. F. Tremain,

Chairman of the Western Centre of the I.E.E.

South-Western District at Bristol, where he remained until 1915. For the two years following he was with the Ministry of Munitions as Inspector of Munition Areas (steel and shell). In 1918 he was lecturer in wireless telegraphy at the University of Bristol. When in the Post Office service, Mr. Tremain carried out extensive experiments in reference to the improvement of the transmission efficiency of underground telephone loops, following up the ideas of Pupin; the first loading coils used in this country were designed by him and used on the pupinised cable laid between Birmingham and Wolverhampton with remarkably satisfactory results. To the construction and design of paper-covered cables Mr. Tremain paid great attention, and many of his ideas proved to be of great value. One of his earliest achievements was the substitution of an electric drive for the weight transmission hitherto employed on the Hughes printer; this involved the application of the highest mechanical skill, as the problem to be solved was by no means such an easy one as might at first sight be imagined.

Sir Henry Thomson, who, between eight and nine years ago was appointed general manager of the Great Eastern Railway, is relinquishing that post and taking up an appointment as head of the Canadian National Railways on a three years contract at $50,000 per annum. It is also reported that Lord Claud Hamilton is resigning the chairmanship of the Great Eastern Railway.

The Carnegie Hero Fund Trustees, at Dunfermline, have awarded a medallion and an annuity of £130 to Dr. John Spence, Edinburgh, who, as a result of X-ray experiments, received serious damage to both hands, necessitating amputation of the right forearm.

We regret to learn that Mr. Thomas Rolls, Corporation electrical engineer of Bradford, is suffering from a nervous breakdown and has been ordered a complete rest for some time. It is understood that an attack of influenza some years ago left him with a weakened heart and made him particularly susceptibe to overstrain; he had also suffered domestic bereavement. He has been granted leave of absence until January 1st, and Mr. James Townley, chief assistant at the Sunderland municipal station, has been appointed deputy engineer to take charge during his absence. Mr. Townley will take up his duties by the end of this month. During the war Mr. Roles had to work under heavy strain and, as in the case of so many men who "did their bit" in important capacities at home, the effects have shown themselves years after. As a matter of fact, the heavy strain of the war period was followed almost immediately by a heavier strain still—there was no relief from pressure, merely a slight change over from one set of problems to another. We are sure we are voicing the sentiments of a host of friends in the electrical profession and industry, when we wish him a speedy recovery as the result of complete rest from electricity supply matters, a full measure of patience, and a change of air and scene on the South or South-West Coast. While the best advice in such cases is against hurrying back to one's accustomed haunts and interests, we hope that it may not be long before Mr. Roles will be his old self again and able to resume control of his important undertaking.

Mr. J. B. Rapkins, chairman of the Guildford Corporation Electricity Committee, has been chosen Mayor Elect of Guildford for the ensuing year.

Mr. Windsor, borough electrical engineer at Monmouth, has resigned. Monmouth Town Council has appointed Mr. Blake as superintendent engineer of the electricity works, with sole control of the staff, for six months from September 20th.

Last week-end Mr. H. Hirst, chairman of the General Electric Co., Ltd., entertained at Reading about 40 representative employers and employed at a conference arranged by the Industrial League and Council. Mr. H. G. Williams, prospective Conservative candidate for Wednesbury, opened a discussion on national and international debts, and, among other things, showed that the idea of some people that the burden of National Debt would be lessened by a capital levy was a delusion.

The marriage took place at Boston parish church on September 26th of Mr. Arthur King, partner in the firm of Hensman & King, electricians, of Bridge Street, Boston, and Miss Bessie Marie Penny.

An application for an increase of salary by Mr. John Lambert, burgh electrical engineer at Perth, has been remitted to a special committee.

Mr. H. H. Wall, charge engineer at the Maidstone Corporation electricity works, has been appointed to a similar position at the works of the Lancashire Power Co., near Manchester. Mr. Wall was married on September 30th to Miss D. E. Kettle, a member of the clerical staff at the Maidstone electricity works, and they were presented by the Electricity Works Committee with a Copeland dessert service, by the staff and employés with a basket of stainless cutlery, dessert spoons, knives and forks and carvers, and by Mr. E. E. Hoadley, electrical engineer, with a Ewbank cleaner.

Watford Urban Council has increased the salary of the electrical engineer by £100 for the month of October, in consideration of additional work carried out in connection with extensions to the plant.

We are glad to learn that Mr. J. J. Woods, consulting engineer, Clones, who has had a serious motor accident at Dundalk in July, is making satisfactory progress, and is expected to be out of hospital in the course of a fortnight.

Obituary.—Mr. Montague Gluckstein.—We regret to record the death, at the age of 68 years, of Mr. Montague Gluckstein, who was prominently connected with well-known large London companies of the catering, hotel, and tobacco classes, and was also a director of the Westminster Electric Supply Corporation, Ltd., and the St. James's and Pall Mall Electric Light Co., Ltd.

Mr. James Fraser.—The death has occurred at 10, Morven Place, Aberdeen, of Mr. James Fraser, M.I.E.E., late executive engineer of the Post Office at Aberdeen. He retired from official duties only a few months ago.

Herr L. Madrnozka.—The death is announced, as the result of an accident while on holiday in the Alps, of Herr Leo Madrnozka, professor of electrical engineering at the Technical High School, Munich.

The death took place suddenly on October 5th, at the age of 30 years, of Mr. Hugh Clark, electrical engineer, of 15, Dongola Road, Ayr.

NEW COMPANIES REGISTERED.

C. F. Young, Ltd. (184,660).—Private company. Registered September 26th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of and dealers in electric light and other electrical apparatus, &c. The first directors are: C. F. E. Young, 7, New Walk, Leicester (managing director); D. Taylor, 12, Halsbury Street, Leicester. Qualification: £100. Secretary: J. F. Chambers. Registered office: 7, New Walk, Leicester.

Underground Electric Railways Dining Club, Ltd. (184,633).—Registered on September 28th as a company limited by guarantee. Objects: To provide a club house and conveniences for the accommodation of the administrative and clerical staff at the head office of the Underground Electric Railways Co. of London, Ltd., and its associated companies and their friends. The subscribers are: F. C. Bingham, 75, Bromley Road, Catford, S.E., railway service; C. Thurston, 45, Chaldon Road, Fulham, S.W., railway service; C. Russell, 22, Victoria Avenue, Hounslow, railway service; J. Adkins, 5, Napoleon Road, Twickenham, railway service; H. Newman, 34, Thornbury Road, Isleworth, railway official; H. Fullen, 116, Burges Road, East Ham, E.C., railway official; W. J. Lamble, 35, Leighton Road, West Ealing, railway official. The management is vested in a Council, but no persons had consented to act to September 27th. Solicitors: Baxter & Co., 12, Victoria Street, Westminster, S.W.1. No notice of situation of registered office was filed at time of incorporation.

Mosley Installations, Ltd. (184,702).—Private company. Registered September 30th. Capital, £1,000 in £1 shares. To carry on at 176, Alcester Road, Mosley, Birmingham, and elsewhere the business of an electric light company, &c. The first directors are: J. N. Collins, Nara Lodge, Widney Manor, Solihull; H. E. Willis, 41, Abbotsford Road, Sparkbrook, Birmingham; R. B. H. Gossage, 176, Alcester Road, Moseley, Birmingham. Qualification: 1 share. Registered office: 176, Alcester Road, Moseley, Birmingham.

Continental Automatic Telephone and Electric Co., Ltd.—Registered on October 4th as a private company, with a nominal capital of £10,000 in £1 shares. The objects are: to carry on the business of telephone, telegraph, wireless, electric light, heat, sound and power company, &c., and to adopt agreements (1) with the Telephone-Fabrik Actiengesellschaft, of Berlin, and (2) with R. de Redon, relating to management. The subscribers (each with one share) are: S. A. Sharpe, 205, Friern Road, Dulwich, S.E.22, accountant; J. Barnes, 7, Walcot Gardens, Kennington, S.E.11, accountant. The first directors are: Reoul de Redon (manager) and others by subscribers. Qualification: £25. The registered office is at 62, London Wall, E.C. The file number is 184,764.

Webster & Allford, Ltd. (184,797).—Private company. Registered October 5th. Capital, £2,000 in 1,650 ordinary shares of £1 each and 7,000 deferred shares of 1s. each. To adopt an agreement with A. Dobson and to carry on the business of glue pot dealers and factors, importers, exporters, produce brokers, workers in wood, vulcanite, rubber, leather, celluloid and other substances, dealers in boilers, engines, machinery, plant and apparatus for manufacturing and distributing gas, water and electricity, manufacturers of and dealers in illuminating apparatus, valves, pipes, cables, meters, and switches for electric and oil lamps, &c. The permanent directors are: W. Webster, 39, Royal Park Terrace, Leeds, engineer; G. F. Allford, 26, Park Mount, Kirkstall, Leeds, electric lamp manufacturer (managing directors). Qualification: £100. Registered office: St. John's Works, Kirkstall Lane, Leeds.

Metalite Co., Ltd. (184,750).—Private company. Registered October 3rd. Capital, £100 in £1 shares. To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, &c. The subscribers (each with one share) are: C. W. Bennett, 28a, Mersham Road, Thornton Heath, Surrey, solicitor's clerk; A. S. Prall, Parkland Grove, Ashford, Middlesex, solicitor. The subscribers are to appoint the first directors. Qualification: 1 share. Remuneration as fixed by the company. Registered office: 11, Fitzroy Square, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

C. F. Elwell, Ltd.—Debenture dated September 8th, 1922, to secure £4,000 and further moneys not exceeding an additional £2,000, charged on moneys due in respect of work carried out at Horses Island, Portsmouth; contract with Radio Communication Co. for work at Christmas Island, Malay States, and the company's undertaking and other assets, present and future, subject to prior mortgage debentures. Holders: J. H. Scrutton, The White House, Buckland, Betchworth.

Mickelwright, Ltd.—Mortgage dated September 20th, 1922, to secure £250 (including £100 previously advanced), charged on plant, machinery, and stock in trade. Holders: J. H. Castell, 106, Vaughan Road, Harrow, and H. C. Heath, 62, London Road, Wembley.

J. Hadden & Co., Ltd.—Debenture dated September 13th, 1921, to secure £2,716, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

X-Rays, Ltd.—Deposit on September 14th, 1922, of deeds of 298 and 300, Kilburn Lane, Kilburn, to secure all moneys due or to become due from the company to Lloyd's Bank not exceeding £5,000.

C. H. Mason & Co., Ltd.—Satisfaction in full on September 8th, 1922, of mortgage dated June 30th, 1921, securing £3,500.

H. F. Foster & Co., Ltd.—H. Allnutt, of 17 and 18, Basinghall Street, E.C., was appointed receiver on September 26th, 1922, under powers contained in mortgage debenture dated March 31st, 1915.

CITY NOTES.

Telephone Manufacturing Co., Ltd.

The profit for the year ended May 31st, 1922, was £64,987, including dividends received from installation companies amounting to £44,890 gross. Adding £24,796 brought forward, the amount available is £89,784. Income bond interest and income tax absorbed £26,717, leaving £63,067. According to the *Financial Times*, the directors have declared an interim dividend of 5 per cent., less tax, and propose writing off the balance of preliminary expenses and of cost of issue of shares £17,162, writing off part expenses of income bonds issue £11,995, reserve for excess profits duty now agreed at £9,304, carrying forward, subject to corporation tax and directors' additional remuneration, £10,084. Shareholders will be asked at the meeting on November 7th to confirm the above dividend as the final one for the year. Nothing is included in the accounts in respect of profits earned during the year by installation companies abroad. The company was formed in May, 1920, but the dividend paid on May, 1921, was 10 per cent. for the previous 19 months. For the twelve months ended May, 1922, the interim dividend of 5 per cent. is the only dividend.

Spanish Electrical Companies.

The following dividends have been declared:—Union Electrica Vizcaya (Bilbao), 4 per cent.; Gran Metropolitano de Barcelona Sociedad Anonima, 25 per cent., Electricas Reunidas de Zaragoza Sociedad Anonima, 15 per cent.; Electra Lerin, 3 per cent.; and Electra de Occidente, 4 per cent.

The Sociedad Hidraulica Santillana announces the distribution of the statutory dividend of 450,000 pesetas to the shareholders, being equivalent to 6 per cent., plus 150,000 pesetas complementary dividend equal to 2 per cent. additional; and 150,000 pesetas to the 2,000 holders of founders' parts, leaving, after provision for the reserve and directors' fees, a balance of 17,626 pesetas to be carried forward.

The Sociedad Hidroelectrica Iberica announces the payment, on the presentation to the Banco de Vizcayo in Bilbao of a dividend of 3½ per cent., or 17.60 pesetas, per share, tax free, of coupon 2 of shares 1 to 40,000, as complement to the profits of last year's working; also of 7 per cent. on the paid-up new capital, or 8.75 pesetas per share; also of payment of interest on the company's bonded debt.

The balance-sheet for 1921 of the Agnas de la Coru a shows a profit of 246,284 pesetas, which, with 13,358 pesetas and other sums brought forward, made a gross profit of 274,463 pesetas. After allowances for reserve, sinking fund, directors' fees, and staff bonus and taxes, a dividend of 6.50 per cent., absorbing 162.500 pesetas, was declared, leaving the small balance of 617.59 pesetas to be carried forward.

Eastern Telegraph Co., Ltd.—The revenue for the year ended December, 1921, was £4,124,976, from which is deducted £1,773,757 for the ordinary expenses, and £664,344 for expenditure relating to maintenance of cables, income and war taxes payable abroad, share of contribution to the pension and superannuation funds towards depreciation of investments, payments to staff, and other expenses incidental to the war, leaving £1,686,875. After providing for income tax and corporation profits tax payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £435,345, there remains £1,251,530, plus £316,479 brought forward, making a total available balance of £1,568,008. £500,000 to the general reserve fund. Total distribution of 10 per cent., free of income tax, on the ordinary stock for the year, leaving £568,008, which is carried forward.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The gross revenue for the year ended December, 1921, was £2,394,324, from which is deducted £708,990 for the ordinary expenses, and £342,694 for maintenance of cables and special expenditure, leaving a balance of £1,342,640. After providing £184,853 for income tax and corporation tax payable in England, £30,096 for interest on the mortgage debenture stock, and £590 on account of expenses of issue of new capital, there remains £1,127,100, plus £80,779 brought forward, making a total available balance of £1,207,880. £500,000 is put to the general reserve fund. Total distribution for the year, 10 per cent., free of income tax; leaving £307,880 to be carried forward. The new cable between Madras and Singapore has been successfully laid and opened for traffic. The directors refer to the death of the general manager and secretary, Mr. F. E. Hesse.

Still Engine Co., Ltd.—According to the financial papers, the balance sheet as at March 31st, 1922, shows the following items.—Debit: Issued shares of £1 each, fully paid, £220,550; issued "A" shares of 1s. each, fully paid, £726; issued 8 per cent. debentures, £14,523; sundry creditors—including £1,814 for directors' fees accrued—£2,571; licences account, £4,750; total, £243,120. Credit: Cost of goodwill, rights and other assets, £154,074; plant, machinery, &c., £5,622; furniture, £1,081; stores, £1,019; experimental and research expenditure, £49,353; salaries, rent, &c., and other expenses, less interest and discount on Treasury bills and transfer fees, £18,606; preliminary and formation expenses, including underwriting commission, £7,205; sundry debtors and debit balances, £5,232; cash at bank and in hand, £928; total, £243,120.

Edison Accumulators, Ltd.—The report for 1921 states that after providing £2,011 for depreciation and proportion of preliminary expenses written off, and reserving £1,246 for doubtful debts, the loss is £31,629. Deducting therefrom £10,606 brought forward, there is a debit balance of £21,023 to be carried forward.

United Electric Tramways Co. of Caracas.—Net revenue for the year ended June 30th, 1922, £18,129. Adding the balance forward, £14,852, less excess profits duty and corporation tax, £5,503, the disposable balance is £27,477. The directors recommend a dividend of 10 per cent., less tax, leaving £10,477 to be carried forward, subject to corporation tax.

Traction & Power Securities, Ltd.—Interim dividend of 3s. 6d. per share free of tax on the ordinary shares.

Companies to be Struck off the Register.—The following companies will be struck off the register at the expiration of three months unless cause is shown to the contrary:—

[illegible]
Domestic Electric Co., Ltd.
[illegible]
[illegible]
[illegible]
Triple A Lamp Co., Ltd.

Oriental Telephone & Electric Co., Ltd.—Interim dividend [illegible] per cent. on the 6 per cent. cumulative preference shares for the current year, less income tax, and 4 per cent on the ordinary shares, free of income tax.

British Electric Transformer Manufacturing Co., Ltd.—Profit for the half-year ended June 1922, £9,266, as compared with £51,085 for the same period of 1921, and £35,341 for the second half of 1920.

Direct United States Cable Co., Ltd.—Interim dividend 1s. per share, less tax, for the half-year ended September.

Anderston Foundry Co., Ltd.—Interim dividend of 3s. per share, less tax.

Electrical Utilities Corporation, Ltd.—Dividend for the quarter ended September of 1¼ per cent. on the preferred stock.

West African Telegraph Co., Ltd.—Dividend of 4 per cent. free of tax in respect of the year ended last December.

STOCKS AND SHARES.

Tuesday Evening.

Once again, it is foreign politics which are responsible for the swaying of prices in most of the Stock Exchange markets. According to the various cables from the Near East (and Paris) so have prices moved from hour to hour. Business in most descriptions shows a tendency to expand, though not to any great extent. The forthcoming visit of Sir Robert Horne, the Governor of the Bank of England, and a member of the Treasury, to the United States, for the purpose of arranging terms for repayment of our War Loan to America, is a factor which comes into consideration as having a possible influence over gilt-edged stocks in the near future. The money position, however, is easier, and experts are talking of the Bank of England being able to maintain its present 3 per cent. rate for the rest of the current year.

The liveliest market in the stocks and shares dealt with in this letter is that for Marconis, where an improvement has occurred in most of the shares, owing to the stimulus given to the broadcasting boomlet by the forthcoming reissue of licences. The price of the parent shares has risen 3s. 9d. to 2 7/16. Canadians are better at 11s., Radios at a guinea and the preferred at 14s. 9d. Up to the present, there has been no alteration in Marconi Marines, which stick at 1⅞. As hinted here last week, it is expected in the market that, before long, dealings will begin in certain of the shares of other subsidiary companies, and this, together with the broadcasting optimism, is responsible for the better tone that prevails throughout the wireless department.

The Eastern group is very quiet, with Eastern Extensions 18½, and Eastern ordinary at 18¼, both ex-dividend. The others are unchanged. Cuba Submarines at 8 are also ex-dividend, and United River Plate Telephones at 6⅞ are half-a-crown up. Amongst the manufacturing shares no alterations have occurred. Metropolitan-Vickers preference gave way to 2⅜, in spite of the big contract which the company has just secured in connection with the important new work to be put in hand by the underground railways.

British Insulated remain dull at 2 3/16, and English Electric preference at 19s. 6d. are a few pence lower. The cable manufacturing shares are all very steady, with no large supply available to meet an investment demand almost as constant as that for the War Loan and other securities in the market for gilt-edged stocks.

Improved conditions prevail in the market for home electrical shares. Metropolitans at 62 and St James's at 9⅛ are both the fraction to the good. The slight wavering in the prices throughout the list, to which attention was drawn last week, is no longer perceptible. County new ordinary remain at 2s. 9d. premium, and the preference have hardened to 2s. premium. No doubt the changing over to Greenwich mean time at the beginning of this week has something to do with the increased strength of the illumination stocks and shares of various kinds, for gas issues have participated in the firmer disposition shown by electric supply shares.

Underground Electric ordinary at 3¼ are 5s. better, the "A" shares strengthening to 8s., while the Income Bonds remain at 85½. Metropolitans, Districts, and Central Londons remain as the [illegible] week.

A good deal of speculative interest attaches to East London stocks at the present time. A substantial sum is understood to be held by the company, presumably for distribution amongst stockholders. Even about this sum there is a degree of uncertainty. However, upon the strength of the expectation that the stockholders will receive something in the near future, the various debenture stocks are steadily rising, although the ordinary are not affected by such optimism. The company's "A" debenture stock is now standing at 78½, the "B" at 61½, while speculative purchases have raised the 4 per cent. third debenture to 36½ and the fourth to 20. Several other improvements are to be noted in the price-charge list of electric railway issues. Metropolitan 5½ per cent., for instance, advancing to 69, and the "A" preference to 68. District 4½ per cent first preference remains at 80 and looks comparatively cheap, considering the progress which the line is making.

Rubber shares continue the mild buoyancy which sprang up owing to the improvement in the price of the produce to 9d. per lb. There is not much trade doing, but the list is distinctly better; in fact, some shares have doubled in price in the past fortnight. Iron and steel shares are dormant, nor is there any public interest being taken in the issues of the various armament companies.

Brazilian issues of every kind have been steeped in depression, owing to the slump in the value of the milreis. Brazilian Tractions dropped to 45, but rallied to-day, Tuesday, to 47. Argentine Trams also have been heavy, and on balance, both the Anglo-Argentine preferences are 1/16 down. Mexican matters do not seem to make much headway, despite the passage of the Bill through both Houses of the Mexican Parliament, under which Bill assent is given to the President's proposal for meeting the country's obligations. Mexico Tramways seconds relapsed to 10. British Columbia Electric Railway stocks are quiescent.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1920.	Dividend 1921.	Price Oct. 10, 1922.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	12	8⅝	—	£7 1 2
Charing Cross Ordinary...	8	9	7⅞	—	5 17 0
do. do. do. 4½ Pref. ...	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	—	4 16 0
City of London	14	14	2	—	6 18 6
do. do. 6 per cent. Pref....	6	6	28/-	—	5 4 4
County of London	8	8	14	—	5 16 4
do. do. 6 per cent. Pref....	6	6	14	—	5 4 4
Kensington Ordinary	9	10	7½	—	6 13 4
London Electric	2½	4	2⅛	—	4 11 5
do. do. 6 per cent. Pref....	6	6	5	—	5 17 1
Metropolitan	7	7	6¼	+ ¼	5 14 8
do. 4½ per cent. Pref....	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	6¼	+ ¼	6 11 6
South London	7	7	4	—	7 0 0
South Metropolitan Pref.	7	7	1⅜	—	5 18 0
Westminster Ordinary	10	10	7⅞	—	6 11 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref	6	6	10⅞	—	5 17 8
do. Def.	1½	84/6	28⅝	—	7 8 8
Chile Telephone	6	6	6	—	6 0 0
Cuba Sub. Ord.	7	7	8½xd.	—	8 12 1
Eastern Extension	10	10	18⅛	—	5 7 5
Eastern Tel. Ord.	10	10	18¼	−2	5 7 8
Globe Tel. and T. Ord.	10	10	18⅜	—	5 6 8
do. do. Pref.	6	6	11⅜	—	5 4 4
Great Northern Tel.	24	22	28½	—	7 13 0
Indo-European	10	10	8⅛	+ 1	7 7 3
Marconi	25	15	2	+ 3/16	6 3 0
Oriental Telephone Ord.	12	12	2⅜	− ⅛	*5 1 1
United R. Plate Tel.	8	8	6⅞	+ ⅛	*5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅜	—	*5 8 1

Home Railways.

Central London Ord. Assented ...	4	4	67	—	5 19 5
Metropolitan	1½	2½	66	—	4 0 4
do. District	Nil	1	4⅛	—	2 6 6
Underground Electric Ordinary ...	Nil	Nil	3/8	+ ⅛	Nil
do. do. "A"	Nil	Nil	8/-	+6d.	Nil
do. do. Income	2	4	85½	—	*4 13 7

Foreign Trams, &c.

Anglo-Arg. Trams. First Pref. ...	5½	12½	8⅜	− 1/16	8 1 10
do. do. 2nd Pref.... ...	Nil	5½	5⅛	− 1/16	7 2 0
do. do. 5 per cent. Deb. ...	5	5	80½	—	6 4 3
Brazil Tractions	Nil	Nil	47	—	8 10 2
British Columbia Elec. Rly. Pcs. ...	5	5	76½	—	6 9 9
do. do. Preferred ...	5	95/-	66	—	*7 1 3
do. do. Deferred ...	3	124/-	71½	—	*8 12 6
do. do. Deb.	4½	4½	75xd	—	6 18 4
Mexico Trams. 5 per cent. Bonds ...	Nil	Nil	70½	—	7 1 10
do. do. 6 per cent. Bonds ...	Nil	Nil	40	−1½	Nil
Mexican Light Common	Nil	Nil	10½	—	Nil
do. Pref.	Nil	Nil	40½	—	Nil
do. 1st Bonds	Nil	5	64½	—	7 14 6

Manufacturing Companies.

Babcock & Wilcox	15	16	21⅜	—	5 12 3
British Aluminium Ord.	10	5	17/9	—	5 12 8
British Insulated Ord.	15	15	2⅜	—	6 17 0
Callenders	15	15	2⅜	—	6 17 0
„ 6½ Pref.	6½	6½	1⅜	—	5 16 7
Crompton Ord.	10	5	15/-	—	6 18 4
Edison-Swan	10	Nil	8/-	—	Nil
do. do. 5 per cent. Deb. ...	5	5	64	—	7 16 4
Electric Construction	10	10	25/6	—	7 17 0
English Electric	8	5	15 0	—	6 7 0
do. do. Pref.	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	6½	6½	21/8	—	6 2 4
do. Ord.	10	5	18/6	6d.	5 8 1
Henley	15	15	2½	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1⅛	—	—
Mex.-Vickers Pref.	8	8	2⅜	— ⅛	6 14 9
Siemens Ord.	10	10	25/0	—	*7 15 4
Telegraph Con.	20	20	25½	—	*4 13 6

* Dividends paid free of Income Tax.

THE ELECTRICITY (SUPPLY) ACTS, 1919 & 1922.

By HENRY M. SAYERS.

(*Concluded from page 474.*)

Prices.—The somewhat important matter of what prices may be charged by a J. E. A., left untouched by the 1919 Act, is dealt with by Section 18 of the new Act. Shortly, the prices are to be fixed so that the receipts shall cover all the expenses on revenue account, including interest and sinking-fund charges, with such margin as the Commissioners may allow. If in any year the receipts do not suffice to cover the said expenditure, the deficiency may be provided in one of three ways: (1) Out of a reserve fund; (2) by apportionment amongst the authorised undertakers who have taken a supply in proportion to the number of units taken by each; (3) carried forward and included in the expenditure of succeeding years, if it appears that it can be made up by a reasonable adjustment of charges, or otherwise; or is too small to justify an apportionment. The principle is that the J. E. A. shall pay its way year by year. Apportionment of a deficiency will be very unpopular with the authorised undertakers, and even somewhat embarrassing for their accountancy. As they will generally have a majority of representatives on the authority, this provision should go far to ensure prudent and economical management of the authority's business. If the object aimed at is achieved regularly it will have the effect of easing the future financing of J. E. A.s by assuring investors of the security of interest and repayments on the issues of J. E. A.s. But this confidence will take some little time to earn.

Section 22 is of enormous importance to the whole supply industry and to the public generally. It has the effect of wiping out the existing law in respect to the revision of methods of charging and maximum prices. All undertakings will be placed on the common footing that maximum prices may be revised every three years. At present there are undertakings without any statutory provision for such revision. Some are under special provisions as to the intervals between revisions, and some are bound by agreements and other instruments to some maximum price. The general period in the case of company undertakings is five years, but there are many exceptions. The section makes the period uniform. It has to be read with the Schedule to the Act, which sets out the procedure for revision. The initiative may be taken by (*a*) the undertakers; (*b*) a number of consumers, not less than 20 (possibly more); (*c*) the local authority, where it is not the undertaker; (*d*) the London County Council where the area of supply is within the County of London, and the local authority is not the undertaker.

The Order made may vary the prices or methods of charging, or may substitute other prices and methods of charging.

The power to vary the methods of charging is perhaps more important than that to vary prices. The section repeals the option given to the consumer to require the undertaker to charge by the actual amount of energy, or the "electrical quantity" contained in the supply.

This change in the law, when it becomes effective, opens the door to a more rational tariff, and in so doing should permit of methods of charging which will encourage a more general use of electrical energy by all classes of consumers, relieving undertakers of the liability to supply, *e.g.*, short-hour lighting consumers, at a loss. This will be to the advantage of undertakers and the majority of consumers.

It remains to be seen what proposals undertakers will make, and what methods the Minister of Transport will sanction. It is not likely that "freak" and ultra-scientific tariffs will be encouraged; but the liberty to try various methods, and the possibility of revision after three years' trial, if any interested party is dissatisfied, ought to result in settling down after a few years to some few sound and equitable methods. The reform is one for which many undertakers have striven for years. It is up to them to make good use of it.

Section 12 makes alterations in Sections 11 and 19 of the 1919 Act. In considering applications for the establishment of a new, or the extension of an existing, station, the Commissioners are not to refuse their sanction if it is proved that the undertakers will, with their consent, be in a position to meet their consumers' demands at a cost not greater than that at which they could give the supply if they obtained a supply from some other source designated by the Commissioners.

Similarly, the Commissioners shall not require undertakers to enter into an agreement under Section 19, 1919, to take a supply from some other specified undertakers, if it is proved that they can do as well for their consumers by taking a supply from some other source than that specified.

These directions to the Commissioners to take into account considerations which it would seem to be their ordinary duty to give heed to, do not really limit their discretion with respect to general interests, since they are by the concluding words of the section permitted to determine that a refusal or requirement is necessary in the interest of the general supply in the district. The section seems rather redundant.

Miscellaneous Provisions.—Section 21 slightly extends the grounds on which compensation for deprivation of employment may be given, substituting "under or in consequence of this Act" for the words "under this Act"; and "in consequence of any such transfer scheme, agreement, or arrangement" for the words "in consequence of this Act"; in Section 16 of the 1919 Act. What is, perhaps, more important, is that it empowers the Minister of Labour to make rules as to the procedure before the referee or board of referees and to provide for limiting the amount of, and the taxation of, costs; and for fixing the fees to be paid to the referees and determining who shall pay them.

Section 7 makes a necessary alteration in the date up to which the expenses of the Commissioners are to be advanced out of moneys provided by Parliament, and the date by which those advances are to be repaid. It further provides for the apportionment of the expenses of the Commissioners among the J. E. A.s and authorised undertakers of Great Britain. In future years these are to be apportioned in the proportion of the units sold by each undertaking, instead of units generated, due provision being made to avoid double assessment on bulk supplies, &c., which may appear as "units sold" in the accounts of two or more undertakers. The Commissioners are empowered to recover unpaid amounts summarily as a civil debt from defaulting undertakers. The assessment on "units sold," deducting units used in the stations, lost in distribution, &c., is more equitable than assessment on "units generated," as these deductions vary greatly with different undertakings.

There is a small amendment of the law as to stand-by charges. Section 15 of the Electric Lighting Act, 1909, which has hitherto regulated these charges, is repealed. It is re-enacted in a form which includes gas, steam, or other form of energy—not only a separate supply of electricity—as the agents to which the supply from the authorised undertaker is a stand-by. This removes a grievance which some undertakers have suffered under.

Section 25 is an addition to the existing law, which may have far-reaching effects. It permits the owners of generating stations for the supply of railways, tramways, &c., to supply J. E. A.s, authorised undertakers and any consumers with electricity. Powers to break up roads for the laying of mains, &c., may be given to such owners. The rights of authorised undertakers,

power companies, and J. E. A.s are safeguarded, and their supplies may only be given with the consent of the Commissioners and subject to such conditions as they may impose. These powers ought to be of great utility in bringing electricity supply into districts along railway, &c., routes, where an electricity supply undertaking could not expect to make a living; and may assist J. E. A.s to cover parts of their districts more economically than in any other way. It need hardly be said that the combination of electric traction and supply is well established in some other countries, with proved advantages to both sides of the undertaking, and to the public.

Section 24 allows a power company or a J. E. A. to supply electricity within its district or railways, tramways, docks, harbours, canals, &c., which may be used in part by such concerns outside the district. This is an extension to J. E. A.s and power companies of the general right of undertakers to give such supplies granted by Section 5, Electric Lighting Act, 1909, with the difference that under the 1909 Act the consent of the Board of Trade is required in each case. Apparently, power companies have the right under the 1909 Act, subject to the consent mentioned, which will no longer be necessary in their case.

A little difficulty of the London County Council is removed by Section 28. The L.C.C. is not an authorised undertaker, and though it is greatly interested in the matter of electricity supply in London, it does not appear to be empowered to spend money under or in consequence of the Electricity (Supply) Acts. It certainly has spent some and may have to spend more. The section allows such expenditure to rank as expenses for general county purposes.

It is hardly necessary to do more than mention the provisions for the payment-off of debentures and the winding up of companies which have sold the whole or parts of their undertakings to a J. E. A., and the extension to 60 years in place of 30 of the maximum period for the repayment of loans by Scottish local authorities.

The last line of the Act says that it shall not apply to Ireland!

This summary of the 1922 Act and its effects will indicate that the time spent since 1919 has not been entirely wasted. Besides the provision of financial powers for J. E. A.s, without which they could not march, a good deal more elasticity is permitted in the constitution of these bodies, or bodies to answer the same purpose; and more elasticity is also given to the J. E. A.s, which should enable them to do their work with more respect to business considerations and less to cast-iron legality.

The possibility of a large measure of relief from the dead hand of 1888 in respect of the compulsory purchase of company undertakings is welcome. It may be regretted that the purchasing authorities have an absolute veto on the application of this relief in each case, but some will use their power reasonably, and the Commissioners should be able to persuade—though they cannot force—others.

The new provisions for revision of prices and methods of charging are also welcome. How they will work out depends on the wisdom and courage of those who administer the provisions, but not wholly. The same qualities are called for in the authorised undertakers who seek to utilise the new powers.

On the whole, the electricity supply industry should feel that it has a freer field for its exertions, and it will be well advised to make the best use of this greater freedom. No doubt experience will show that the Acts of 1919 and 1922 have defects. There is no finality in these things. But, taken together, they do constitute a great improvement on the law as it stood before, and we must be thankful that the Government and Parliament have done so much.

THE WIRELESS EXHIBITION.

The First All-British Show.

(*Continued from p. 499*)

The extension of the wireless market by broadcasting has attracted many keen brains to this field and has already resulted in improvements in wireless receivers. One of the chief difficulties facing manufacturers was the Postmaster-General's opposition to valve receiving sets using reaction, as such sets can easily become miniature transmitters and cause serious interference with other listeners-in. To do away with reaction on existing receivers would greatly impair their efficiency; in fact, the broadcast music and speech could only be restored to its original volume by using an extra valve with its consequent additional expense and complication. The Telephone Manufacturing Co., Ltd., however, claims to have solved the difficulty in an ingenious way. The new single valve receiver is said to employ the reaction principle in such a way that no interference can possibly be caused to other receiving stations. It is one of the first receivers of its kind and one of the first employing reaction to receive the Postmaster-General's approval for broadcasting.

The second advance which this firm claims is the production of a crystal detector "which is always sensitive and never need adjusting." This means that the use of crystal receivers fitted with this detector becomes exceedingly simple as it is necessary to turn only one handle to hear the broadcast concerts.

Another interesting device was to be seen on the stand of Messrs. Burndept, Ltd., whose exhibits included "radio gramophones." For [illegible] scientists have been experimenting with piezo-electricity for a considerable time, but it has fallen to the lot of two Cambridge undergraduates—the Hon. E. W. Hanson and Mr. A. F. B. Cotton—to win the distinction of "harnessing this force to the needs of commerce."

The Cotton-Hanson system of piezo-electricity has been applied to sound transmission with amazing results. Among the new inventions resulting from this application are the silent gramophone and the distance transmitter. The silent gramophone consists essentially of a piezo-electric sound box and a pair of high-resistance telephone receivers, and any suitable means of revolving the record. Sound is audible only in the receivers, of which any number may be operated by the sound box simultaneously, without batteries or amplification. Otherwise the instrument plays practically silently in the room. Hence its name. The silent gramophone is of value in places where music is required only by one or two individuals and where an ordinary gramophone would cause an annoyance to others, *e.g.*, in hospitals, nursing homes, institutions, universities, and so forth.

With regard to the distance transmitter, by means of this novel invention the music of an orchestra may be transmitted from one part of a hall to another, or from the orchestra well of a theatre or kinema to the tea-rooms or lounge. Hitherto, experiments in this direction have been unsuccessful, but the piezo-electric apparatus has overcome all the distortion, resonance, and "metallic effect" associated with the microphone. Obviously, the uses for such an instrument are unlimited. In addition to signalling a new era in the entertainment world, it will be of value in restaurants, ocean liners, and elsewhere.

The Igranic Co., Ltd., had an interesting exhibit, including "duo lateral" or honeycomb inductance coils, for which the company has the sole manufacturing rights under the De Forest patent. The advantages of this type of inductance coil are that the formation of the winding allows the maximum spacing between the various turns of wire, thereby enormously reducing the self-capacity of the coil in comparison with that of concentrically-wound coils, and making sharper tuning possible with consequent increase in volume of reception. Slab inductance coils, wound by the self-forming cross-wind method were also exhibited, and duo lateral coils were being actually wound by machinery on the stand, and the speed and accuracy with which the coils are produced is very noticeable. There was also a machine winding transformer coils. The method of interlaying paper between the layers of wire automatically, to secure high insulation, is very ingenious. The cotton

interweave method produces an exceptionally durable coil, as the absorbent character of cotton makes very thorough impregnation possible, and a better space factor is obtained than with other methods of winding.

In addition to the coil exhibits, various types of coil holders or tuners were shown. The "micro-adjusta" coil holder is designed for exceptionally fine tuning, where adjustment of coupled coils needs to be carried out very accurately, as in telephony.

The "Triplug" coil holder is suitable for table use, or for panel mounting, and a new departure is shown in the patented method of mounting both honeycomb and slab inductance coils. This is described as the "gimbal" mounting. The coil is provided with pivots at right angles to its axis, so that when tuning, in addition to the radial movement, the coil can be rotated about its own pivot, thus affording what might be described as a vernier adjustment. A further advantage of this method of mounting is that two coils connected in series can be used as a variometer.

A specially designed coil-holder for use with this type of mounting was shown, one advantage being that the terminals are placed widely apart so as to reduce leakage losses to a minimum. Adapters enable this type of mounting to be used with the usual plug type coil holder. A new design of honeycomb-wound variometer was shown, as well as one or two types of intervalve transformers.

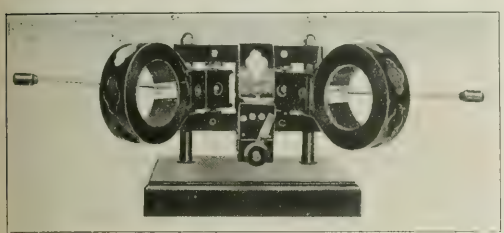


Fig. 5.—Tapped Igranic Inductance with Selector Switch in Coil Holder.

Amongst the exhibits of the British Thomson-Houston Co., Ltd., were wireless time flashing devices than can be used with any satisfactory form of receiver. The models illustrated in fig. 6 are a representation of the Eiffel Tower, suitable for show windows, and a box equipment for external display. The apparatus consists essentially of a multiple flashing device, arranged so that one only of the three figured panels on the glass screen is brilliantly illuminated

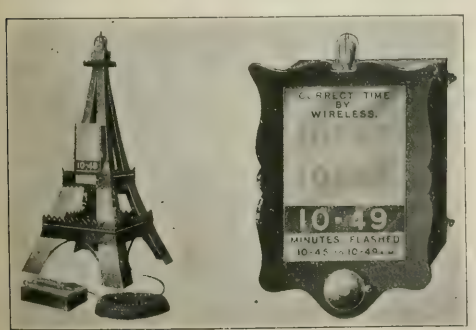


Fig. 6.—B.T.H. Wireless Time Flashers.

precisely at the right instant. Each panel is illuminated in turn, and is operated electrically by means of a tapper switch (or push button). Screens can be supplied for any of the various wireless time checks, of which there are at present four, *viz.*: 9.27 to 9.30 a.m., 10.45 to 10.49 a.m., 11.57 to 12 noon and 10.45 to 10.49 p.m., all at Greenwich mean time. In addition to the illuminated screen, a lamp is provided at the top of the frame which flashes simultaneously with each change of the screen shutter. To facilitate operation a special diagram is supplied with each equipment which gives the actual Morse symbols used for the official time check, together with a translation in plain figures. All the operator has to do, therefore, is to press the key at the end of each minute at the exact instant indicated by the wireless signals, which gives to the public correct Greenwich mean time, which is guaranteed by the Observatories correct to one-hundredth of a second.

The [illegible] portable [illegible] receiver [illegible] simple owing to the [illegible] range of reception [illegible] tion to [illegible] aerial [illegible] earth [illegible] tion [illegible] and [illegible] the necessary apparatus, including even dry batteries and accumulator. The receiver consists of a coil enclosed in the [illegible] ing valve lit by a special four-volt non-spillable accumulator. [illegible] dry batteries fitted in the lower portion of the case. A condenser is fitted in the centre of the receiver for tuning to the various [illegible] by means of a pointer moving over a graduated scale. The condenser consists of a set of fixed and moving plates and the rotation of the latter by means of the knob gives the required variation of capacity. There is also a hinged retro-action coil for controlling the self-oscillation of the receiver, and two switches for increasing the range of wave length by varying the inductance and capacity respectively. The valves are interchangeable and of the three electrode type. The operation of the receiver is extremely simple and the set can be readily connected to aerial and earth wires when required. The equipment will operate satisfactorily on any wave length from 1,500 to 15,000 metres. The receiver, however, can readily be modified for an extended range of from 300 to 20,000 metres if desired.

Messrs. Siemens Bros. & Co., Ltd. The Siemens broadcasting wireless receiver, type C.V., outfit is contained in a compact box of polished mahogany [illegible] 7 in. high and containing all the apparatus except the filament battery and telephone headgear. The right-hand side of the box, fig. 7, is made to slide in order to permit the valve or the high-pressure battery to be replaced and the tuning coil to be changed if it is desired to receive Paris time signals. Protection for the valve is secured by means of rubber feet fitted to the box. Special precautions have been taken in designing this receiver to eliminate extraneous noises, such as the hum of electric light circuits, &c., which are often a source of considerable disturbance.

The tuning coil provides for the reception of wave lengths of from 350 to 450 metres. Other coils can be supplied for use with aerials that differ considerably from the usual type. A special coil is also made by means of which the receiver can be tuned to receive the Paris time signal. The telephones are of the low resistance type and work in continue-

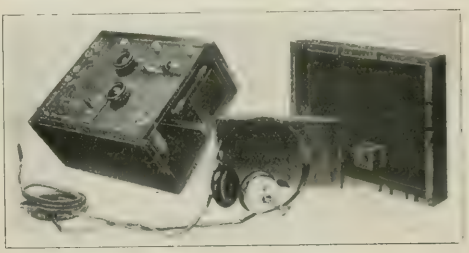


Fig. 7.—Siemens Type C.V. Receiver.

tion with a telephone transformer by using which body capacity effects are avoided. A further advantage is that when more than one telephone head set is used, the additional sets reduce the signal strength less than would high-resistance telephones. Provision is made for plugging in a second pair of head telephones. If more telephones are required, a special adaptor can be supplied. Terminals are provided so that a further note magnifier and loud-speaking telephone can be added. A high-resistance telephone can also be inserted by means of these terminals, should the user have a preference for this type.

The following combinations are possible and are brought about by a simple change-over switch: (1) Crystal reception only. (2) Single-valve reception only. (3) Crystal reception with note-magnifying valve.

The advantages of these different combinations are as follows:

(*a*) In the event of the filament batteries being run down or unavailable, it is still possible to obtain signals by using the crystal only. The crystal only will also give perfectly satisfactory results when receiving strong signals or when listening in at short ranges. When the crystal only is used, considerable economy is effected, as the life of the valve is increased and the filament accumulator requires less frequent recharging.

(*b*) In case the crystal should fail, reception is still possible by using the valve only. Signals received on the valve are somewhat stronger than those received on the crystal. Moreover, by first listening in to the signal strength on the valve only, and then changing to crystal only, it is possible to adjust the crystal to its most sensitive position so that in combination 3 the highest signal strength is obtained.

In the case of reception the valve is used as a rectifier, the crystal rectification has taken place the strength of signals is greatly increased and telephones can be heard which is inaudible in combinations 1 and 2.

No expert knowledge is required to use this apparatus. The box of the valve is so constructed that it cannot be closed unless the handle of the change-over switch is in the position for crystal reception, in which position the filament battery is disconnected; the battery, therefore, cannot be left on accidentally. The range of reception in wireless telephony from a normal 1½kW broadcasting station is about 40 miles under ordinary conditions when using a standard Post Office antenna.

Marconi's Wireless Telegraph Co., Ltd., exhibited historical apparatus, a direction finder as installed at Croydon and other aerodromes, an aircraft set, various crystal and valve receivers "Marconiphone" equipment, and accessories.

The Marconi Scientific Instrument Co., Ltd., showed a 5-15-watts 30-mile transmitter and another of 10-50 watts and from 50 to 60 miles range, in addition to receivers built up on the "unit" system that is to say, to the initial simple receiver can be added various component parts as may be required from time to time, thus making it more complete and as complicated as may be desired. Telegraph apparatus and accessories were also to be seen on this stand.

The M. O. Valve Co., Ltd., had a comprehensive series of transmitting, receiving, rectifying, and amplifying valves ranging up to the 600-watt type, and including three types of low-temperature emitter valve working at filament voltages of 1·8 or 3·6. A standard telegraph and telephone equipment of the Marconi 3-kW type, 2,000 to 3,000 metres wave length, for ship or land stations, was shown as well as G.E.C. crystal and valve sets and aerial fittings.

As its name implies the outfit illustrated in fig. 8 is made by the General Electric Co., Ltd.; it has special tuning facilities by which it is claimed to be possible to practically eliminate interference by other transmitting stations. The range of both the crystal sets, however, is practically limited to 25 miles under the present proposals for transmission, and they obviously have their limitations. It is, for example, impossible to operate a so-called "loud-speaker" with a crystal detecting set without the addition of some amplifying device.

This set has two coupled circuits with adjustable coupling. The detector is a specially sensitive crystal and does not require a potentiometer; it is fitted with a testing buzzer and key so that the crystal may be adjusted to its most sensitive position, provided with one pair of 2,000-ohm double headed telephones and fitted with sockets to take one extra pair of telephones if required. The whole is enclosed in a well-made polished mahogany case, and supplied complete with two 10-ft. lengths of flexible wire for connecting up to aerial and earth, one coil of 100-ft. 7/22 enamelled copper aerial wire, two insulators, one pulley block, one aerial fixing eye, one leading-in terminal, and one earthing clip.



Fig. 8.—"Geophone" No. 2 Crystal Set.

(To be continued.)

LOCAL ELECTRICAL EXHIBITIONS.

Autumn is the season of exhibitions, and this year is no exception to the rule. There has recently been quite a crop of them—both of electrical interest and otherwise—and others are being organised to take place in the near future. As a rule exhibitions are held in large cities, but if the use of electricity is to be encouraged generally its advantages must be brought to the notice of the residents of the smaller towns in no less degree than they are emphasised in the cities.

In this connection it is satisfactory to record that a type of show that is becoming increasingly popular is that referred to as local exhibitions, which are organised with a view to bringing before the public in the provincial towns in which they are held the benefits to be derived from the use of electricity and electrical methods in the home. That they succeed in doing so seems to be indicated by the fact that such shows are increasing in number and frequency.

Housing Exhibition, Glasgow.

A three-weeks' exhibition is being held in the Kelvin Hall, Glasgow, and all space is taken up by exhibits connected with the housing trades. It is under the direction of the Glasgow Corporation, and was opened by Lady Weir, of Eastwood. The exhibition has attracted crowds of visitors.

One of the leading stands is that of the Electricity Department of Glasgow Corporation. Special attention is drawn to the kitchen cabinet and a domestic-type electric cooker—a favourite in Glasgow homes. The electrically-operated "kitchen-aid" does everything in mixing, mashing, and beating. Laundry appliances include the latest types and patterns, and vacuum cleaners and electric fires are also on view.

Messrs. Edwin Hill & Smith, Glasgow, stage electric lamps of every description, carbon, drawn wire, and spiral filament, all voltages up to 300 candle power.

The Thermal Syndicate, Ltd., Manchester, have a display of "Vitreosil" goods, which is easy to clean and suitable for cooking. It also includes electric irons, electric coil boilers, vacuum cleaners, &c.

Messrs. Duncan Stewart & Co., Ltd., have a very fine display of lighting, both in the form of beautiful reproductions of famous historical period pieces and of the most modern design. The showrooms are filled with a wide selection, and include pendants, brackets, and bathrooms, and all types of portable lamps.

Messrs. L. C. Hennings & Co., Ltd.—A range is on view of the Imperial electric cooking and heating appliances, including toasters, grills, heaters, irons, radiators, and laundry appliances. Attention is directed to the "Miller" electric fittings and table standard in the latest artistic designs, combining metal and glass.

Mr. D. Landale Frew, Glasgow, displays "Edmoid" electrical fittings made up in any combination of colours to suit any scheme of decoration.

The Thermal Syndicate, Ltd., Wallsend-on-Tyne, shows a complete range of "Vitreosil" heat proof anti-glare globes in a variety of colours and designs.

Messrs. James Meighan & Son, Glasgow, stage electrical appliances and fittings, with exclusive designs in lamp shades.

Mr. H. J. Lagden, Edinburgh, has an exhibit of "Thor" electrical washing machines.

Messrs. Kemp, Williams & Colquhoun, Ltd., Glasgow, stage bowls in glass, mother-of-pearl, shell, and crystal, and electrical fittings of all kinds. They are makers of advertising signs.

The Electric Appliance Co., Ltd., Glasgow and London, exhibits the Imperial Eureka electric vacuum cleaner.

Rogers Electric Sales Co. (Great Britain), London, has a display of electro-medical appliances. It also shows fittings, including a pedestal table radiator, a sewing machine motor and starter, and household utensils.

Messrs. Astro Electric, Ltd., London, exhibit intensifiers (types suitable for lamps of any size, and also have an interesting insight into "Astro Advertisers" for shop windows.

Messrs. Electrolux, Ltd., London, give a demonstration of the "Electrolux" electrical floor polisher for polishing "lino" and parquet floors.

The Electric Suction Cleaner Co., Croydon, Surrey, shows the Croydon electric vacuum cleaner, also a number of small portable electric drilling machines.

The Hotpoint Electric Appliance Co., Ltd., London.—This is a fine display of appliances for domestic and industrial use, including coffee-pots, toasters, and vibrators, also electric heat for domestic, laundry, and tailors' use. Distinction is seen in fires and radiators.

The Venetian Glass Improta Co., Glasgow, has on view a choice of fittings and stand lamps.

The Falkirk Iron Co., Falkirk, has supplied all interior fittings to the bungalow erected by the National Building Guild, Ltd., electric lights and heaters, also electric fires.

Electrical Exhibition at Brighton.

An electrical exhibition, organised by the local firms of the Electrical Contractors' Association, in conjunction with the Electricity Department of the Corporation, was opened by the Mayor (Mr. E. J. Pankhurst) at the Corn Exchange, Brighton, on October 5th. The exhibition, which has been promoted with the object mainly of demonstrating the innumerable uses to which electricity can be put, both in the home and in connection with business, coincides with the completion of the 30th year of the electricity undertaking, under Corporation control, and in asking his worship to perform the opening ceremony Councillor C. J. Galliers (Chairman of the Lighting Committee of the Town Council) gave some interesting figures illustrating the extent to which the business has grown during this period. As against 213 consumers at the end of the first year, he said, there were now nearly 10,000, and while the output of electrical energy had increased from 150,000 kWh to nearly 12,000,000, the average price had fallen from 7d. to 3.95d. per kWh. The revenue, which was £1,690 for the year 1891-92, was last year £206,245. The total capital expenditure to-day stood at £923,424, but of this sum no less than £577,010 had already been written down, leaving the outstanding debt at the comparatively small figure of less than £350,000. During the whole thirty years also the undertaking had never at any time been a charge on the rates; on the contrary, it had relieved them to the extent of £36,000 out of the surplus funds, and in addition to this, a reserve fund of £13,000 had been built up.

The Mayor, who was accompanied by the Mayoress and a large number of members of the Town Council and borough officials, declared the exhibition open in a happily-phrased speech, in which he commented on the coincidence that Councillor Galliers should have been chairman of the Lighting Committee, both when electricity was in its infancy and again now when it was in its golden age.

The exhibition itself has been admirably arranged under the direction of the electrical engineer (Mr. John Christie) and his able lieutenant (Mr. Cleary), and while the latest appliances for lighting, cooking, heating, laundry work, and other domestic uses have probably constituted its strongest appeal, visitors have found much to interest them in the application of electrical science to surgery and medicine. There are also exhibitions of glass blowing and wire drawing for the purpose of showing how the filaments of electric lamps are made, and in addition visitors have been able to enjoy the, to many of them, novel experience of listening to

[illegible] graph Works Co., Ltd., the Hot-Point Electric Appliance Co., Ltd., the [illegible] Wireless Telegraph Co., Ltd., Messrs. Marryat & Scott, Ltd., the [illegible]

Concerning [illegible] tus through the electrical contractors on favourable terms to the user will be put into effect, and now that the rate for power has been reduced [illegible] meter rental, [illegible] ratus can be [illegible]

The Corporation also assists and advises any consumer or prospective user of electricity as to the best methods for the lay-out of his installation, free of charge, but all actual work must be carried out through a contractor [illegible] the consumer himself.

The Corporation, in conjunction with the local electrical contractors and manufacturers, has endeavoured to make this exhibition one of the most representative displays of its kind held in the provinces.

Southport Industrial Exhibition.

At the Industrial Exhibition now being held in Southport a display of electrical appliances has been arranged by the West Lancashire Electrical Co., Ltd., with delightful effectiveness, accentuated by prettily-shaded lamps. The lamp shades exhibited on the company's stall are artistic, delicately coloured, and neatly finished, but their elegance does not detract from their serviceability. There are also displayed electrically-heated irons, a great boon to the housewife; electric heating installations which may be adapted to any dwelling house with perfect safety; vacuum sweepers worked by electricity; kettles which may be heated by electricity; stoves, telephone sets, bells, and many other articles which electricity aids in the working.

Brief notes of other exhibitions, which reached us too late for insertion on this page, will be found elsewhere in this issue.

THE LONDON MEDICAL EXHIBITION.

The 12th show organised by the official managers of the exhibition of the International Congress of Medicine, 1913, and the exhibition of the Fifth Clinical Congress of Surgeons, London, 1914, was held at the Central Hall, Westminster, from October 2nd to 6th.

Doctors from all parts of the country visited the exhibition to acquaint themselves with the latest products of the chemical laboratory and the newest surgical appliances. It was not an exhibition for the general public, and the few visitors from outside the medical profession came away with the feeling that it was just as well that prospective patients did not see the array of glittering instruments which adorned some of the stands.

From an electrical point of view there was not so much to see at this year's show as there has been on previous occasions, the number of electrical exhibits being few, and only two stands were devoted to X-ray apparatus. The use of wireless telephony for the relief of deafness was demonstrated to aural surgeons. In people hard of hearing one ear is usually worse than the other, and the whole of the work falling on the better ear strains it and causes further deterioration. This is particularly the case in progressively increasing deafness. In the work of "re-educating" the ear in which the deafness is more pronounced, aurists have depended hitherto on an instrument making simple noises, but wireless telephony has now been enlisted in the service of the specialist. The head-piece of an ordinary receiving set is connected to the dull ear, and in this way it is stimulated by the human voice without any strain being imposed on the other ear. The apparatus is exhibited by Mr. W. H. Potter, who had many excellent aids for the deaf on view, some of which make use of thermionic valves for amplification purposes.

Neat portable apparatus for assisting the deaf was shown by other firms. There were sets which can be carried in vanity cases, slipped into the waistcoat pocket, or hidden from sight under the tie.

The special feature of The Deaf Appliance Co.'s exhibit was the "Earlux Phonophor," as it is fitted with a very small receiver and constructed to fit easily and comfortably in the ear without being held either by hand or head-band. This instrument is said to be specially recommended by doctors for nerve deafness or slight middle ear deafness. Another interesting instrument was the "Earlux," made in six types, four of which are portable, and two for table use. These, on account of their strength and small size, are particularly adaptable for home, office, theatre, &c. "The Megaphraste and Orthorphone" are fitted with concentrators and a six-tone sound regulator, and they possess a very powerful range of sound and a most natural reproduction of speech.

Another stand on which electrical and non-electrical aids for deafness were shown was that of the General Acoustic Co. (C. & B., Ltd.), the British patentee of the "Acousticon" telephone aid that is claimed to be free of all tinny sounds frequently associated with metal telephone sets, only vul-

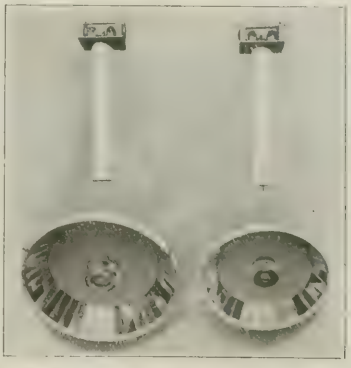


Fig. 1.—Sematic Electric Lights.

canite being used. Over 30 different types of this [illegible] are made to suit varying forms and degrees of deafness.

In medical work special lamps and lighting effects are frequently required, and a number of devices [illegible] that purpose were on views. Mayer & P[illegible] exhibited Rollier, Bernard and Turrettini [illegible]

sizes, from the full size operating theatre model to the consulting room type. The "Scialytic" light throws a very strong and [illegible] beam on the subject, and presents the advantage of low energy consumption owing to the small size of lamp used. The penetrative value of the beam is considerable, and heat is practically eliminated, while the simplicity of the fitting should make it attractive to the surgeon who has not a skilled electrician at his disposal. The fitting is so designed that it can easily be kept clean, an important consideration from the medical point of view, and is adapted for a 100-watt electric lamp, with which a shadowless light of 3,000 c.p. in the case of the big model, and 1,750 c.p. in the case of the small model, is thrown in an 18-in. ring on to the table. Heat and glare are both eliminated, as are all head-shadows.

The fitting is illustrated in fig. 1, and, as will be seen, consists of a dioptric lens fitted at the centre of a metal saucer (large model, 35-in. diameter; small model, 27-in. diameter), round the rim of which are a number of silvered reflectors. The result is an inverted cone of light concentrated on the table. The lamp-holder is at the top of the fitting, has a quick-release catch for changing the lamp, and is adjustable in height, so that any standard type of lamp can be used. The bottom of the fitting is closed by a screen made of special toughened glass, so fitted as to be very easily taken down when the whole apparatus is exposed for cleaning. The Scialytic light can either be supplied as a fixed light, when it is simply hung from a hook in the ceiling by means of three chains or wires provided for the purpose, or it can be supplied with compensated gear housed in a dust-tight tube, as shown in the illustration, when the light may be tipped up to any angle required, so as to give light from the side or end of the operating table.

Amongst the exhibits on the stand of Messrs. Chas. Hearson & Co., Ltd., were noticed an electric anhydric incubator, an all-metal wide-range thermostatic chemical and drying oven heated by electricity, an electric [illegible] incubator,

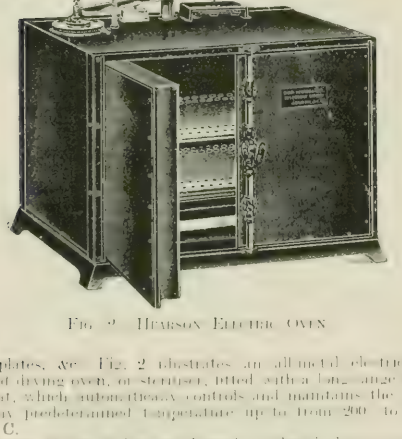


Fig. 2.—Hearson Electric Oven.

test plates, &c. Fig. 2 illustrates an all-metal electrically-heated drying oven, or sterniser, fitted with a long-range thermostat, which automatically controls and maintains the oven at any predetermined temperature up to from 200° to 300 deg. C.

Messrs. Mayer & Phelps showed an electric beam spatula and instrument for excision of gasserian ganglion, a natural light shadowless lamp for the operation theatre; Storey's compact balanced electric cautery for ophthalmic work; Isen. Moore's combined electroscope and endoscope tubes with interchangeable proximal and distal lighting for laryngological purposes, and a natural light lamp for the examination of the skin.

On the stand of Messrs. Allen & Hanbury's, Ltd., the Greville operating and examination lamp was shown. It throws a clear patch of light without shadow, and can be used on any mains supply with a resistance. Electrically-illuminated ophthalmoscopes and a Newton & Wright X-ray examination couch were also on view.

The exhibit of Hommel, Ltd., consisted of Lovibond's colour [illegible] tintometer" apparatus for measuring and registering the colours of all substances; Dr. Dudley Corbett's radiometer for use with Sabourand's and other pastilles; and a new form of Oliver Haemoglobinometer with a fixed standard [illegible].

Messrs. [illegible] exhibits included De Zeng electric dynamometer [illegible].

The Silvertown [illegible] Co., Ltd., showed several portable high-frequency violet-ray generators with various applicators [illegible] mouth and throat lamp, and an electric table stove.

Messrs. Down Bros. [illegible] other things, exhibited a laryngoscope [illegible] driven by an electric motor.

On Messrs. Ogilvy & [illegible] and electric microscope illuminating lamps could be examined, including a special model for research workers and an ordinary one for laboratory use. All the lamps are fitted with "Opalite" bulbs, which are made of a grainless opal glass. The lamps are made at the firm's London workshops.

Messrs. De Trey & Co., Ltd.—This firm's display included a Ritter X-ray outfit and Sheringham daylight lamps of the table pattern.

Messrs. T. Clark & Son's exhibit consisted of a static machine fitted with a wave device, high-frequency apparatus, an ozone generator, radiant and thermal heat baths, a 1,500-c.p. therapeutic lamp, a foot switch for X-ray and dental apparatus, dental violet ray apparatus with electrodes for treating pyorrhea, electric heating pads, radiators, and Sheringham daylight lamps. Mr. Clark demonstrated Dr. D. H. Yates' method of static treatment for chronic deafness, methods of producing the Morton wave current, local treatment, using two electrodes for treating rheumatism, muscle testing, and regulating the heat beats electrically.

Messrs. F. Davidson & Co. showed outfits for the examination of the eye, ear, nose, and throat; batteries (their "Davon" dry battery is used for trans-illumination and light cautery); resistances; the Davidson electroscope for the stimulation of muscles and nerves; a portable cautery set for use with a motor car accumulator; and surgical lamps, &c.

Messrs. Kodak, Ltd., were showing examples of X-ray negatives on Eastman "Dupli-Tized" films, together with prints made from them on Kodak "Nikko" bromide paper, which demonstrated the rapidity of the film, its fine gradation, and the detail which it records. Apparatus for handling the film was also shown, also accessories, &c.

Messrs. X-Rays, Ltd., now represents a combination of five manufacturing firms, *i.e.*, X-Rays, Ltd., X-Ray Tubes, Ltd., High Tension Co., F. R. Butt & Co., Ltd., and Siemens Bros. & Co., Ltd. (X-ray and electro-medical supplies), and exhibits from all these sources were to be seen on the large stand.

The X-ray treatment of deep-seated tissues has come much to the fore recently, largely due to the researches carried on at the Women's Clinic at Erlangen, and it is hoped that further experiment along the lines indicated by Dr. Wintz, of that institution, will lead to the cure of many deep-seated malignant growths.

As in the case of X-rays as used for diagnosis, there are two main types of apparatus available, namely, the coil and the transformer, each having its respective advantages. Much depends on the tube, of which there are again two distinct varieties, the hot cathode (as, for instance, the Coolidge or Lilienfeld tube) and the gas tube. The latter has yielded very satisfactory results when operated with suitable induction coil outfits. With a gas tube coil set giving a suitable wave form of secondary current with a voltage corresponding to a parallel gap of 13-16 in. rays of practical homogeniety can be obtained by filtration through .5 m/m of pure zinc. The problem is, therefore, to design the coil to give and maintain for lengthy periods this current, and, at the same time, to arrange that during the period the tube shall remain constant.

For this purpose the "self-hardening boiling-water-cooled tube" is used, and automatic softening devices have been designed for one with a gas-heated osmosis regulator. As regards the coil itself, the duplex principle of construction, as first introduced in this country by M. A. Codd, is essential, as only by this means can the correct wave form and absence of harmful oscillations be obtained. The mercury interrupter does not differ radically from those used for radiography. A special tube stand is necessary to withstand the high voltages (300,000), and Dr. Wintz has shown that the optimum secondary current for these tubes is 2.2 milliamperes. The automatic regulator consists essentially of a moving coil milliammeter and mechanical relay, actuated by the movement so that whenever the current drops below an agreed figure (usual the 2.2 mA) due to the self-hardening feature of the tube, the relay will electrically turn on the gas supply to the tube, the gas being ignited by a small spark constantly passing between the anticathode and anode. The flame plays on the palladium wire of the osmosis regulator and thereby softens the tube, the resulting increase of the milliamperage to the 2.2 figure automatically turning off the gas. The tube therefore constantly hovers around any agreed current intensity with strikingly uniform results. Experiment with these tubes running at the intensities already mentioned have shown that 18.24 per cent. of the dose received by the skin is received at a point 10 c/ms. below the skin, thus making it possible to give the lethal carcinoma dose 100/110 per cent. in six applications through different parts of entry without damaging the intervening tissues.

The estimation of these doses is carried out by the "Ionto Quantimeter," an instrument working on the principle that the rate of leak of an electrical charge due to ionisation of the surrounding atmosphere is a direct measure of the intensity of the X-rays passing through that atmosphere. It consists of a special electroscope and ionisation chamber, the latter being conveniently subjected to the X-rays with and without the interposition of water chambers or wax of 10 c/ms. thickness, this being considered the equivalent as regards absorption to the human tissue. It is thus possible

to obtain a comparison of the intensity of X-rays falling on the skin and that arriving at the growth, assumed to be 10 c/ms. down.

The alternative (the use of a transformer, 200,000 V, working in conjunction with the new high-voltage Coolidge tube) is perhaps the more simple, but it is claimed by some that as regards the efficiency of the radiation estimated in terms of the percentage depth dose in comparison to the skin dose, the coil and the boiling water gas tube is the superior system.

Amongst the many exhibits of the Cox-Cavendish Electrical Co., Ltd. (the incorporation of which was the outcome of the amalgamation three years ago of H. W. Cox and Co. and the Cavendish Electrical Co., Ltd.) particular attention was directed to the "Standard" X-ray group for large hospitals, with which instantaneous radiography may be undertaken, using the "Imprex" plate, exposures being possible with a gas tube of only a fraction of a second. The advent of this product of patient research by Dr. Leonard Levy, F.I.C., the firm's chief chemist, was announced a few months ago. It enables to exposure, so it is claimed, to be reduced to 1/20 of the normal, being thus twice as fast as a plate or film used with a separate intensifying screen. The radigrams on view indicated that this great speed is obtainable without loss of detail. The firm's dental and bedside outfits are of the transformer type, and operate with a radiator-pattern Coolidge tube. Advantage is taken of the fact that this in itself is a perfect rectifier so long as the potential applied to it is less than that required to spark across a 5½-in. gap. The transformer is so designed that the potential shall not exceed this value in any case, and thus the need for any mechanical rectifier is eliminated, the tube being connected directly across the secondary of the transformer. The heating current for the Coolidge filament is obtained from a separate transformer, and is connected to the tube in the ordinary way, having a switch for controlling the circuit. A further specially-designed switch controls the primary current of the transformer. The operation of these sets is thus reduced to the minimum of simplicity. To start the tube working the filament switch, and then the operating switch, are closed; the cathode filament first lights up, and then the emission of X radiation begins. The tube cannot be connected up the wrong way, and there are no adjustments to make.

A complete tube-holder forms an integral part of the apparatus, making it self-contained. The shield is made of lead-glass a full quarter of an inch in thickness, and gives a protection equivalent to about 1/16 in. of metallic lead. It is made in two hemispherical parts, fitting closely round the bulb, and provided with tubular extensions, through which the catode and anode ends project. It is held at the end of a horizontal arm of special design, giving universal movement, and may be locked in any position. A stereoscopic shift is also provided. The vertical member carrying this arm moves up and down on a tube of large diameter, in which slides a lead weight forming a counterpoise to the whole moving part, and thus allows of absolutely easy adjustment for height; the tube can be brought into any desired position and made to point in any direction. An auto-transformer is fitted to enable the transformer to maintain a constant voltage at variable loads, thus enabling the milliamperage to be increased without loss of penetration. This unit is designed to give 10 milliamperes through the tube, but a regulator is provided for controlling the Coolidge filament current, and thereby the current through the tube. The bedside unit comprises a larger transformer giving up to 30 milliamperes, auto-transformer, and a regulator whereby the output can be varied between this maximum and zero.

THE MEG INSULATION TESTER.

A New Instrument.

It was in 1889 that Mr. Evershed, the pioneer of modern methods of insulation testing, introduced his insulation testing set, in which, for the first time, an ohmmeter was used in conjunction with a hand generator to test insulation under pressure. The combined ohmmeter and generator also originated with Mr. Evershed, who, in 1903, produced the "one-box" instrument known as the "Megger," which still remains indispensable for important work.

With the ever-widening use of electricity there has, however, arisen a need for an instrument which, while not perhaps representing all the advantages combined in a Megger set, performs all insulation tests efficiently at a reasonably high pressure, and is cheap enough to allow a contractor to largely multiply his testing facilities at a reasonable cost. The instrument must combine with these advantages a reduction of weight, which facilitates its being carried to the most distant and inaccessible job. A new product of the makers of the Megger sets, Messrs. Evershed & Vignoles, Ltd., the manufacture of which we had the pleasure of witnessing last week, is that known as the "Meg Insulation Tester," and combines these features. The name, a kind of diminutive of "Megger," has been given to it to suggest its relationship to the Megger set. The [illegible] appeal to [illegible] it is portable, being contained in a [illegible] case, [illegible] [illegible] [illegible] is impervious to weather. It is light, weighing less than 7 lb. and [illegible] the dimensions being [illegible] x 6¼ in. It is efficient, capable of carrying out all the customary insulation tests, and is cheap, in consequence of the [illegible] has been omitted and essentials only retained.

The new instrument, of which fig. 1 is a general illustration, is contained in a case of cast aluminium, one end of



Fig. 1.—The Meg Insulation Tester.

which is formed of an oil-tight gear box. In this box steel gear of concentric type is entirely enclosed, so that it is kept clean and thoroughly lubricated. The driving handle is always ready for use, and is of such a shape that it is naturally protected by the box and no ordinary blow can damage it. At the same time it does not project in a manner to interfere with the snug packing of the instrument. An ingenious, but simple and light, free-wheel device protects the gear from damage, and prevents the armature from being turned the wrong way. At the further end from the handle an element of the case contains the ohmmeter and

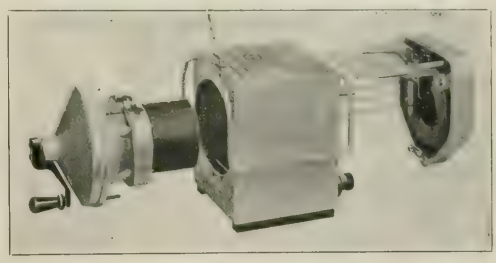


Fig. 2.—Expanded View of the Instrument.

protects the line and earth terminals, which are housed conveniently beneath it. At the top a glass window with hinged cover gives a view of the dial, which is [illegible] marked with the scale of readings. The carrying handles are of ingenious construction: they hang at the side of the [illegible] entirely out of the way when the Meg is in use, and meet together in a flat spring catch, which lies comfortably in the hand when the instrument is carried. In fig. 2 we illustrate the instrument with the handles folded back.

The substantial construction of this well-made set [illegible] tered design No. 690,326) has been rendered possible [illegible]

[illegible] system of [illegible] and by the introduction of [illegible] patented features in both generator and ohmmeter. The reduction in weight has not been obtained at the expense of working forces, for these are large in proportion to the mass and inertia of the movement, giving great promptness and precision in the indications. [illegible] are employed for the movement, and give security against damage by careless usage.

[illegible] to secure the lowest possible selling price, it becomes important to manufacture on the largest possible scale. For this reason, for the present, the Meg insulation tester is to be made in one form only, providing a voltage pressure generator developing 500 volts at [illegible] and having an ohmmeter reading from 0 to 100 megohms. Each scale is separately calibrated and is clearly marked in black on a white background. The instrument is sold with a light carrying case of stiffened canvas, [illegible] a strap by which it may be carried in the hand or slung from the shoulder. This case provides space for leads, [illegible] and an occasional packet of sandwiches.

In addition to the features already mentioned, attention may be drawn to other novel points, namely with respect

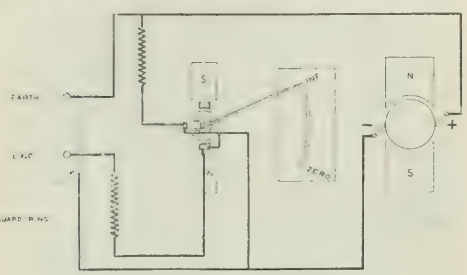


Fig. 3.—Diagram of Connections.

to the generator the reduction of the magnetic reluctance of the air gap and the resistance of the windings by flanging the outside laminations; a concentric construction which greatly facilitates the correct assembly of parts.

With regard to the ohmmeter, a design of magnet which eliminates pole-pieces, a movement frame constructed from one stamping; the provision of fixed instead of moving ligament drums, thus saving weight in the movement, shortening the axle, and thereby increasing the stiffness; and in connection with the case, an external case entirely in cast aluminium; the utilisation of the opposite ends of the case to form [illegible] for the ohmmeter and generator.

Once more Messrs. Evershed & Vignoles have broken new ground and put new facilities at the disposal of producers and users of electricity. The novel and striking qualities of the new tester will doubtless lead to its immediate employment on a large scale. Two objections only have ever been urged against the Megger set—the standard instrument—first, that its weight was irksome when it had to be carried long distances; and, secondly, that its price made its acquisition difficult for the man with a small business. To those with whom these objections have had force, the Meg insulation tester will appeal.

An expanded view of the set is shown in fig. 2, while fig. 3 is a diagram of the connections. The instrument is beautifully made throughout, and bears a 12 months' guarantee.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Do Motors "Go Bad"?

With reference to the above question, your correspondent does not say under what circumstances and, therefore, the question is rather vague. It is quite possible for the windings of new motors to deteriorate if stored in a damp and badly ventilated showroom, but if stored under suitable conditions there is no reason why deterioration should ever take place. There is certainly no comparison between a motor and a dry battery, as the life of the latter depends upon chemical action. The makers' expert referred to may have been quite correct in his statement that a motor had deteriorated in stock, but, of course, it had not been the mere fact of the motor having been kept in stock that caused its breakdown, being more [illegible] to a defective showroom. The writer is not [illegible] to contest, but has tested motors which have been in stock and found that the insulation was [illegible] one would expect on [illegible] machines. This, of course, was due to the moisture in the coil caused by atmospheric conditions and the machines soon regained their former high insulation test on being placed in commission. Apart from motors, anything will "go bad" if subjected to adverse conditions, and if "Auld Reekie's" showroom is as it should be he need have no fear of his motors deteriorating and no salt or hot water bottles will be necessary.

Adsum.

October 7th, 1922.

The Status of the Electrical Contractor.

I am glad that Major Morris has made public, through your columns, the fact that many men who were trained engineers before the war, and served in the same, are now at a disadvantage.

Some might say that this is due to the trade slump, but the following proves one of the evils that exist:—

Presiding at a Barnsley meeting of the Yorkshire branch of the Association of Mining Electrical Engineers, the chairman said that a painter and paperhanger, who obtained work as an electrician's labourer during the war, was now in charge of a colliery electrical plant.

The above is only one case; no doubt there are hundreds.

While ex-service engineers and electricians are walking the streets these individuals (with an abnormal amount of luck) are carrying on, with a wage no doubt inversely proportional to their luck.

Victim.

Rotherham, *October 9th*, 1922.

Calculating Currents in a Mesh-connected Three-phase Circuit.

In your issue of July 21st last there appeared an article by Prof. Still with the above heading. This article contains a construction purporting to show graphically the currents in a mesh-connected load when the three line currents are given. There appears to be a slip in the statement of the proposition, as the method really shows the currents in the mesh of a three-phase alternator supplying a line carrying currents of known values. It appears that there is no perfectly straightforward way of solving the first-named problem, even when the phase angles of the load currents are known relatively to those of the impressed voltages. I have tried to find a solution trigonometrically, but have only been able to obtain an equation of the fourth order, the solution of which can only be found by a tedious trial-and-error method. I have, however, devised a simple means of obtaining the required values in another manner:—

1. Assume a non-inductive load. Draw on a piece of paper three lines meeting each other at 120 deg. Next, draw on a piece of thin tracing paper a triangle with sides representing to scale the three line currents; the load currents are obtained in a moment by placing the tracing paper on the first-named paper in such a manner that the intersecting lines cut the three angles of the triangle, as shown in diagram "A," when the three loads in the mesh can be measured off to the same scale as before between the angles of the triangle and the common point o.

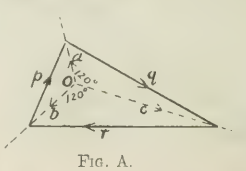


Fig. A.

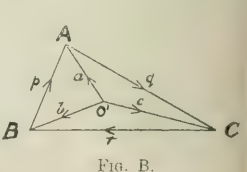


Fig. B.

The mesh current *a* is fed from lines *p* and *q*; *b* from *p* and *r*, *c* from *q* and *r*. Proof is hardly necessary. The difference between any two currents in the mesh must be equal to that in the line common to both. A glance at the diagram shows that **a − b = p**, **b − c = r**, **c − a = q**; and that **p+q+r=0**; **a+b+c** is not equal to 0 unless these three currents are equal.

Knowledge of the currents is perhaps only academic, but should anyone require frequently to find them, this could be effected very simply by keeping at hand a piece of millboard on which the three vectors are already drawn and graduated (the point o being zero), when direct readings could at once be obtained by merely reading through the tracing paper on which any particular line vector triangle has been drawn.

2. Assume an inductive load. The problem is unsolvable unless the phase angles of the load currents are known; this is, of course, unlikely. If, however, they are known, the three intersecting load vectors should be set off to meet at the correct angles and the line current triangle superimposed as before, but with care taken that each angle of the triangle is cut by the correct load vector, i.e., vector *a* should cut the angle made by *p* and *q*, &c., as in fig. A.

Reverting to the problem of finding the loads in the mesh of an alternator, it occurs to me that the accompanying simple diagram, fig. B, is even more concise than that given by Prof. Still; the diagram shows all six vectors on the same scale, their magnitude, phase, and sense being all indicated. The diagram also shows a direct relationship between the values of the mesh and line vectors without involving the use of the

factor 3. No preliminary triangle requires drawing as is the case when the three line vectors—of unknown phase—are represented meeting in a point. *p*, *q*, *r* represent line vectors, and *a*, *b*, *c* mesh load vectors. The point o′ is the centroid of the triangle. To find it, bisect sides AB and AC. Join C and B respectively to the points of bisection. These lines meet at o′. It is at once apparent that $\mathbf{a}-\mathbf{b}=\mathbf{p}$; $\mathbf{b}-\mathbf{c}=\mathbf{r}$; $\mathbf{c}-\mathbf{a}=\mathbf{q}$, and since o′ is the centroid of the triangle $\mathbf{r}-\mathbf{p}=3\mathbf{b}$; $\mathbf{p}-\mathbf{q}=3\mathbf{a}$; $\mathbf{q}-\mathbf{r}=3\mathbf{c}$. The validity of this construction can be easily seen from the proof given by Prof. Still. An oversight appears to have crept into this proof which needs correction; the diagram of connections shows that $\mathbf{I}_2=\mathbf{I}_a-\mathbf{I}_c$ as stated, while it follows from the vector diagram that $\mathbf{I}_2=\mathbf{I}_a-\mathbf{I}_b$.

L. W. Schuster.

Manchester, *October 4th*, 1922.

[Bold type is here used to represent vectors.—Eds. Elec. Rev.]

An Electric Door Lock.

I shall be glad to know if any manufacturer has placed on the market an electric lock for doors. When the switch is closed the door is to be locked; and when the switch is opened the door will be unlocked, so that it can be opened by anyone.

Particulars of such a lock will be welcomed by

October 4th, 1922. **Lock.**

"All British"?

It is interesting to manufacturers of small instruments to attend an exhibition which is entitled "The All-British Wireless Exhibition," and to find that about eight manufacturers—and indeed some of the most important manufacturers of this country—have foreign instruments on their stands and apparatus.

Unfortunately the numbers of small instrument makers in this country are few, otherwise they might combine to demand that the all-British-made apparatus which is going to be used for broadcasting must be fitted with British-made instruments.

The Walsall Electrical Co., Ltd.

Walsall, *October 5th*, 1922. V. Delebecque.

How to Buy.

I regret that Mr. Shandy has not seen fit to continue the discussion on the lines of his original letter, or at least apologise for some of his remarks. My letter was not written in wrath; on the contrary, had he not made certain statements reflecting on both the contractor and the traveller, I should have passed the article with a smile.

As to the free advertisement, I might remind the writer that had he stated his name and address, and also the business with which he is connected, more attention would have been given to his contribution.

One can only presume that from being a factor's inside man where he attempted to carry out orders given to factors' travellers through the medium of liquid refreshment and generous promises he has been appointed a manufacturer's inside man where he still finds his unique methods are not successful and that well-established factors are still progressing steadily.

The contention that manufacturers only have to organise a sales department and orders are transferred to the manufacturers instead of the factor is all very well, but he has left out of consideration that manufacturers who are not now carrying stocks would have to take new premises for stores and lock up a considerable amount of capital in stocks; this is one of the reasons why small manufacturers utilise factors' selling organisations. A works selling organisation must naturally cost more than the factors' as the makers only sell their own products.

There is no need to mention Mr. H. R. Taunton's name, as the question of German imports was not discussed in the original article of "How to Buy" and opens up quite another field which has nothing to do with the present correspondence.

There is also another aspect of the case, that large manufacturing companies having works in the country and sale organisations in the large industrial centres, are really factors for their own works, and no doubt their sale organisation and stocks cost them considerably more than 15 per cent. mentioned by the contributor, and further, as most of the leading factors have interests in manufacturing concerns, and several take the sole output of such manufacturers, it would not affect them if the factors were cut out altogether, they would automatically be manufacturers.

Mr. Shandy is very unfortunate in taking out of "the thousand and one household articles" such items as soap, toilet requisites, tinned food, &c.—I do not think he could have taken worse examples to prove his case.

I will take one article only, "Tinned Food." Has not Mr. Shandy ever heard of Lovell & Christmas, G. Bowles, Nicholls & Co., and J. T. Travers & Sons, Ltd.—has he not even a nodding acquaintance with Eastcheap? They are not termed factors, but generally merchants, importers and exporters, but it comes to one and the same thing in the end.

I notice Mr. Shandy refers to certain "Science of Thought," and I would like to say that a little thought would have prevented his original article appearing.

L. C. Jeary,
Managing Director
The Jeary Electrical Co., Ltd.

London, E.C.4, *October 9th*, 1922.

Electrical Heating in Churches.

A clergyman of my acquaintance is thinking of installing the above method of heating in his church, and would like, if possible, to see one where it has been adopted; can you, or any of your correspondents, inform me where one can be seen?

Clerical.

October 4th, 1922.

[Theatre heating is a similar problem; a successful example was described in our issue of January 9th, 1920.—Eds. Elec. Rev.]

THE ELECTRIFICATION OF THE TURIN-CERES RAILWAY.

In the *Bulletin du Congrès des Chemins de fer*, for August, quoted in a recent issue of the *Génie Civil*, are given some particulars of the electrification of the above line, which carries a large tourist traffic. The electrification, at a pressure of 4,000 volts, was carried out by the Swiss firm of Brown-Boveri, and was practically completed in 1920.

Only one sub-station is used, this being situated at Ciriè, towards the middle of the line. It receives three-phase current at 22,000 volts, 50 cycles, supplied by the Upper Italy Electric Supply Co. The current is first transformed to 500 volts by static transformers, afterwards passing into one or other of the converter sets which supply the direct current. Each set comprises a group of machines mounted on one shaft: A synchronous three-phase motor in the middle; two generators; and two exciters, one being used for the motor and the other for the generators. The set has a speed of 1,000 r.p.m. The motor, of 700 kW, starts as an asynchronous motor at a pressure of only 250 V, and when it has reached a suitable speed, the control gear provided comes into action and makes the motor run as a 500-V synchronous motor. The two generators, each producing current at 2,000 V, are connected in series; each develops 325 kW on continuous load, the exciter being governed by an automatic pressure regulator. Further, the 3-phase motor-exciter has a few of the turns of its field coils connected in series with the main lead from the generators, so that when the load of the former increases, the excitation of the motor rises in proportion.

The main switches are of the gradual and multiple-break type so as to quench the arcs which form when the switch is opened.

The contact lines, starting from the sub-station, form two sections, *viz.*, Turin-Ciriè, and Ciriè-Ceres. On the second section which is a single track the contact wire is supplemented by a feeder of the same section (60 mm².). The catenary type of suspension is used for the lines.

The locomotives are of the total-adhesion type, being mounted on two bogies having two independent live axles. They weigh 42 tons. Each axle carries a 140-h.p. motor turning at 660 r.p.m., at a voltage of 1,800, the speed being reduced by 1 : 4 gearing. These motors are constantly connected by twos, in series, and the two groups are coupled in series or parallel by means of the combining switch. Owing to the starting rheostats fitted, it is possible to get seven speeds in series and five in parallel; electric braking is provided for by short-circuiting the motors on to these resistances. The tractive force at the wheel rim is 4.65 metric tons, but at starting this may rise to 9.3 metric tons. The passenger trains weigh about 150 metric tons between Turin and Lanzo and 85 tons between Lanzo and Ceres, the respective speeds being 65 and 45 km. per hour.

Each locomotive is fitted with two pantograph collectors, with aluminium sliding bows; the body work of the locomotive includes two drivers' cabs and a locked cab containing the high-pressure gear. The centre portion of the body work serves as a luggage compartment.

From each end cab the driver controls, by pneumatic or electric gearing, the h.p. apparatus.

The gear in the cabs includes the combiner (combining or grouping gear) and the main cut-out. The latter is fitted for the purpose of saving the contacts of the combining switch, the wear being borne by the cut-out which is fitted with powerful magnetic blow-out coils. The locomotive is also fitted with a main switch similar to those fitted in the sub-station; it is pneumatically-controlled with emergency hand control. A small converter set is also fitted for supply current at 110 V for lighting, heating, and operating the air-compressor. The starting rheostats, of cast iron, are fitted in a special case and ventilated by a fan mounted on the shaft of the converter set.

E. S. H.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

25,819. "Means for connecting wires of electric connections to sparking plugs." [illegible] Sykes. September 25th.

25,827. "Means for [illegible] explosion engines." Brolt, Ltd., and W. Holt. September 25th.

25,870. "Electrical [illegible] instruments." C. R. Belling and C. H. Smith. September 25th.

25,880. "[illegible] starting and stopping device for photographic [illegible]." C. P. Longwell and C. G. Lowen. September 25th.

25,879. "Automatic telephone exchange." I. A. Faller. September 25th.

25,882. "Receiving installations for wireless telegraphy, telephony, &c." C. Perrier, A. Stuart, Stuart Wireless Telephony Co. and A. E. Watkins. September 25th.

25,885. "Method of ship propulsion." Electric Boat Co. September 25th. (United States, November 22nd, 1921.)

25,908. "Method of moulding casein, &c., into plates having polished surface." Compagnie Générale d'Electricité. September 25th. (Germany, September 20th, 1921.)

25,911. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 25th. (United States, January 20th.)

25,942. "Electric generators." J. G. Parsons. September 25th.

25,945. "Electric heaters." British Thomson-Houston Co., Ltd. (International General Electric Co.). September 25th.

25,924. "Clock-controlled electrically-operated time signal devices." T. Houghton and F. W. Langworth. September 26th.

25,931. "Projection of light in head lamps." A. Heushall. September 26th.

25,948. "Means for securing electric fixtures." H. J. C. Forrester (Malepart & Mathieu). September 26th.

25,965. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). September 26th.

25,977. "Electrically-operated switches for controlling lighting, &c., circuits on railway vehicles, &c." J. Etchells and Vickers, Ltd. September 26th.

25,980. "Rotors for dynamo-electric machines." Dayton Engineering Laboratories Co. September 26th. (United States, July 6th.)

25,984. "Manufacture of jacks for telephone switchboards." M. B. Richter. September 26th.

25,988. "Multiway socket for electric fittings." Elektronoris Ges. and W. Hesse. September 26th.

25,994. "Electric incandescent lamp." E. de Lorenzi. September 26th.

25,995. "Electric furnaces." L. Tagliaferri. September 26th.

26,004. "Thermionic generators." Ges. für Drahtlose Telegraphie. September 26th. (Germany, November 14th, 1921.)

26,005. "High-frequency telephony." Ges. für Drahtlose Telegraphie. September 26th. (Germany, December 20th, 1921.)

26,009. "Anti-spilling constructions for electric batteries." C. R. Hardy and Hart Accumulator Co., Ltd. September 26th.

26,015. "Electro-magnetic receivers for telephony, &c." E. Shipton. September 26th.

26,037. "Electric motors." H. F. Moore. September 27th.

26,038. "Electric motors." H. F. Moore. September 27th.

26,039. "Electric motors." H. F. Moore. September 27th.

26,048. "Conversion of electricity into heat." T. Cooper. September 27th.

26,062. "Rectifying devices." A. R. Augus. September 27th.

26,063. "Rectifying devices." A. R. Angus. September 27th.

26,072. "Electric induction coils." N. E. Dobbin, S. L. Forbes, and J. W. Fothergill. September 27th.

26,085. "Method of telegraphing photographs." T. T. Baker. September 27th.

26,087. "Electric cooking grill." M. Tocchio. September 27th.

26,091. "Power-transmission device." Metropolitan-Vickers Electrical Co., Ltd. September 27th. (United States, October 25th, 1921.)

26,095. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). September 27th.

26,096. "Control of trains." A. R. Angus. September 27th.

26,112. "Burglar, &c., alarms." H. Pengelly. September 27th.

26,126. "Tuning inductances for crystal, &c., wireless receivers." H. W. Sullivan. September 27th.

26,137. "Receiving systems for wireless telegraphy and telephony." G. P. Mair. September 27th.

26,157. "Control of trains." A. R. Angus. September 28th.

26,173. "Electric switches and fuses for dynamo lighting and battery-charging systems of motor vehicles, &c." Brolt, Ltd., and W. Holt. September 28th.

26,186. "Sparking plugs." E. G. Marklew and M. J. O'Brien. September 28th.

26,188. "Collapsible hood for open-deck tramcars, &c." H. S. Skenfield. September 28th.

26,206. "Process for electrolytic separation of pure chromium in thick layers." G. Brewer (F. Krupp-Akt. Ges.). September 28th.

26,212. "Impulse transmitters." Western Electric Co., Ltd. September 28th. (United States, May 24th.)

26,213. "Miners' electric lamps." T. Stretton and Thor Electric Safety Lamp Co., Ltd. September 28th.

26,217. "Electrically-operated elevators, &c." Metropolitan-Vickers Electrical Co., Ltd. September 28th. (United States, October 10th, 1921.)

26,233. "Electric arc lamp." Jupiter Kunstlicht Kersten & Brasch. September 28th. (Germany, October 13th, 1921.)

26,241. "Closed-circuit burglar alarms." G. B. Carpenter. September 28th.

26,245. "Electric vulcanisers for pneumatic tires, &c." J. Haelg. September 28th. (Spain, September 29th, 1921.)

26,252. "Directly measuring coefficients of self-induction and capacities." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. September 28th. (France, October 1st, 1921.)

26,254. "Composition for screening X-ray, &c., emanations and for electric [illegible]." [illegible]. September 28th.

26,259. "Receiving circuits for wireless telegraphy." B. Hesketh. September 29th.

26,272. "Electric cables." British Insulated & Helsby Cables, Ltd., and J. [illegible]. September 29th.

26,278. "Sparking plugs." R. Bosch Akt. Ges. September 29th. (Germany, [illegible].)

26,282. "Sparking plugs." Sphinx Manufacturing Co., Ltd., and D. H. Corbin. September 29th.

26,[illegible]. "[illegible] controlling on and off of mercury-vapour [illegible]." [illegible]. September 29th. (Holland, October 1st, 1921.)

26,312. "Electric motors." A. Arütunoff. September 29th.

26,316. "Loud-speaking telephone instruments." H. P. P. Rees. September 29th.

26,327. "Foot battery." Commercial Trading Co., P. Crow, T. D. Draper and F. Crabtree. September 29th.

26,329. "Dynamo-electric generators." J. H. St. H. Mawdsley. September 29th.

26,336. "High-frequency transformers and switches therefor." A. Griffiths, B. H. Hardy, Moores & Griffiths, Ltd., and L. W. Smith. September 29th.

26,345. "Suspension for electric lamps." A. Bonig. September 29th. (Germany, September 30th, 1921.)

26,353. "Electric [illegible]." Brompton & Kensington Accessories Co., Ltd., and R. S. Dixon. September 29th.

26,359. "Apparatus for heating water, &c., by electricity." J. C. Vines. September 29th.

26,360. "Telephone receivers." E. C. Cope and G. F. Oxtins. September 29th.

26,368. "Telephonic receiving apparatus." E. A. Graham. September 29th.

26,370. "Loud-speaking telephones." Automatic Telephone Manufacturing Co., Ltd., D. N. Rosoky, and S. R. Smith. September 29th.

26,375. "Indicator for measuring maximum demand of electricity." W. Elliott. September 29th.

26,384. "Electric light fittings." W. T. Gray. September 30th.

26,388. "Commutators." J. A. Blackburn. September 30th.

26,403. "Apparatus for electric welding and for production of low-frequency alternating currents." Macfarlane Engineering Co., Ltd., J. C. Macfarlane, and W. A. Macfarlane. September 30th.

26,424. "Oscillating electric fans." A. E. Angold and A. H. Railing. September 30th.

26,425. "Oscillating electric fans." A. E. Angold and A. H. Railing. September 30th.

26,426. "Headlights for motor vehicles." F. H. Ireland. September 30th.

26,428. "Frame aerials." H. J. Round. September 30th.

26,429. "Inductor compasses." T. N. Whitehead. September 30th.

26,431. "Telephones." R. H. White. September 30th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

7,331. "Magnetos." L. Arnall. March 7th, 1921. (185,771.)

7,410. "Electric measuring instruments." F. Holden and Measurement, Ltd. March 8th, 1921. (185,773.)

7,887. "Oscillating valve relays." G. A. Mathieu. March 12th, 1921. (185,775.)

13,266. "High-frequency multiplex signalling system." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 10th, 1921. (185,795.)

13,398. "Electric accumulators." W. O. Garbutt. May 11th, 1921. (185,797.)

13,492. "Transforming an alternating electric supply to a supply having a higher number of phases." S. A. Stigant and Johnson & Phillips, Ltd. May 12th, 1921. (185,801.)

15,047. "Process for the electrolytic refining of tin." W. P. Thompson (W. J. Aikens). May 31st, 1921. (185,808.)

15,341. "Electric alarms." A. W. Amos, W. F. Lloyd, and A. L. Lloyd. June 2nd, 1921. (185,810.)

15,435. "Electrodes, welding rods, and soldering sticks." E. H. Jones and Alloy Welding Process, Ltd. June 3rd, 1921. (185,813.)

15,838. "Automatic telegraph systems." Western Electric Co., Ltd. July 1st, 1920. (165,783.)

15,845. "Multiple fuse." J. Szykier. June 9th, 1920. (164,361.)

15,990. "Fitting for clamping and connecting electric cables in wiring and the like systems, specially applicable for connecting and earthing metallic-sheathed cables." British Insulated & Helsby Cables, Ltd., F. A. Cole, and H. Leicester. June 10th, 1921. (185,831.)

16,148. "Electrolytic treatment of metalliferous materials containing tungsten or molybdenum." R. E. Pearson, E. N. Craig, and Durelco, Ltd. June 11th, 1921. (185,842.)

16,244. "Fly wheels for use as the rotors of magneto electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. June 13th, 1921. (185,847.)

16,283. "Electric calling devices." A. W. Whistlecroft. June 13th, 1921. (185,848.)

16,290. "Method and arrangement for increasing the efficiency of alternating-current power transmission plants." K. Kando. August 16th, 1918. (164,743.)

16,419. "Electric plug and socket connections." J. B. Tucker. June 14th, 1921. (185,854.)

16,484. "Electric lamp holders and adapters." L. B. Codd and C. Martin. June 15th, 1921. (185,858.)

16,513. "Burglar and like alarm systems." S. G. Adams. June 15th, 1921. (185,861.)

16,737. "Safety or protecting arrangements for use in connection with electric switches, electrical installations or the like." J. E. Pollak (Naamlooze Vennootschap Hengelosche Electrische en Mechanische Apparatenfabriek "Heemaf"). June 17th, 1921. (185,866.)

17,029. "Electric current detectors." S. T. Sherill and Am-O-Meter Co. June 21st, 1921. (185,870.)

17,120. "Selectively-operable devices for selective signalling systems." Western Electric Co. (Western Electric Co., Inc.). June 22nd, 1921. (Addition to 117,170.) (185,871.)

17,367. "Electrical relays." R. B. Ransford (Soc. Francais Radio Electrique). June 24th, 1921. (185,875.)

17,683. "Induction motors." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. June 29th, 1921. (185,883.)

17,924. "Mechanically-operated interrupters for electric currents." J. E. Pollak (Maschinenbau Akt. Ges., Seebach, Zurich). July 1st, 1921. (185,888.)

18,127. "Method of and device for mechanically rectifying high-tension polyphase current." Lodge Fume Co., Ltd. (Metallbank und Metallurgische Ges. Akt. Ges.). July 4th, 1921. (185,891.)

18,758. "Electric heaters." May & Padmore, Ltd., and E. W. N. May. July 12th, 1921. (185,902.)

19,723. "Renewal of electric incandescent lamps." M. Calderara. March 3rd, 1921. (176,309.)

19,916. "Magnetos." P. Courtot. July 26th, 1920. (166,903.)

20,183. "Voltage regulating systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 27th, 1921. (185,920.)

20,406. "High-frequency inter-valve transformers and method of constructing the same." A. E. Greenslade. July 29th, 1921. (185,923.)

21,062. "Magnetos." M. E. Maegrath. August 9th, 1921. (185,928.)

23,066. "Electric accumulators." J. R. Palmer and W. C. Ashton. August 31st, 1921. (185,946.)

24,598. "Electric hand lanterns." Efandem Co., Ltd., and J. Eaton. September 15th, 1921. (185,958.)

25,822. "Wireless telegraphy and telephony apparatus." H. P. P. Rees. September 29th, 1921. (185,967.)

29,136. "Electric batteries." Three Star Accumulators, Ltd., and C. Kendall. November 2nd, 1921. (185,989.)

33,533. "Insulator for high-pressure electric lines." A. Renaudin. December 15th, 1920. (172,963.)

1922.

3,697. "Electric glow discharge lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 9th, 1921. (175,274.)

6,073. "Electric circuit controllers." British Thomson-Houston Co., Ltd. (General Electric Co.). March 1st, 1922. (186,010.)

8,247. "Control of electrically-opelled vehicles." British Thomson-Houston Co., Ltd., and H. C. Hasting. March 21st, 1922. (186,013.)

11,848. "Emergency governors." Metropolitan-Vickers Electrical Co., Ltd. May 10th, 1921. (179,922.)

THE

ELECTRICAL REVIEW.

VOL. XCI. OCTOBER 20, 1922. No. 2,343.

ELECTRICAL REVIEW.

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WORKING HOURS, WAGES, AND OUTPUT.

THERE is a particular kind of fallacy which one reads of in the study of logic, called arguing from the particular to the general. This fallacy leads the superficial thinker to imagine that he has discovered a simple and invariable law because two or three observational results happen to be in a straight line; but it is nearly always the case that the law does not hold when limiting values are approached. Even Euclid is not true when x becomes indefinitely close to zero, and the straight-line law that the stretching of a spring is exactly proportional to the weight applied does not hold above the elastic limit.

It is never safe to apply simple straight-line law arguments to matters in which human beings are concerned. If a man can do twice as much in two hours as he can in one, we are not justified in supposing that if he gives up eating and sleeping he can do twenty-four times as much in a complete day. Yet it has been stated by at least one famous leader of industry that the work accomplished by trained technical engineers is in exact proportion to the number of hours worked. Conversely, if men are working above the fatigue-point, and a reduction of hours enables more work to be done, it is not justifiable to argue that a further reduction will increase the output in the same inverse ratio.

With regard to industrial affairs, there has been much inaccurate thinking, much slipshod administration, and much claptrap, particularly since the Armistice. At the beginning of 1919 the normal working week in the engineering industry was reduced from an average of about 53 hours, with two breaks, to a uniform level of 47 hours, with only one break. Later, Labour attempted to obtain a further reduction, to 44 hours, but in August, 1919, this proposal was withdrawn, and a joint committee, consisting of six representatives of employers and six representatives of trade unions, was set up to investigate the whole question of working hours and output.

There was a certain advantage in setting up this committee of investigation at this particular time, inasmuch as the first reduction of hours had been in operation for some time, and an opportunity was thereby afforded of ascertaining the true facts as to its effect. The argument in favour of the reduction was that 53 hours was too long, and that the men would be brighter and fresher with a 47-hour week, so that if wages were allowed to remain the same in spite of the less time worked, the employers would get the same output, and the cost per unit of finished product would not be increased. Since the cost was to remain the same, the bargain was that selling prices should not be raised, the implication being that if they were, profits would go up, and the workmen would be justified in asking for higher wages. It may be parenthetically remarked that some employers took this with a considerable grain of salt, and during the period of rising prices the notorious flexible price clause formed a means of passing on increases of cost, from whatever cause arising, to the customer. There was nothing reprehensible in this, for the money had to come from somewhere. Increased costs can only be met out of increased revenue. The inevitable result of the furious race between prices and wages was the slump, in the depths of which the industrial world is still wallowing.

The Committee, then, got to work, and in June last published a report on its investigations. In June and

July of 1920, when, so far as the electrical industry was concerned, the first signs of the slump were still three or four months off. Twenty-one shipbuilding and engineering establishments were visited. In the spring of the following year the Committee visited eleven Belgian, four German, and seven Dutch works; and in August of 1921, when trade was decidedly bad, twelve places in the English Midlands came under review. The intention was that a visit should be paid to America, but it was rightly decided that in present circumstances no results of value could be thereby obtained.

It was found, as might be expected, that very much more work is accomplished when payment is by results than when it is based on time. It is a common thing to find the output doubled, and in a case where riveters were employed on a warship, it was more than quadrupled. "For a short time, until their society intervened," says the report, "shipwrights worked piecework at laying decks. It was found that output was more than doubled." In the matter of the reduction of working hours, the reduction of output was in general equal to or greater than that of the time worked.

Here we encounter an old acquaintance—the idea of the "work fund," which is responsible for ca' canny and restriction of output in general. The argument of Malthus is that population increases up to the limit of the supporting capacity of the country in which it lives, and he adduces much historical evidence in support of the view. When Malthus wrote, however, methods of transport and of cultivation were not so advanced as they are now; and even if the productive capability of England were worked to its utmost capacity (which it obviously is not) the market, being of an expanding character, would absorb the output. We do not agree with a certain well-known physicist that the remedy for shortage is birth control. If the population becomes too great to be supported here, there is ample room in other countries, such as Canada and Australia, for further development. And if, as the trade unionist so often complains, bootmakers walk the streets workless because too many boots have been made, the resulting cheapness will increase the demand, and in normal times he will soon be in work again. The supply of raw materials, such as coal, must, in the nature of things, be limited, but we have not nearly arrived at the limit yet; and the productive capacity of the world, in crops, cattle, and other living things, is capable of increase far beyond anything that has yet been accomplished. If only we could get rid of the bogey of there being only a certain limited amount of work available, so that every worker would do all he could, the resultant prosperity would be such that unemployment would become an administrative detail, and the support of workers during periods of over-production could be paid for without difficulty.

We have before now advocated some system of payment by results. Sir Lynden Macassey, in his notable book, "Labour Policy—False and True," reviewed in our columns recently, points out that the attitude of different sections of the labour world towards the idea varies considerably. Cotton operatives are universally paid by results. Carpenters and joiners call it "a pestilential system." The justification for this appellation is a little difficult to understand, though the difficulties attendant upon the variation of piece-prices consequent upon the introduction of new machinery must not be under-rated. Money that is invested must bring in a return, and while we are entirely against the notion of limitation of earnings and the vicious system of rate-cutting that has only too often been practised with that end in view, it must be admitted that the benefits derived from improvements in production ought to be shared between the employer and the consumer as well as the operative.

The more the matter is examined, the more does it become clear that only by an increase of the "will to work," on the part of all classes of the community, can the ills of the present generation be cured, and the health of the coming generations ensured.

The Therm and the Thousand.

An apologia for the therm by Sir George Beilby appeared in *The Times* of the 7th inst., the contents of which are no doubt of academic interest, but—as remarked in a leading article in *The Times* of the 9th inst.—Sir George's letter lends unconscious support to the demand for an independent inquiry into the matter. Sir George concludes his letter with these words: "The determination of the actual price to be charged for the gas supplied . . . obviously does not come within the province of the Fuel Research Board." *Verb. sap.*

Our esteemed contemporary, the *Gas World*, in a leading article a few weeks ago, put the question: "Is the therm popular?" and from the replies contributed by gas engineers and others it may reasonably be inferred that the answer to this question is decidedly in the negative. One contributor asserted that "the Gas Regulation Act was unpopular and the therm less popular; that the apathy with which the gas undertakings adopted it bore this out; and that those which had adopted it had invariably had ulterior motives." This gentleman further "ventured to say that if a power had been given to statutory gas undertakings to increase the price of gas on the 1,000 cu. ft. basis, nothing would ever have been heard about charging by therms."

It is common knowledge that gas experts are divided in their views upon the calorific value best suited to modern gas appliances and also upon the question whether the gas it may be most economical to produce will always be that which will give the consumer the greatest satisfaction. Gas of 1,000 B.th.u. (such as, according to Dr. Lander, is produced by low-temperature carbonisation) is admittedly too rich for use in existing gas appliances. Mr. George Keillor (Greenock) is a strong advocate of low B.th.u. gas, and is reported to have expressed the view that 410 gas was perfectly satisfactory, and that nothing better was needed—indeed, he is said publicly to have stated that "people who were selling anything higher were not acting with justice to the consumer." On the other hand, Mr. James Richmond (of Penycuik) avers that it is borne out in practice that gas of 500 B.th.u. is 25 per cent. better value than gas of 400.

When doctors disagree, who shall decide? It is obvious that if the consumer be charged by the therm, 500 gas will cost him 25 per cent. more than 400, and Mr. de Segundo's two questions in a recent issue of the *Gas World* are very pertinent: "Can it be expected," he asks, "that, in practice, the consumption of 500 gas in a given heater or cooker for a given duty will be 80 per cent. of that of 400 gas, and is the cost of production and distribution of 500 gas, as compared with 400 gas, fairly represented by an increase of 25 per cent. in the price per 1,000 cu. ft. which, in effect, is the result of charging per therm instead of per cubic foot?"

Clearly, unless the consumption diminishes in exact proportion to the increase in calorific value, the equivalent cost to the consumer will rise in some measure with the rise in the declared value if the charge is based upon the calorific value.

There is another aspect of the matter which should not be overlooked. Complete combustion of the gas in gas appliances is conditional upon the right proportion of air being mixed with the gas in the burners of the heater or cooker. Variations in the pressure of the gas disturb this proportion. Mr. George Keillor has published some very careful and interesting trials from which he deduces that in one case "45.4 per cent. more gas was used (for a given duty) with the tap full on than with the tap half open, with a decrease of efficiency of 5.11 per cent." But is it likely that every consumer is able to judge when the tap should be full open or half open or three-quarters? and even supposing he were, how is he to guard against the effect of variations in the pressure *at his meter*? The pressure at the consumer's meter is supposed to be about two and a-half inches of water, so that a variation in the pressure in the mains,

small in itself, might bear an appreciable relation to 2½ inches of water, and thus could materially affect the efficiency of combustion in the burners of gas appliances.

Whether a Board of Trade inquiry be the most satisfactory way of deciding the issues to which the provisions of the Gas Regulation Act have given rise is a matter upon which we will express no opinion, but it would certainly seem to be the part of wisdom for the gas companies to determine, with all convenient speed, the calorific value best suited for use in modern gas appliances and to revert to the volume basis of charge, adopting whatever calorific standard be decided upon. It will be just as easy for the proper authority to control a calorific standard as it was in the old days to control an illuminating standard. There seems little doubt that under subsisting conditions the consumer has nothing to gain and everything to lose by being charged per therm instead of per thousand cubic feet.

Salesmanship.

The first lecture of the new series arranged by the Electrical Development Association was delivered last Friday, and it demonstrated beyond argument that the E.D.A. is now a potent force in the industry.

In general, the lecture was just the type that is required if we are to make progress, and from that point of view the discussion was somewhat disappointing. Indeed, there was a tendency last year for the discussions upon the lectures to wander away from the real point, and this happened again in the case of Mr. Bush's lecture. For instance, the question of manufacturers' discounts is rather off the general question of sales campaigns, but it entered quite largely into the discussion. A great deal was said, also, as to educating the customer in the meaning of the term "foot-candles," but we are inclined to agree with Mr. Robinson, of Hackney, who said that the use of the term is all very well among those in the trade, but it is unlikely that the ordinary user of lighting appliances will bother himself about it. Certainly the private householder will not, whatever might be the case when dealing with architects and engineers in lighting large buildings. After the remarks made by Mr. Bush as to the attitude of the trade Press, it was something of a retribution for the lecturer to be told that there was a danger of the contracting people suffering from "technicalitis." Mr. Bush was left in no doubt at the meeting that those responsible for the trade Press dissented entirely from the view he put forward. It may be that Mr. Bush's comments are true of some papers, some time, but they certainly are not true of all papers, all the time, and the columns of the Electrical Review speak for themselves as to the prominence which the commercial side of the industry receives. We fancy Mr. Bush realised that his comments were a little too sweeping.

It was a wise move to take as the theme of the lecture the obtaining of new business in premises already using electricity for lighting, for there can be little doubt that many of these premises would be all the better for a thorough overhaul from every point of view. The development and pushing of new business of any class, however, is essentially a matter for combined action between the supply authorities, the manufacturers, and the contractors, and Mr. Bush was not a bit too strong in his strictures upon the lack of sales campaigns or any mildly-sustained relationship between the consumer and the supply authorities or contractors, except so far as the former is concerned, in the shape of the quarterly bill. The lack of really trained lighting salesmen is one of the strongest points made in the lecture, but that question is not so simple as it might at first appear. It would seem that development along these lines must depend more upon the supply authorities than the contractors, except in the case of the relatively few large contracting firms, for the small contractor cannot be expected to employ the type of man referred to. At the same time, knowledge of the kind indicated on the part of the man who is endeavouring to push the sale of lighting apparatus among the users is essential to real progress, and it is well that this aspect has been emphasised.

The E.P.E.A. Agreement and a Moral.

In our issue of the 6th we gave particulars of an agreement which had been entered into between the Electrical Power Engineers' Association and the Union of the Workmen's Trade Unions. The agreement is broadly to conclude an offensive and defensive alliance between the technical staffs and the workmen, so that the whole of the employés from the top down to the bottom shall be able to present a united front if trouble arises and the question of a strike comes up. One noteworthy item in the agreement is that joint action is to be taken to endorse all agreements made in the National and District Councils and Boards.

The agreement is certainly, in theory at least, one of the most important "moves" that has taken place in the industrial history of the electricity supply industry. It welds together staff and men into what is for practical purposes an *ad hoc* industrial union and, moreover, an industrial union unique in its inclusion of all grades. The agreement is not, of course, formally complete. The E.T.U. is not in it. But we can assume that it carries the E.T.U. with it if it comes to a "scrap." Anyhow, that the E.T.U. agrees with it in principle is common knowledge.

But the agreement, crucial as it is in principle, is not of the "red flag" variety, either in letter or spirit. It is, in essence, law-abiding. In one sense, although it makes the strike-weapon more formidable, it places it in more responsible hands; by this we mean that the considered opinion of all grades combined is weightier than that of one section only. It would discountenance unofficial, irresponsible striking. But the saving grace from the employers' point of view should be that the parties are virtually pledged to observe the decisions of the Whitley Councils. That they will do this there is no reason for doubting. During the whole time the Whitley Councils have been in existence we do not remember hearing of any occasion when the *employés* have departed from any decision.

The obvious moral of all this is that the industry should stick to Whitleyism. The present scheme of Whitley Councils in operation in the electricity supply industry is unparalleled in sound and comprehensive organisation. No other industry has so secure an industrial basis. And yet there are some reactionary employers who still refuse to be persuaded as to the "good of" Whitley Councils and who seem to sigh for the good old days of rough and tumble. But one cannot put back the clock industrially in the electricity supply industry. For good or ill we have to realise that the trade union organisation of the industry is complete, and the present agreement is merely making assurance doubly sure. Destroying or weakening the Whitley Councils would not mean weakening the unions or in any way reverting to the "good old days." Quite the reverse. It would really mean that there would be combination on the side of the unions, but none on the side of the employers. Employers who think that any good can come to them this way simply do not know at first hand the present day industrial conditions in the industry.

Finally, coming back to our original thesis, Whitley Councils are the greatest possible safeguard against strikes (and this is a point of paramount importance to an industry such as the electricity supply industry). So long as these Councils function properly the closest co-operation of the unions, by agreement, as in the present case, or otherwise, need not be viewed with disquietude. But *without* the Whitley Councils, the greater the co-operation between the unions the greater the danger. So the moral to the employers, with regard to the E.P.E.A. agreement (or anything else of the kind) is—strengthen the Whitley Councils.

THE "ELECTRICAL REVIEW" FRENCH TOUR.

In our issues of April 14th and July 21st, 1922, we gave an illustrated description of the huge power station which has been erected at Gennevilliers by the Union d'Electricité for the supply of electricity to Paris and the surrounding district, with an initial capacity of 200,000 kW and an ultimate capacity of 320,000 kW. This is, we believe, the highest rating of any steam-driven installation in the world, and the plant embodies a number of novel features in every department—from the intake on the Seine to the main transmission lines and sub-stations; hence the scheme aroused much interest in British engineering circles, in view of the national policy of concentrating generating plant in large power stations and distributing energy in bulk on a large scale.

The first impulse of an engineer when confronted with a technical problem is to say: "Let's go and have a look at it"; and realising that this feeling animated many of our compatriots, we felt that by assisting them to carry out their wish we should at the same time gratify our constant desire to render service to the electrical engineering industry. Consequently we announced our intention to organise a visit to Gennevilliers, followed by a tour embracing other interesting features.

Our proposal met with a gratifying response; applications rapidly flowed in, and the Council of the Incorporated Municipal Electrical Association gave its official support to the scheme, with the result that when over 100 applications had been received it was necessary to close the list, lest the party should become unwieldy. Owing to various causes a number of the applicants were unable to carry out their intentions, and eventually the party numbered about 70 members, *viz.*:—

A. H. Allen ...	Electrical Review.
F. N. R. Baker	... St. Helens Corporation.
J. Bell ...	... Mayor of West Bromwich.
A. W. Blake	... Willesden Urban District Council.
F. A. Bond ...	... Battersea Borough Council.
F. R. Burnett	... County Borough of Barrow-in-Furness.
*H. W. Butler	Messrs. H. W. Butler & Co.
H. P. Bramwell	
E. Fowler Clark	
*J. H. Clothier	Urban District of St. Anne's-on-Sea.
*Sir W. F. Coates, Bt., D.L.	Lord Mayor of Belfast.
J. Cusworth	Newcastle Electric Supply Co.
H. A. Cutler	City Surveyor (Belfast).
A. C. Cramb	County Borough of Croydon.
Boyd Dawson	Messrs. Baillie & Dobrée.
Bailie D. McK. Dewar	Glasgow Corporation.
H. W. Duckett	Metropolitan Railway.
W. F. Duffett ...	Rotherham Corporation.
P. Dunsheath	Messrs. W. T. Henley's Telegraph Works Co.
C. Erith	... Messrs. Charles Erith & Co.
T. F. Evans ...	... The Underfeed Stoker Co.
Councillor J. Farr	Nottingham Corporation.
F. Forrest	Birmingham Corporation.
S. Ferguson	Messrs. Ferguson & Pailin.
F. A. Garrett	Messrs. Ransomes, Sims & Jefferies.
E. A. Gatehouse	Electrical Review.
J. P. Gregory	The British Thomson-Houston Co.
*A. E. Hadley	The Victoria Falls & Transvaal Power Co.
*T. Hall	Borough of Burton-on-Trent.
*J. T. Hancock	
J. G. Harris	Assistant Town Clerk (Belfast)
R. T. Hawkins	County Borough of Wallasey.
C. F. Hewitt	The Metropolitan Vickers Electrical Co.
P. M. Hogg	Messrs. Pilkington Bros., St. Helens.
H. L. Hoorwood	The General Electric Co.
J. Horsley	Borough of Hackney.
J. Hughes	County Borough of Wallasey.
W. A. Jackson	Borough of West Bromwich.
Councillor O. Jamison, J.P.	Vice-Chairman (Belfast).
*L. M. Jockel	The North Metropolitan E. S. Co.
*T. A. Kingham	Borough of Kingston-upon-Thames.
F. M. Long ...	Norwich Corporation.
J. R. P. Lunn ...	... Darlington Corporation.
*F. H. Mann ...	... Messrs. Mollett, Rosher and Mann.
*H. C. McCann ...	... The English Electric Co.
Councillor T. E. McConnell, C.B.E., M.P., J.P., Belfast.	
R. B. Mitchell ...	... Glasgow Corporation.
F. A. Nixon ...	... The Victoria Falls & Transvaal Power Co.
G. Pailin	... Messrs. Ferguson & Pailin.
F. G. Penny ...	.... Rotherham Corporation.
F. W. Purse ...	... ... County Borough of West Ham.
L. L. Robinson	... ... Borough of Hackney.
D. A. Rickwood	Messrs. Dienny & Lucas.
Major T. Rich	
G. Riley ...	... ... The British Thomson-Houston Co.
Convener R. Sadler	... Glasgow Corporation.
C. L. S. Stewart ...	... Borough of Rawtenstall.
H. Talbot ...	... ... Nottingham Corporation.
*W. C. P. Tapper	... ... Metropolitan Borough of Stepney.
W. G. Turner ...	... Borough of Southampton.
G. V. Twiss ...	... ... Messrs. Twiss Electrical Transmission.
*Major S. Utting	
*W. R. Whiston	... ... The Leamington & Warwick Power Co.
G. Wilkinson ...	... Borough of Harrogate.
T. P. Wilmshurst ...	... County Borough of Derby.
A. E. Wilson ...	... Messrs. Callender's Cable Co
Johnstone Wright ...	... County Borough of Belfast

*Those members whose names are marked * were unable to take part in the Northern visit.

Victoria Station was the rendezvous on Friday, October 6th, and the start was made under rather unpromising weather conditions, the crossing from Dover to Calais being somewhat unpleasant; however, no one was any the worse for the short sea voyage, and a comforting meal in a roomy dining-car beguiled the time *en route* to Paris, where the party arrived before 10 p.m. Owing to the motor show, the city was very full, and it was not possible to accommodate so large a number under one roof; very comfortable quarters, however, were provided at the Hotels du Louvre, Moderne, and Montreal. After taking possession of their rooms, most of the visitors proceeded to demonstrate that the hour was not too late to sample the attractions of the "Gay City," and it is believed that they retired to rest at an early hour.

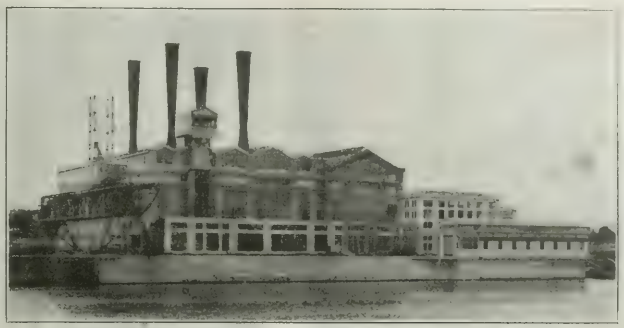
The programme for Saturday morning consisted of a visit to the military wireless station at the Eiffel Tower. The apparatus is housed in a series of underground chambers near the foot of the antennæ in the Champ de Mars, and on account of limitations of space it was necessary to divide the party into three groups, arriving successively at 9.30, 10.30 and 11.30 a.m. The visitors were received by the officer in charge of the wireless station, Commandant Jullien, who conducted them through the rooms and explained the functions of the various apparatus. The first party had the pleasure of witnessing the operation of distributing news by the musical spark system.

The equipment installed by the Military Radio Telegraphs comprises four types of sending apparatus, namely: Musical spark transmitter, 150 kW, 2,600-m. wave-length, used for broadcasting time signals, meteorological bulletins, daily news service, &c.; arc transmitter, 150 kW, 3,200-8,000 m. (usually 7,300 m.) wave-length, used for military or civil communications; high-frequency alternator, giving 20 kW in the antenna, 10,000-m. wave-length; and a three-electrode valve transmitter giving 1 kW in the antenna and used specially for wireless telephony. The principal apparatus is in duplicate, for the sake of reliability, and the necessary power can be obtained from three external sources or generated in the station. A valve transmitter giving 5 kW in the antenna is being installed.

Much interest was aroused by the special type of spark gap, the spark leaping across two gaps between three disks, which are kept continuously in motion, with an

air-blast to blow out the arc. Normally the gap is just too long for the spark to jump, but a pilot spark, controlled by relays and a Morse key, ionises the air in the gap and releases the spark. For sending by alternator a mercury turbine is used, which varies the voltage by short-circuiting a resistance in the exciting circuit of the machine.

After inspecting the station, the visitors proceeded to the Eiffel Tower and, by the courtesy of the authorities, were enabled to ascend not only to the third platform, which is open to the public, but beyond this limit to M. Eiffel's private rooms, and ultimately to the foot of the flagstaff, where there is only sufficient room for six men at a time, the last stages being negotiated with the aid of vertical ladders. We understand that M. Eiffel still pays an occasional visit to this secluded spot, whence on a fine day a view of unique interest can be obtained; unfortunately, at the time of our visit, misty weather prevailed, and the view was restricted thereby. The aerial, formerly of copper, now consists of steel cables, attached by double strings of suspension insulators to cables and electric winches on the top platform. The top of the aerial is 290 m. (951 ft.) above the ground. The six cables are spread out fanwise and anchored at the lower ends, which are insulated in the same manner, leads being brought into the underground station by way of a sunk courtyard. The visitors examined the structure of the famous tower and of the antennæ with interest, and admired the art characteristic of our French comrades,



Gennevilliers Electricity Works.

for cooling the generators is circulated through a closed circuit, and is itself cooled by the water of condensation, thus recovering the heat liberated in the alternators; the feed water is further passed through heaters, coolers and through heaters fed with steam from turbines, heating it nearly to boiling point; the distribution pressure is 60,000 volts; the switchgear and underground cables work at this pressure; in the outer areas overhead mains are used, comprising in all 250 km. of route.

The turbo-generators were constructed by the Société Alsacienne de Constructions Mécaniques and Messrs. Schneider & Cie., the first of Escher Wyss supplying one turbine. The boilers are of the Stirling type, built by the Compagnie Fives-Lille, with Erith Riley stokers, and the Babcock & Wilcox type, built by the S.A. des Fonderies et Ateliers de la Courneuve, with B. & W. stokers. The switchgear was constructed by the Compagnie Française Thomson-Houston.

Under the guidance of the staff officials, the visitors inspected the arrangements for handling coal and water, the generating plant and boiler-houses, and the switch-house, where they were entertained with light refreshments by the Union d'Electricité. This was a suitable moment for acknowledging the courtesy of the directors.

Sir William Coates, Lord Mayor of Belfast, in proposing the health of the company and of Col. Mercier, referred in eulogistic terms to the great kindness the company had shown to the visitors in allowing them to



Some of the Visitors at the Eiffel Tower.



The Party Arriving at Gennevilliers.

with which a huge assemblage of lattice girders was endowed with grace and lightness.

After luncheon, the whole of the members of the party assembled at the Place de la Madeleine and were conveyed in charabancs to Gennevilliers, where they were received by M. Ernest Mercier, managing director of the Union d'Electricité, and a number of engineers connected with the undertaking.

Having so recently described the works at considerable length, we need only recapitulate the particulars in brief. The five generating sets already installed are rated at 10,000 kW each, and are supplied with steam at 355 lb. per sq. in. by 15 water-tube boilers; the air

inspect the station, and congratulated it most heartily on the great progress that had already been made and on the prospects of a brilliant future which obviously lay before it. The engineers would return to their various centres profoundly impressed with the splendid future of the electricity supply industry, especially as exemplified in the power station of Gennevilliers. Those who came from the North of Ireland, forming the largest deputation from a single centre, were more especially interested owing to the fact that they were establishing a new generating station of large capacity for the use of Belfast and the adjoining district, and he extended a hearty invitation to Col. Mercier and the officials of the

Gennevilliers power station to be present at the opening of the new installation, which, he hoped, would take place in March next year.

The party honoured the toast with enthusiasm and hearty cheers, and Col. Mercier briefly responded to the compliment. He expressed the greatest pleasure in being able to receive the visitors and to show them what had been accomplished at Gennevilliers, and said he hoped that he and his colleagues would be able to accept the Lord Mayor's invitation to Belfast, where he felt sure they would learn much from the new plant. He then invited the party to form a group and face the camera, which was duly done, the photograph being taken on the ground level of the switch-house.

in consequence of the erection of the new station at Gennevilliers. Many comments were heard regarding the dismay and indignation with which the proposition to scrap a seven-year-old generating station would be regarded by a British municipality—yet it cannot be doubted that the spirit of this policy is abundantly justified on technical grounds, and if a 200,000-kW power station could be erected in this country, as has been done at Gennevilliers, at a cost equivalent to 600 francs per kW installed—which will be reduced to 530 francs when the plant capacity is increased to 280,000 kW—the policy would be justified on a commercial basis also.

The sub-station provides for underground mains at 60,000 volts incoming from Gennevilliers and outgoing



At the Royal Coach-house, Versailles.



A Group in the Trianon Park.

After this pleasant function it was announced that Col. Mercier had invited those who were so disposed to visit a new sub-station, connected with Gennevilliers power station, whilst others might inspect the switch-gear factory of the Société Française Gardy at Argenteuil. The party accordingly divided, large contingents setting out for these objectives, whilst the remainder returned direct to Paris. The drive to the sub-station, which was situated at Billancourt, on the south-west of

to other sub-stations, with three-phase transformers, and presents many interesting features. The main oil-circuit-breakers are on the floor level, and operate at 60,000 volts. The switch-house is open to the roof, skeleton construction being adopted as at the power station. The longitudinal bus bars, provided with sectionalising switches, are connected to the circuit-breakers through isolating switches fitted with a horn-break, and are on two levels with a horizontal fireproof



Leaving Versailles for the Trianon.



A Wayside Halt near Malmaison.

the city, roughly followed the course of the river for a distance of some 12 miles, traversing suburbs presenting many interesting features, including overhead distribution lines alongside of the road, and passing close to the Puteaux electricity works. Approaching the sub-station, two large power stations were seen, one on either bank of the river. One of these (Billancourt), which belongs to the Union d'Electricité, was built in 1915, and contains generating plant rated at 20,000 kW, in first-class condition; perhaps no feature of the visit made so great an impression on the visitors as the fact that this fine station, barely seven years old, is to be scrapped

screen between them. The transformers, in banks of three, are housed in cells having iron doors which open upon a railway, so that they can be run out directly on a trolley and removed to the adjoining repair shop. There are no instruments on the 60,000-volt mains. The pressure is reduced to 15,000 volts for distribution, and all the instruments on the secondary side are housed in a separate building, the feeders being controlled by mechanically operated oil-switches. The potential transformers are completely isolated from all other gear, so that any mishap in connection with them can be strictly localised. The 60,000-volt mains and trans-

formers are fully protected on the Merz-Price balanced-current system, a pilot wire being provided in association with the single-core cables. The two sets of 15,000-volt bus bars are separated by a vertical shield which enables work to be carried out on either set in safety while the other set is alive.

After a brief inspection of the superseded generating station, specially desired by some of the party in order to see what sort of plant was being scrapped after so short a life, the party drove back to Paris, and the members were free to pursue their own devices for the rest of the evening.

The principal feature of the programme for Sunday, October 8th, was a visit to the Palace of Versailles, whither the party was conveyed in charabancs. The weather was charming, and the excursion was thoroughly enjoyed by all who took part in it. The magnificence and beauty of the Palace and its contents were warmly admired, and the gardens, though past their prime owing to the lateness of the season, were still a mass of colour and verdure. The famous palace of Louis XIV, said to have cost 40 millions sterling, was the scene of the proclamation of William of Prussia as German Emperor in 1871, and of the signing of the Treaty of Peace in 1919.

On the outward journey the Chateau of Malmaison was visited, where numerous relics associated with Napoleon Bonaparte were inspected with interest. The Chateau was purchased in 1789 by Joséphine Beauharnais, who retired there after her divorce from Napoleon in 1809. *(To be continued.)*

THE TEXTILE MACHINERY AND ACCESSORIES EXHIBITION.

In opening the above exhibition at the City Hall, Manchester, on October 6th, Sir E. Mackay Edgar, who was supported by many leaders of the industry in Lancashire, spoke in an optimistic manner about the future of the industry. He also criticised any return to control of the industry, and indicated that in other branches of trade there was undoubtedly a progressive movement.

Although there was no complete range of textile machinery (indeed, to attempt to stage one would be a difficult task) the visitor was able to find examples of plant and appliances used in the various sections, each presenting some new and particular improvement. In a survey of the equipment displayed the foremost thought that asserted itself was that only in a few cases was there any attempt to depart from traditional practice. Refinement had been made with a view to improvement, but there had been little, if any, bold adventuring in search of new principles. Nevertheless, ingenuity was displayed in numerous ways and the persistent search for something better was evident. The trend, therefore, is to perfect what we have rather than to create something fresh.

Few exhibitions have been held in Manchester that have made a greater use of electricity than the one under review. The textile industry offers immense opportunities for electric power plant and there was, therefore, a useful suggestiveness about the exhibition, for nearly all the plant on view derived its motive power from electric motors. It is disclosing no secret to mention that several of the manufacturers of textile plant did not intend to demonstrate their machinery in motion, but when they saw what other firms were doing, they made application for power. That some were "left in the lurch" was evidenced by the fact that at two of the stands, the merits of machines were orally explained, whilst hand-written cards were suspended from the machines—"Waiting for Electric Power." The Lancashire Dynamo & Motor Co. at its stand had a 45-kilowatt set supplying electricity to no fewer than 20 stands. This plant was heavily overloaded, the percentage being as high as 60, and at the time of our visit was actually 50, and running sparklessly at that. Although erected on a wooden foundation, the set was running in perfect balance. This company, in association with the Crypto Electrical Co., Ltd., of Willesden, exhibited Lancashire and Crypto a.c. and d.c. motors, Lancashire automatic centrifugal clutches, Crypto battery-charging plant and a.c. to d.c. motor generators, and a Lancashire motor-alternator set. The motor-alternator was employed to change the Corporation 400-volt d.c. supply into a.c. (400 volts, 50 periods, 3-phase) required for supplying power to many stands having a.c. motors. The switchgear for controlling the set was made by Messrs. Brook, Hirst & Co., of Chester. On another stand of the associated companies named was a range of electric motors specially suitable for driving textile machinery, [illegible] 20 b.h.p. Lancashire pipe ventilated squirrel-cage [illegible] motor with a Lancashire automatic centrifugal [illegible] a 24 b.h.p. Lancashire protected type, sa[illegible] motor a 32 b.h.p. enclosed ventilated d.c. motor, the [illegible] smaller d.c. and a.c. Crypto motors. Messrs. [illegible] and Co., Ltd., of Manchester, [illegible] able tachometer or speed indicato[illegible] gines, dynamos, &c., fabricated [illegible] and transmission dynamometer [illegible] Messrs. T. Broadbent & Sons, Ltd. [illegible] model consisting of a Johnson [illegible] with a "Broadbent" controlling [illegible] laminated gear transmitting power to a brake drum. The model clearly demonstrated (1) The ease with which the motor accelerates to [illegible] predetermined speed absolutely without load. (2) The simple and positive manner in which the centrifugal clutch automatically picks up the load after the motor has accelerated. The automatic stopping of the clutch in the event [illegible] overload on the motor. The above was provided with an "Ellison" star-delta starter mounted on a pedestal along with an ammeter. Several of the roller chain manufacturers had excellent displays of their lines by showing systems of power transmission. Messrs. Hans Renold, Ltd., of Manchester, having a running exhibit driven from an overhead electric motor. Two or three B.T.H. motors were likewise employed by the Coventry Chain Co.

Messrs. Hindle, Son & Co., of Haslingden, showed electric baling presses, and examples of wireless telephone apparatus, by the Palatine Wireless Equipment Co., of Manchester. At the stand of Messrs. Ward & Co., Ltd., of Dewsbury, there was an exhibit which is an entirely new departure in the way of variable speed drives for electric motors and textile machinery.

The invention consists of an expanding pulley for a flat belt, and made its *debut* at this exhibition. The whole arrangement is ingenious and the construction throughout robust.

The exhibit also includes an arrangement for fast and loose pulleys at any diameter and altogether fills a long-felt want in the textile industry.

Messrs. Hancock & Co., Ltd., of Wallington, Surrey, exhibited their newest type of electric furnace, the heat produced passing along thick longitudinal carbon rods, which are protected against oxidisation by a patent process. They are removable and replaceable in a few minutes. Demonstrations of different types of furnace work were given. A neat working model of a steam turbine specially designed for driving textile mills was erected on the stand of the Metropolitan-Vickers Electrical Co., Ltd., Manchester. The model showed a high-pressure steam turbine running at 4,500 revolutions per minute, coupled to double helical gearing, reducing the speed on the rope wheel to about 400 revolutions per minute. From the latter, ropes are taken off for driving the various floors of the mill. A comprehensive range of smaller classes of electrical plant and apparatus are staged by the General Electric Co., Ltd., for complete electrification schemes in textile mills. Lantern slides were projected by the company at its stand. The exhibits included ¾ and 1-h.p. loom motors, loom motor starting switch, a.c. and d.c. motors, desk and porthole fans, cases showing processes of manufacture of Osram lamps, examples of turbine blading, semi-portable electric drill, lighting fittings, &c. A usefully suggestive stand was that of Messrs. Meller Bromley and Co., Ltd., of Leicester, which showed a set of electrically-heated forms for trimming hose and half-hose, electric transfer machinery for marking fabrics, and electric fabric cutting machinery. The British Thomson-Houston Co., Ltd., of Rugby, exhibited the Roxburgh control gear—a new patented device for regulating the speed of ring spinning frame motors in order to maintain a constant yarn tension; a.c. commutator motors; fractional h.p. motors and loom motors, and standard squirrel-cage induction motors; motor starting gear, including auto-transformer gear; steam flow meters; "Fabroil" silent pinions and lighting exhibits including the B.T.H. "Truetint" colour matching unit.

The exhibition, which closes to-day, was organised by the *Textile Recorder*, to which it was a "pleasurable piece of work. It has heartened us to note the variety of effort expended in bringing textile machinery to a completer state of efficiency, and it has proved to us that in every direction, either in the production of the essential machines, the provision of necessary appliances, the application of economic power generation and transmission apparatus, the textile industries of this country are most admirably served."

Absolute Zero.—The absolute zero, the lowest degree of cold, has been approached within less than one deg. This announcement was made at the meeting of the [illegible] Society on October 16th by Prof. Onnes, of Leyden, [illegible] who in 1908 liquified helium gas at a temperature [illegible] above absolute zero. Prof. Onnes stated that he reached a temperature of only 1.15 deg. in 1910, and that he had lowered that figure to 0.82 deg. He had reached the most attainable with existing processes and gases, but he felt sure that the difficulty that had arisen would be overcome.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A 4-in. Power Lathe.

A compact form of power-driven lathe is being manufactured by the Britannia Lathe and Oil Engine Co., Ltd., Britannia Works, Manchester. In this tool, as will be seen from the illustration (fig. 1), the motor is incorporated in the right-hand end of the stand, the power being transmitted through a ... belt to a spur and pinion gear. The spur is fitted to a three-speed driving wheel which transmits the power to the speed-cone of the headstock by belt. The lathe itself has centres 4¼ in. high with a maximum distance of 25¼ in. between them. Below the face-plate is a gap 1¾ in. long, which enables a disc 12 in. in diameter to be accommodated.

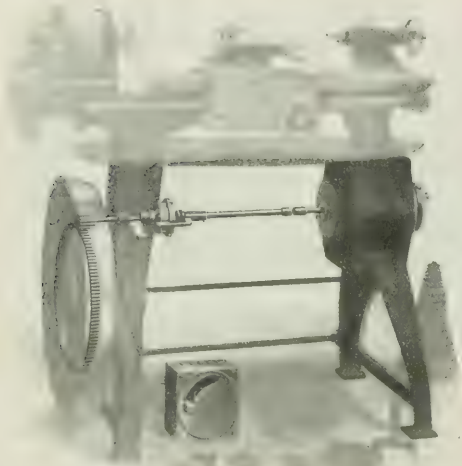


Fig. 1.—A 4-in. Power Lathe.

The headstock mandrel is mounted in roller bearings, and the back gear spindle is carried in eccentrics. The tailstock possesses an adjustment enabling it to be put out of alignment for taper turning. The slide rest is fully compound and easily removed by the unscrewing of four nuts. A number of attachments for milling, gear-cutting, boring, &c., are supplied with the lathe.

The "Unit" Time Switch.

Messrs. H. B. Turner, 79, Playford Road, N.4, have sent us a sample of their "Unit" time switch. This, we believe, is new in that it consists of an adaptation of the ordinary alarm clock. A metal frame, to which a plunger is rigidly attached, is fixed to the back frame of the clock movement. When the action of the clock reaches the release point, a pin on the alarm device raises the frame and, consequently, the plunger, pushing up the dolly of an ordinary tumbler switch mounted above the clock. The clock stands in a cast iron frame, and the switch is mounted at the back. The movement of the plunger is positive, and ample for the purpose, and the alarm can be set to within five minutes of the desired time. The makers have applied for a patent for the device.

The "Safe economy" Iron.

With a view to ensuring safety in operation and economy of energy, the Lanston Monotype Corporation, Ltd., of 43, Fetter Lane, London, E.C.4, is about to place on the market an electric iron provided with a grip switch in the handle. Directly the handle is gripped, the switch is closed, and when the grip is released, the current is automatically switched off. Thus there is no risk of absent-mindedly leaving the iron to become red-hot and burn its way through the table. Moreover, there is a marked economy of energy; tests made at Messrs. Whiteley's laundries by Faraday House of irons in actual use on similar work showed that the one fitted with the switch handle consumed only 0·28 kWh, whilst the other took 0·46 kWh, a saving of 39·2 per cent. The switch has a quick break at four points in series, and takes up very little room.

"Heatrae" Appliances.

Among the latest designs produced by Electric Fires, Ltd., King Street, Norwich, are those illustrated in figs. 2 and 3. Fig. 2 depicts a "dog-grate" model of electric fire in which the heating elements lie horizontally, the heat being projected outwards by a polished steel reflector of suitable shape. The whole construction is of steel with the recessed parts

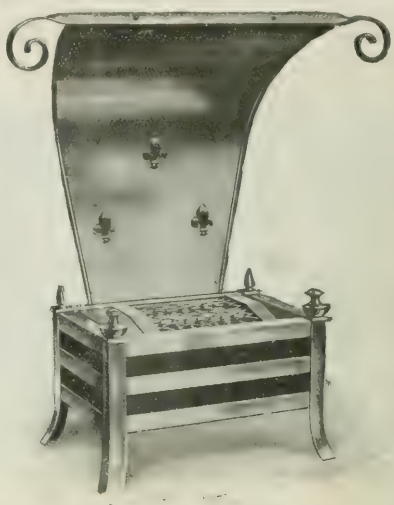


Fig. 2.—"Heatrae" Dog-grate Fire.

lacquered with art black and the prominent parts polished. There are three elements each of 1-kW loading and provided with a separate switch. The fire weighs 38 lb., its height is 3 ft. (approx.), its width 2 ft. 8 in., and its depth 1 ft. 2 in. The appliance shown in fig. 3 is a "utility" fire of novel design. As in the previous case, the elements are in a

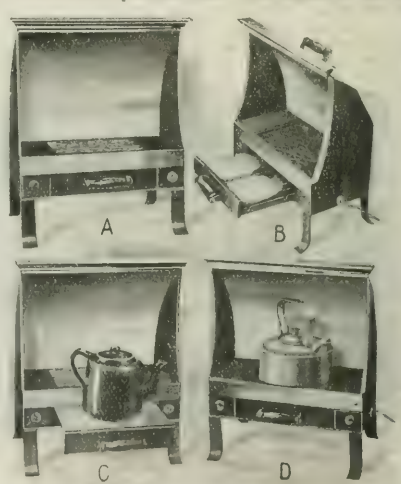


Fig. 3.—"Heatrae" Utility Fire.

horizontal plane. There are two 1-kW elements each with its own switch. The back reflector is of polished aluminium. It will be seen that the horizontal position of the elements enables the fire to be used for boiling purposes (D). In addition a trivet-toaster slides out from beneath the elements; upon this a kettle or other utensil can be placed to keep water or food warm (C). Again, the slide may be used for toasting bread by placing the slices upon it and pushing it back beneath the elements (B). The dimensions of this fire are: Height 20 in., width 16 in., and depth 10½ in. Its weight is 14 lb.

LEGAL.

High- and Low-Voltage Lamps for Southend.

In the Shoreditch County Court, on October 12th, before Judge Cluer, Messrs. J. M. Webber & Co., Ltd., 47, Great Eastern Street, E.C., electric lamp specialists, sued Messrs. Harrisons, of 88-93, Princess Street, Southend-on-Sea, electrical engineers, to recover £19 8s. for low-voltage lamps supplied. The defence, as filed, was that the defendants had paid for them, and that they held a receipt. On the case being gone into, however, it appeared that the defence really was that the lamps had never been ordered. Mr. A. E. Robinson appeared for the plaintiffs, and the defendants appeared in person.

Mr. Morris Arthur Webber, a director of the plaintiff company, said that in August he booked an order from Harrisons, at Southend, for 500 high-voltage lamps at 10s., and 500 low-voltage lamps, at 9s. By a mistake the low-voltage lamps were invoiced at 10s., whereupon the defendant wrote and said that he had never ordered them, but if they liked to take 9s. less 5 per cent. he was willing to take them. They replied that it was by a clerical error that the lamps had been invoiced at 10s.; they should have been 9s. There was no agreement to allow 5 per cent., as the sale was at 2½ per cent. cash. This was not carried out with the high-voltage lamps, as the cheque was not sent for a fortnight or more, and 5 per cent. was deducted, of which they were now claiming back half.

Judge Cluer asked the witness why he had not got a signed order, and he replied that it offended people to ask for signatures.

In cross-examination, the witness agreed that the firms had done hundreds of pounds' worth of business together, and this was simply an unfortunate misunderstanding.

For the defence, Mr. Harrison said he never gave an order for low-voltage lamps at all, as they were useless in Southend. He had paid for all he ordered, high-voltage, and considered himself entitled to 5 per cent. discount on a 500-lamp order, which a firm did not take every day. He admitted that he could not produce an invoice of a previous transaction where he had been allowed 5 per cent.

Judge Cluer: If these low-voltage lamps were of no use to you, why offer 9s.?—Defendant: Because I could have made a profit on them in London at that price.

Judge Cluer said it was the height of absurdity for a business man to suggest that lamps were of no use to him when he could make a profit on them. As to not having given the order, he called the defendant's attention to a letter, in which he said his order was at 9s. and not 10s. He considered the plaintiffs must succeed for the full amount claimed, and entered judgment for them for £19 8s., and costs.

CORRESPONDENCE.

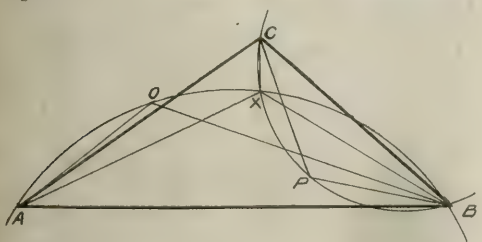
Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Calculating Currents in a Mesh-Connected Three-phase Circuit.

In the case which Mr. L. W. Schuster thinks there is no perfectly straightforward method of solving, and for which he gives a trial and error method, the following straightforward geometrical method may be of interest:—

Let the sides AB, BC, CA of the triangle ABC represent the three line currents. Assume, as Mr. Schuster does, a non-inductive load, *i.e.*, the three load currents have equal phase differences of 120 degrees.

On AB draw any triangle ABC having the angle AOB=120 degrees.



On BC draw any triangle BCP having the angle BPC = 120 degrees.

Draw circles through AOB and BCP respectively. The point X where these two circles intersect is the point which gives the three load currents AX, BX, and CX respectively. A similar construction for any other equal or unequal load power factors and consequently any unequal phase differences may be used.

Norman J. Hockley.

Manchester, *October 16th*, 1922.

Installations by Unauthorised Persons.

Referring to your very interesting paragraph from the *Melbourne Age*, it is obvious that the Melbourne Electricity Commission will not allow plumbers or other unqualified persons to carry out electrical installations. It is to be hoped that our British "Rip Van Winkles" will realise that it is high time something was done in this country to put a stop to scamped work and encourage the genuine electrical contractors. The writer has had many experiences of work carried out by "Mr. Plumber" and would feel gratified beyond measure if all plumbers and handy men were barred from interfering with electrical work. It is no exaggeration to state that a vast amount of electrical work is at present being carried out by unscrupulous persons, to the detriment of old established electrical contractors whose reputations are beyond reproach. The pity of it is, there is nothing to prevent those "Shoddy Merchants" from carrying on their nefarious work and, in fact, they seem to be encouraged by some supply authorities. The present method of most supply companies is to send an official when an installation is completed, who tests the wiring, &c., and, if satisfactory, the installation is connected to the supply company's mains. All electrical engineers will agree that a "Megger" will not disclose the secrets hidden behind walls, under floors, &c., and only time will show up the mysteries of carelessly-laid hidden cables. If supply authorities sent their officials periodically to examine electrical installations in progress scamped work would become a thing of the past and "Mr. Plumber" with his confederates would sink into oblivion.

Contractor's Foreman.

October 14th, 1922.

"How NOT to Buy."

On reading your correspondent's reply to my last letter on the above subject I immediately fell into a deep sleep; it made me feel so tired.

Luckily, however, it is not necessary for me to answer it in detail as he has not brought forward any facts to controvert my statement that the consumer of electrical goods is paying an unnecessary profit, such statements as that to the effect that a manufacturer's sales organisation will cost more than a factor's being only a dogmatic expression of erroneous opinion, not of fact.

When it comes to swapping instances, I can give him one of a manufacturer who left his selling organisation entirely to one or two wholesalers to whom he sold his whole output. Unfortunately, on the outbreak of the slump, they decided to drop him and as his goods had never gone under his own brand he had a very strenuous time until he managed to build up his own sales department. A second cousin, I heard, of the prodigal manufacturer previously mentioned, who returned to his loving factor because he couldn't get enough husks elsewhere.

Every traveller knows that a certain amount of conviviality is necessary to obtain business, and this ranges from Masonic dinners and luncheons at the Engineers' Club at one end of the scale, to a pint of bitter over the saloon bar at the other, but to suggest—or to suggest that I suggested—that all contractors' orders to factors are vows made in wine is absurd.

Your correspondent's reference to Eastcheap is not particularly happy as I spent four years of my business life there and could probably cap his list of food factors—Kelly's Directory could beat us both at that—but that does not alter the fact that the tendency among food producers is to cut out the wholesaler.

As to the personal part of the business, your correspondent is very much out in his suggestion that I am a disgruntled manufacturer's inside man, and as it appears to be my turn to show—in my opponent's practical fashion—my appreciation of the advertising value of the Electrical Review "Correspondence" column, I will mention that I am, in theatrical parlance, "resting."

Walter Shandy.

October 16th, 1922.

Labour Policy: False and True.

In your article on Sir Lynden Macassey's book you mention the fact that the E.P.E.A. is the only staff union that has set seriously about improving the lot of its members.

It is undoubtedly true that the E.P.E.A. has done a lot for many of its members, but there is a tremendous lot still left undone. Recently I visited a friend who is charge engineer at a 20,000-kW station. The watch-office was like a dog's kennel. No bathroom, a very feeble apology for a wash-hand basin, a rough wooden table, one broken-down kitchen chair, and paltry little lockers not large enough to contain a change of clothes and barely large enough to accommodate the few technical works of reference, &c., that

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most engineers like to keep by them. The salary, attained after three years' service, at present "cost-of-living" rates is £353 by E.P.E.A. schedule—this for the entire responsibility of something like a million pounds' worth of delicate, complicated interconnected plant for eight hours a day, six days a week. The holidays, after a year in that vile atmosphere, generally at a temperature "not fit for a white man to work in," with that nerve-racking responsibility and that constant nerve-racking noise (probably, if all the subconscious truth were known, the most wearing factor of all), the holidays are 14 days, rising one day per year to a maximum of 21 days. Just the same as any office man doing 38 hours a week and never a night out of bed. If the four charge engineers were raised to Grade 5, E.P.E.A. schedule, the total cost would be £400, about .002 of a penny per unit sold. The cost of an additional charge engineer, by means of whom it would be possible to run six-hour shifts, would mean another .0021 of a penny. And it is more than probable that the added vigilance that shorter hours, better conditions and more pay would enable a man to maintain, would result in at least 01 of a penny being knocked off the cost. Power station engineering is now an advanced science, and, as one authority has recently said, "the price of efficiency is eternal vigilance"; and the very high degree of mental vigilance necessary to the man who takes charge of a modern power station cannot possibly be maintained for long hours without a break in a vitiated atmosphere. Anyway, salaries are such a small item in the total cost of most stations that if they were doubled or halved there would not be any very material difference in the profit or loss. A glance at the records of most stations shows that they are making handsome profits, and, as a correspondent in your columns recently pointed out, there is, in most cases, no real reason for any reductions at all. In fact, most stations with the highest salaries cost show the most profits. For instance, Liverpool, with salaries at .21d. shows £146,964 profit; Manchester, at .11d., only shows £44,564; Leeds, at .14d. shows £26,891; Sheffield, at .07d., only £11,824; Glasgow, at .13d., shows £161,576; Birmingham, at .07d., only £68,161. Among smaller stations, Tunbridge Wells, at .53d., shows £7,465, while Swansea, at .14d., shows a loss of £3,866—and it serves them jolly well right! It must be quite obvious to the meanest intellect (and some power station authorities are pretty mean!) that the one secret of success in station work is to keep the salaries factor very high.

Anyway, the alleged cost of living reductions are getting about the limit, and it is about time the E.P.E.A. called a halt.

Welfare.

October 15th, 1922.

The Status of the Electrical Contractor.

Is it any worse for a "painter and paperhanger" to take charge of a colliery plant than for a hot-water and sanitary-engineer to paint on his signboard "Electrical Contractor"?

Why is it considered right and proper for a contractor—electrical or otherwise—to act as a consulting engineer, but wrong and improper for the latter to take contracts?

Consultant.

London, *October 15th*, 1922.

Estimating for Internal Wiring Contracts.

In the correspondence that has arisen from my article entitled "Estimating for Internal Wiring Contracts," which appeared in your issue of September 1st, there is a general expression of opinion that the existing methods of obtaining estimates for internal wiring contracts are unsatisfactory.

The recognition of this fact is a first step in the right direction; logically, the next step is to explore all possible avenues leading to ultimate improvement of such faulty methods.

It was with this aim in view that the writer submitted his suggestions for the adoption of "Electrical Bills of Quantities," in conjunction with specification and plans, as an improved means of obtaining tenders.

"Lodestone," in your issue of the 6th instant, agrees that "bills of quantities satisfy quality and quantity," but continues with a non-contentious assertion that bills of quantities do not eliminate the need of specification and supervision.

Properly prepared bills of quantities, preferably in the form of "spot" bills, with an abstracted summary for pricing, give the following definite advantages:—

(1) Actual amounts of material included in the contract are given.

(2) Quality of material is specified.

(3) Inspection of materials is indicated.

(4) Schedule of rates usable for variations is provided.

(5) Measuring up and taking off of quantities is carried out by the surveyor only, in lieu of each contractor tendering.

(6) The client obtains an absolutely reliable index to the items of expenditure.

The writer has not touched upon all the points raised by your correspondents owing to their irrelevant nature.

Alan Kirk.

London, S.W.1,
October 16th, 1922.

The British Society of Engineers.

Referring to the "Institution Notes" in your issue of May 19th, 1922, *re* the British Society of Engineers, we should like to obtain the views of your readers on the value of the diploma which this society awards, we understand, by examination. Perhaps some one could enlighten us as to the activities of this society, and the advantages obtained by being a member.

Students (Electrical).

October 12th, 1922.

Electricity Supply Problems.

An interesting situation has arisen in a certain Sussex town, in which an electricity supply company has completed an agreement with the local Council for supplying the town with electricity. Apparently, one of the clauses is to the effect that a Provisional Order would be applied for at once, but this has not been done, and the company is either refusing point blank to connect, or charging a fee of £10 for connecting houses where the wiring has been done by outside contractors, the grounds of its action being that the Council gave it this right. Even the contractors living in the parish are barred from doing wiring work in their own town.

It seems as though the Council has been "had" and is powerless to act, as it does not move in the matter. Probably, when the supply company has forced as many people as possible to have the wiring carried out at its own price and on its own terms, at a "take it or leave it" penalty, it will apply for a Provisional Order for a bigger area.

Now there is a group of persons who do not intend to be treated in this way, and would rather club together for a plant of their own (the rest of the town being too apathetic to move). The doubtful points are these:—

(1) Can they pay for the running of the plant by meter?
(2) Can their wires cross a main road (from house to house)?
(3) How will they stand when the supply company gets a Provisional Order?
(4) Has the Council powers to grant a monopoly (without a Board of Trade order) either outside or inside owners' houses, such as is claimed at present?

It is of interest to find that a similar concern is being promoted in a district in Kent, and it is to be hoped that the local authorities concerned will keep awake, or their juice "will cost them more."

A Lost Unit.

[Provisional Orders have been replaced by "Special Orders," granted by the Electricity Commissioners, whose consent, by the way, must be obtained before any plant for public supply is established. (1) Yes. (2) Yes, if wayleaves are obtained from the house-owners or tenants, and the Electricity Commissioners' Rules are complied with. (3) The supply company cannot interfere, if the private group's operations are carried out before the Special Order is obtained. (4) No.—Eds. Elec. Rev.]

Do Motors "Go Bad"?—In the letter on p. 538 of our last issue, line 2 from foot of first column should commence with the word "not."

An Electrically-equipped Liner.—A special feature of the *Volendam*, a large Holland-America liner, built by Messrs. Harland & Wolff at their Govan shipyard, and which has run successful trials, is the electrical installation. There are four generating sets, each capable of giving 2,270 A at 110 V. In addition to these, there is an emergency Diesel engine direct-coupled to a dynamo, situated aft above the water line, capable of supplying 680 A at 100 V. There are over 2,200 lights distributed throughout the passenger accommodation and machinery spaces, some of those in the engine room and for working cargo having an illuminating capacity of 1,000 c.p. There are two motors driving the steering gear, either of which can, if required, provide the necessary power. There is also an auxiliary motor which takes the place of the more usual hand gear. The windlass, capstans, and all the winches, including those operating the boats, are electrically driven. The first-class rooms, including the public rooms, are supplied with electric radiators. The water-tight doors on the tank tops are all operated electrically from the bridge, where there is an indicator to show the position of each door at any time. All the auxiliary machinery in the engine-room, comprising over 30 motors, is electrically driven, including the refrigerating machinery and main circulating pumps. In the boiler-rooms Messrs. Harland & Wolff's electrical oil igniters are installed for lighting up the oil burners. There is a very complete installation of electric clocks, all controlled from a master clock in the chart-room. Among the other electrically-driven apparatus are potato peelers, dish washers, dough mixer, ice-cream machine, egg mixer, meat chopper, coffee mill, knife cleaners, ash hoist, fire extinguishers, and also hot plates and hot-water boilers, as well as two electrically-driven pantry hoists.

BUSINESS NOTES.

The "Electrical Review" Jubilee.—With the issue of this journal dated November 17th we shall complete fifty years' publication, the Review having been started on November 15th, 1872. This jubilee issue will be very much larger than our ordinary weekly number, and a considerable part of it will have to go to press early. That being so, we desire to draw the attention of advertisers to the announcement which is made in our advertising pages to-day. The possible space is strictly limited and the scheme has to be closed promptly.

Bankruptcy Proceedings.—Wm. Reginald James White, electrical agent, late of Golden House, 29, Great Pulteney Street, W.—The first meeting of creditors under this failure was held last week at the London Bankruptcy Court, a receiving order having been made on the petition of a creditor on September 28th. Mr. Walter Boyle, Official Receiver, reported that it appeared from the debtor's statements that for some twenty years prior to September, 1920, he held a commission in the Forces, and then retired with a gratuity of £3,300. He became partner in an electrical business, carried on at 29, Great Pulteney Street, W., under the style of "Dent & White," paying £200 for a one-half share, and introducing £300 as capital. The partnership was merely verbal and no capital was found by the partner who retired six months later. The debtor was joined shortly afterwards by another partner, who paid £500 for a one-half share of the business and £50 as premium. The business was continued under the style of "White & Dayrell" until the partner resigned last May. The firm was then quite solvent and the late partner left his capital in the business on condition that he should be released from all liabilities. The debtor was subsequently joined by another partner who was given a one-sixth share in consideration of services rendered. The business was now being carried on as electrical agents and factors, and the debtor attributed his failure to losses on investments. The case was left in the hands of the Official Receiver. The accounts showing liabilities of £1,150 against assets £45 gross and 10s. net.

S. H. Dougherty (Mersey Electric Co.), electrical engineer, Liverpool.—Trustee, Mr. H. W. Bowler, 30, North John Street, Liverpool, released September 6th.

H. A. Depledge, electrical engineer, 53, Frodingham Road, Scunthorpe.—Last day for proofs for dividend, October 28th. Trustee: Mr. S. M. Forrester, 1, Town Hall Street, Grimsby.

F. J. Martland (F. Martland & Co.), electrical engineer, Albion Yard, Millgate, Wigan.—Last day for proofs for dividend, October 28th. Trustee: Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool.

G. F. Coupe, electrical engineer, 2, Spring Gardens, Stockport.—The first and final dividend of 10d. in the £ payable October 23rd, at the Official Receiver's Offices, Byrom Street, Manchester.

Charles Johnson Haxby and Edward Brady, trading as Haxby & Brady, 1a, East Parade, Harrogate, electrical engineers.—The first meeting of the creditors of the above was held on October 16th at the Court House, Harrogate. The statement of affairs showed gross liabilities of £538, of which £508 was expected to rank, against net assets of £314, or a deficiency of £194. Debtors attributed their failure to insufficient capital, keen competition, bad debts, and law costs. The case being a summary one was left in the hands of the Official Receiver as trustee.

The following are creditors:—

	£		£
Albion Electric Stores	29	Fox, W. Dundas	20
Baxendale & Co., Ltd.	14	Morley, T. B., & Co., Ltd. ...	11
Chadwick, E.	32	Russell, J., & Co., Ltd.	15
Shanks, D., & Co., Ltd.	11	English Electric & Siemens Supplies Co., Ltd.	29
Electric & General Stores, Ltd.	83		
Electric Engineering & Equipment Co., Ltd.	11	New Italian Art Association, Ltd.	10
Edison Swan Electric Co., Ltd.	23	Wilson, Hartnell & Co., Ltd. ...	16
Falk, Stadelmann & Co., Ltd. ...	27	Parr, Harold	10

George William Humphry, trading as Humphry Electric Co., 24, Broad Quay, Bristol, electrical engineer.—The receiving order in this matter was made on October 3rd, on debtor's own petition. The statement of affairs shows liabilities of £467, while the assets are estimated to realise £339. The net assets are £311, or a deficiency of £156. Debtor attributes his failure to bad trade, loss of capital of £68 invested in Farrow's Bank, Ltd., and depreciation of shares for £500 invested in an electrical company. It appears that after being employed as an electrical engineer until 1905, he took a course of technical training, and in 1911 commenced as a consulting engineer. In 1914 he obtained an engineering appointment, which he had to give up in March, 1915, on account of ill health. In 1917 he commenced business as an electrical engineer as the Electrical Repair Co. His capital consisted of £30 in cash, but in addition he had two houses of the value of £600. In 1919 he removed to 25, Warwick Road, Bantist Mills, Bristol. In April, 1920, he was appointed a director and engineer of a company at Avonmouth, and until December, 1920, he was employed in purchasing the necessary machinery and carrying out the work of installation of the company. He states it was his intention to form his own business into a limited liability company, and in December, 1920, he removed his stock and plant to Avonmouth, but the negotiations fell through. In March last he removed to his present address. He became aware of his position in February, 1921.

Company Liquidation.—Jones Brothers, Ltd., Wolverhampton.—A meeting of the creditors of the above was held at the Victoria Hotel, Wolverhampton, recently, when it was reported that the company had gone into voluntary liquidation, with Mr. M. Wilkie, C.A., of 22, Darlington Street, Wolverhampton, as liquidator. It was stated that he, as receiver, had offered the business for sale as a going concern, but it had not been disposed of. The present position was attributed to the slump in trade which followed the armistice, and heavy loss on the realisation of the stock. In answer to a question, the receiver stated that it did not appear that there would be a very substantial dividend for the unsecured creditors, and he was in negotiation for the sale of the business privately. It was decided to confirm the voluntary liquidation of the company with Mr. Wilkie as liquidator.

Dissolutions of Partnership.—T. W. Craig & Co., electrical engineers, 3, Church Road, Waterloo, Lancs.—Messrs. T. W. Craig and E. H. Wells have dissolved partnership. Debts will be attended to by Mr. R. T. Goulding, chartered accountant, 41, North John Street, Liverpool.

Lee & Bufton, electrical engineers, Fornham Street, Sheffield.—Messrs. H. Bufton, W. Marples, and C. Marples have dissolved partnership. Debts will be attended to by Messrs. H. Bufton and W. Marples, who will continue the business.

Trade Announcements.—Messrs. Rice, Wilson & Herd, of Johannesburg, dissolved partnership on September 30th. Mr. F. Peabody Rice and Mr. C. Diethelm then entered into partnership as Rice & Diethelm, Ltd., with offices at Standard Bank Chambers, Johannesburg, where they represent a number of well-known electrical manufacturers. Messrs. C. E. Wilson and Philip Herd have formed a firm under the style of Wilson & Herd, with head office at Johannesburg (Standard Bank Chambers), and a branch office at Cape Town (3, Waterkant Street). They will represent a different group of equally well-known British electrical manufacturers.

Mr. John Brunton, of 28-30, Lime Street, London, E.C.3, has been appointed agent for the Universal Bolts & Nuts, Ltd., of Old Hill, Birmingham, suppliers of bolts and nuts for telegraph and telephone ironwork and other purposes. Illustrated leaflets have been issued.

Owing to increased business in the Liverpool branch area Messrs. W. T. Henley's Telegraph Works Co., Ltd., have taken larger premises at 37-41, Duke Street, Liverpool, and all communications should now be sent there instead of to Whitechapel. Larger stocks of wires and cables and other manufactures will be carried. New telephone number: "Liverpool, Royal 790."

Messrs. Hobdell, Way & Co., Ltd., engineering merchants, &c., have removed from St. John's House to 45, Church Street, Minories, London, E.1. The new warehouse address is Haydon Square, Minories, E.1. Larger stocks will be carried and the insulating and asbestos departments extended.

Catalogues and Lists.—Alloy Welding Processes, Ltd., 14-16, Church Street, N.1.—A pamphlet describing electrodes for the welding of non-ferrous metals.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Leaflet No. X2828.—A list of reduced catalogue prices of low and medium-pressure switchgear.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A booklet describing the "Relay" system, and containing letters of appreciation from clients, and illustrations of buildings in which the system is installed.

Electric Fires, Ltd., King Street, Norwich.—September list of electric fires. Fully illustrated and priced.

Messrs. Archibald J. Wright, Ltd., 395, City Road, E.C.1.—An illustrated price list of electric pocket lamps, torches, and electrical novelties.

Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, W.4.—List No. 154, illustrated and priced, being a full description of the "Meg" insulation tester, a new product of the firm.

Radio Instruments, Ltd., 12, Hyde Street, Oxford Street, W.1.—An illustrated price list of wireless apparatus of all kinds.

Ironclad Switchgear Co., Ltd. (Eccles), 23, Queen Anne's Gate, S.W.1.—A mailing card advertising the firm's switch and fuse gear.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—A series of pamphlets, &c., dealing with "Mazda" lamps, "X-Ray" reflectors, and "Keldon" and "Ace" lighting units.

The Selson Engineering Co., Ltd., 83-85, Queen Victoria Street, E.C.4.—Catalogue No. 114, giving numerous illustrations and particulars of braiding machines, cable and wire-rope machinery, &c.

Lanston Monotype Corporation, Ltd., 43, Fetter Lane, E.C.4.—An illustrated pamphlet describing an electric iron fitted with a grip switch in the handle.

The Mullard Radio Valve Co., Ltd., 35a, Claybrooke Road, W.6.—A showcard illustrating, in colours, examples of the firm's wireless apparatus.

Messrs. John Musgrave & Sons, Ltd., Globe Iron Works, Bolton.—A treatise upon the design, installation, and maintenance of the "Radojet" air pump. The publication is fully illustrated by means of diagrams and photographic views, and the capabilities of various sizes of "Radojet" pumps are given in tabular form.

Messrs. Greenly's, Ltd., 37 and 38, Strand, W.C.2.—"Greenly's Ghost," a little magazine dealing with the firm's publicity organisation.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—List No. 375, illustrating and describing "Sunco" switch boxes for recessing into walls, &c. Also a folder advertising "Sunco" electric fires. Both publications are priced.

Mr. Frederick Tuckett, 87, The Grove, Hammersmith, W.6.—An illustrated catalogue of shades for electric light pendants, standards, &c., together with a net trade price list.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Price List 2110, containing illustrations, details, and prices of ironclad oil-break switch pillars of various types.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C.2.—Publication W.L. 4, giving details, illustrations, and prices of "Isco" 30- and 60-A single-pole cut-outs.

Messrs. Herbert Kennedy & Co., Ltd., 47, Victoria Street, S.W.1.—Illustrated booklet describing the "Electroscope," a new optical-mechanical device, which visually slows the motion of mechanisms, so that their functioning can be observed, and also enables production to be speeded up.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Twelfth addition of general catalogue (151 pp.) dealing in a comprehensive manner with the company's products—telephones, switchboards, bells, indicators, batteries, wires, mine exploders, &c. Fully illustrated and priced.

The Jeary Electrical Co., Ltd., 8, Lambeth Hill, Queen Victoria Street, E.C.4.—Catalogue Q 1922, giving illustrations and prices of crystal and valve wireless receiving sets, components, and accessories.

Messrs. Casey, Bean & Cassells, 63, Queen Victoria Street, E.C.4.—List No. 822, a pamphlet dealing with the "Super" improved rim friction clutch. Profusely illustrated by examples of applications.

Expanding Pulley & Electric Co., Thornhill Lees, Dewsbury.—An illustrated folder describing a motor-driven expanding pulley set.

Our Foreign Trade.—September Figures.—The following were the values of imports and exports of electrical goods and machinery during September, 1922:—

	Sept. 1922.	Inc. or dec.	Inc. or dec. 9 months 1922.
Imports.—	£	£	£
Electrical goods and apparatus	129,488	+ 5,775	− 570,744
Machinery	623,222	+ 76,491	− 3,035,118
Exports.—			
Electrical goods and apparatus	524,142	− 400,625	− 5,247,233
Machinery	4,280,692	− 917,225	− 19,792,512
Re-exports.—			
Electrical goods and apparatus	7,525	− 6,082	− 52,305
Machinery	99,086	− 5,491	− 184,081

Local Exhibition.—An electrical exhibition, in which a number of leading firms will participate, is to be held at Villa Marina, Isle of Man, from October 25th to November 6th. This will be of some importance in view of the scheme of electricity supply now being carried out by the Douglas Town Council.

A New Power House in Gloucestershire.—In September last the Electricity Commissioners issued a sanction to the Norchard Syndicate, Ltd., for the erection of a power house to supply a delimited area in Gloucestershire. We are informed that the name of the company has been changed to the West Gloucestershire Power Co., Ltd., the capital of which is being increased to £285,000, with necessary borrowing powers, and that work has been started on the erection of the power house at Lydney, which is designed for an ultimate capacity of 30,000 kW, of which 10,000 kW is already on order. It is expected that the whole of the power available will be absorbed very rapidly, as a large amount is required for the collieries and for industrial purposes over the area of supply, which is 300 square miles. We understand that the contractors are The Foundation Co., Ltd., who have undertaken that current will be available early next year. The contract is a comprehensive one, including the distribution system throughout the area. The contractors state that they will not require any addition to their staff.

Electrical Enterprises in Japan.—Japanese electrical supply companies would seem to be prospering in contrast with other classes of undertakings, due, in part, to the progress made in the amalgamation of various companies.

According to the returns published by the authorities, the generating power showed an increase of 40,000 kW during the first half of last year over the corresponding period of the preceding year, and an increase of 81,000 kW during the first half of the current year over the corresponding period of the preceding year.—*Reuter's Trade Service* (Tokio).

Boiler Manufacture in Sweden.—*Dagens Nyheter* learns from Gothenburg that the Goetevorkon shipyards have taken over the rights of manufacturing and selling Babcock & Wilcox boilers in Sweden. These rights were previously held by the Hunktell engineering works.—*Reuter's Trade Service* (Stockholm).

French Companies.—Fibrett Mica is the style of a company formed with a capital of 1,000,000 fr., for the manufacture and sale of all kinds of electrical insulators. Its offices are at Villeurbanne (Rhône). The company is an off-shoot of the Compagnie Electro-Mécanique, from whom it takes over certain assets.

La Compagnie Française d'Applications Electriques is the name of a new undertaking which has lately been formed in Paris (168, Rue du Faubourg, St. Honorè), with a capital of 100,000 francs.

Lead.—In their report dated October 14th, Messrs. James Forster & Co. state:—"There has been a considerable demand from consumers this week for November and December delivery, but for spot or near lead, fortunately, they appear to be comfortable. No doubt consumption is increasing—the building trade is much more healthy and electrical cable work is better. The Board of Trade returns for September show: Imports 17,030 tons, exports 1,373 tons, leaving for home consumption 15,657 tons."

Book Notices.—We have received a copy of the October edition of "The Buff Book," published by Business Telephone Directories, Ltd., of 25, Lawrence Lane, E.C., which contains, in addition to the usual classified lists of London traders and London professional classes, alphabetically arranged, a Hotel section, which gives the names of the principal hotels in the British Isles, the Continent, Egypt, &c.

Faraday House Journal.—The Michaelmas term number, Vol. X, No. 1, of this well-known house organ, in addition to the usual notes and notices of interest to Faradians, contains an article by Mr. C. I. Walker, on "Boiler Feed, and its Influence on the Economic Performance of Boiler Plant," while the subject of "The Application of Electric Traction to Industry," is dealt with by Mr. A. D. M. Eaton.

"Working Diagrams of Valve Receiving Circuits" (21 diagrams). London: Radio Instruments, Ltd. Price 1s.—These diagrams show simple forms of valve receiving circuits not usually included in text-books. Special arrangements for "broadcasting" reception are embodied in the booklet.

"Electric Drive in Textile Mills" (Descriptive List No. 640A). Rugby: The British Thomson-Houston Co., Ltd.—This is a well-produced brochure in which are set out the advantages of the electrical driving of textile machinery, the methods of installing motors, and other relevant details. The publication is profusely illustrated with clear photographic views of installations, &c.

"Post Office Electrical Engineers' Journal." Vol. 15; part 3. October, 1922. London: The Electrical Review, Ltd. Price 2s. net.

British Trade Mark Applications.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below. In the case of foreign firms, the address in this country to which objections are to be sent is also stated:

Radion. No. 427,065. Class 40. Electric insulating materials of hard rubber and vulcanite. The American Hard Rubber Co., 11, Mercer Street, New York, U.S.A. (Haseltine, Lake & Co., 28, Southampton Buildings, London, W.C.). October 11th, 1922.

Broadco. No. 427,612. Class 8. Telephone, telegraph and wireless apparatus, and components. Gordon O. Tutton, trading as the Broadcast Wireless Co., 2, Tower Royal, Cannon Street, London, E.C. October 11th, 1922.

Ethophonola. No. 128,250. Class 8. Self-contained receivers and sound-diffusing apparatus for wireless telephony. Burndept, Ltd., Ariel Works, Blackheath, S.E.3. October 11th, 1922.

Sunray. No. 424,577. Class 13. Incandescent electric lamps (ordinary). The Harland Engineering Co., 196, Greengate, Manchester. October 11th, 1922.

For Sale.—Darwen Corporation Electricity Department has for disposal one 150-kW d.c. Belliss-Siemens steam dynamo, with spare armature, condenser, valves, and steam piping, &c. —Belfast Corporation Tramways Department invites offers for 2,000 tons (approx.) of old rails, crossings, fishplates, &c. (See our advertisement columns to-day.)

Tuition in Traffic Problems.—We have received from the National Traffic College (Royal Liver Buildings, Liverpool) a pamphlet relating to two courses of instruction which have been prepared for the assistance of those responsible for or interested in the transportation questions of trade and industry. The courses deal respectively with "The Science of Industrial Traffic Management," and "The Art of Shipping Goods Abroad." They are prepared by those who have had very lengthy practical experience in traffic management. The pamphlet sets forth the lists of subjects covered in the two courses. In addition to the correspondence tuition thus provided, the student is also helped with his day-to-day problems in the position that he fills with the firm or authority employing him.

Siemens & Halske.—The 75th year of the existence of the Siemens & Halske undertaking was celebrated in Berlin on October 12th, the concern having been formed in 1847 by Werner Siemens & J. G. Halske, as a telegraph manufacturing business. In 1897 the firm was converted into a joint-stock company, and the number of persons employed, together with those of the Siemens-Schuckert Works, is stated to be close on 100,000 at the present time.

Swansea Electrical Exhibition.—After a most successful run the Corporation Electrical Exhibition closed on Saturday evening. Mr. Hodge, of the British Thomson-Houston Co., Ltd., on behalf of the exhibitors generally, presented the Borough Electrical Engineer and Mrs. J. W. Burt with a handsome standard electric lamp, and Mr. and Mrs. Harvey Davies with an electric coffee percolator. In handing over the gifts Mr. Hodge commented upon the excellence of the general arrangements, and declared it was one of the pleasantest exhibitions with which he had ever been associated. He added that the exhibitors were well satisfied with results. In acknowledgment Mr. Burt said that he was delighted to know that the exhibitors were well satisfied with the orders received. It was a great satisfaction to him to know that over 25,000 people had visited the exhibition. That was a number he had not dared to anticipate. As to expenses, these, so far as could be judged, had been met, but the exhibition was intended to educate the public into the greater uses of electricity rather than to make profits.

New Belgian Company.—There has been formed at Brussels (Rue du Frône, 91) the Etablissements Industriels G. Landare, for the installation, sale, and manufacture of electrical apparatus, and especially of that for heating and lighting. Capital 500,000 fr.

Proposed Belgian Electrical Exhibition.—The scheme to hold an international electrical exhibition in Brussels in 1925 has not been wholly abandoned, as has been supposed in some quarters. It is true that the Comité Central Industrial has pronounced against it, but the Chambre Syndicale des Electriciens Belges and other organisations interested in the electrical industry have not yet expressed their opinions on the subject, and, says *L'Electricité pour Tous*, nothing definite can be assumed until they do so.

Costing.—On November 2nd, Lord Leverhulme, president of the Institute of Cost and Works Accountants, will address a public meeting to be held in Manchester under the auspices of the Manchester and District Branch of the Institute, on "Human Factor Influence on Costs." The Lord Mayor of Manchester will preside. Tickets can be obtained from the hon. secretary of the Manchester and District Branch of the Institute of Cost and Works Accountants, Mr. F. Ewing, F.C.W.A., 232, Stockport Road, Cheadle Heath, Stockport.

LIGHTING AND POWER NOTES.

Abergavenny.—Electricity Supply.—The Town Council has under consideration a proposal to supply the town with electricity.

Australia.—New South Wales.—The Minister for Works has under consideration, states the *Sydney Daily Telegraph*, an important proposal for the establishment of a State Electricity Commission, on the lines of the body which is developing the Victorian brown coal area at Morwell. The establishment of schemes at Burrinjuck and on the North Coast of the State are in contemplation, and a large amount of data has been collected by the Public Works Department with regard to hydro-electric energy. Various bodies in the south-west of New South Wales are urging the Government to proceed with the Burrinjuck project, which will cost approximately £350,000. It is also stated in Sydney that the Railway Commissioners have tentatively decided to proceed with the big scheme for a power station, either in or near the town of Lithgow. In the course of a letter to the Blaxland Shire Council, the Secretary to the Commissioners, said that it was proposed to lay down a plant that would to a great extent meet the demand for lighting and power throughout a large area of the western district.—*Reuter's Trade Service* (Melbourne).

Aylesbury.—Wiring Scheme.—The Town Council has adopted an "assisted" wiring scheme for houses. The wiring is to be left in the hands of local contractors provided that their charges do not exceed £1 per point.

Birkenhead.—Special Order.—The Town Council have applied to the Electricity Commissioners for a Special Order extending the area of supply to the Urban Districts of Bebington and Bromborough.

Chester.—Purchase of Plant.—The Electricity Committee has recommended that the plant at Queensferry be purchased for £54,000, and that application be made to the Electricity Commissioners for sanction to borrow that amount. On completion of the purchase of this plant, the Committee recommends that two additional transformers and switchgear be obtained at a cost of £6,000, and pumping plant at a cost of £1,500.

China.—South Manchuria.—H.M. Consul at Dairen reports that the South Manchurian Railway Co. proposes to expend about 30,000,000 yen (£3,250,000) upon new developments. This will include 2,007,881 yen for electrical works, such as the extension of the third power station at Antung and the Changchau works. The company's supply system will be enlarged, and the tramway system in Dairen extended.

Cirencester.—Fire at Electricity Works.—Damage estimated at several thousands of pounds was caused on Friday last by a fire at the electricity works. The cause of the outbreak has not yet been ascertained. The power station was a practically new building, was equipped with some of the most up-to-date machinery. There were several sets of generators and batteries at the works, and two of them are totally disabled. Thanks to the promptitude of the local fire brigade, a practically new set was saved. The staff was able to remove a quantity of inflammable oils from the zone of the fire, and so avoid explosions and greater conflagration. The lighting service was partially restored on Saturday, and for use in the churches on Sunday.

Clevedon.—Application for Order.—The North Somerset Electric Supply Co. has applied to the Electricity Commissioners for an order enabling it to supply electricity to the district by overhead wires.

Continental.—France.—According to a recent publication of the French Ministry of Public Works the power of the hydro-electric stations installed at the present time in France totals about 2,100,000 h.p., sub-divided as follows: Lighting, small motive power, and heating, 650,000 h.p.; industrial motive power, electrochemistry, and electro-metallurgy, 1,300,000 h.p.; electric traction, 50,000 h.p.; agriculture and sundry, 100,000 h.p. At the end of the war, the total installed power amounted to 1,500,000 h.p. The latest figures consequently show an increase of 40 per cent. The power of stations now under construction and expected to be finished within two years from date, may be estimated at about 300,000 h.p.

The Conseil Général of the *département* of Eure-et-Loir has taken in hand a large scheme of electrification affecting some 350 communes. A distribution network of 165 km is projected, to be fed from an existing generating station at Aube in the neighbouring *département* of the Orne, calculated to furnish 5,500 kVA, of which 500 kVA will be allotted to agricultural purposes. The scheme is estimated to cost about 40,000,000 frs, and private installations about the same amount.

Dalton-in-Furness. — Electricity Supply.—The Urban Council has asked the Barrow-in-Furness Town Council to extend its area of supply so as to include the whole of the Urban District, with charges the same as those ruling at Barrow.

Ealing.—Price Reduction.—The electricity charges have been reduced from 9d. to 8d. per kWh for lighting, and from 3d. to 2½d. per kWh for power.

East Lothian.—Electricity Scheme.—The chairman of the County Council has reported that the Council has been in touch with the Musselburgh Electric Light and Traction Co., and a scheme has been formulated, whereby a new company will be formed to deal with the electricity supply for the whole county. Mr. Cownie, managing director of the Musselburgh Company, is willing to undertake this, provided that a bulk supply can be obtained from Edinburgh Corporation on reasonable terms.

Halifax.—Year's Working.—The accounts of the municipal electricity undertaking (engineer Mr. W. M. Rogerson) for the year ended March 31st last show that the total revenue was £169,383, comparing with £182,998 in the preceding year. The working expenses amounted to £105,396 as against £126,983, leaving a gross balance of £63,986 (£56,015). After crediting interest on investments (£3,247 and deducting capital charges (£46,776), the net result was a profit of £20,461, which was slightly in advance of the previous year's profit of £20,124. This was transferred to the appropriation account together with other credits. Against this total was charged a deficit of £31,052 from the previous account, capital and other special expenditure amounting to £22,774, and other charges, totalling £6 2s., leaving a deficit, carried to the balance sheet, of £37,574. The total expenditure on capital account was £88,9[illegible]. This

included items of £[illegible] and £15,671 in respect of a 10,000-kW turbo-alternator set, and £15,778 for mains and services. The energy sold was 15,737,512 kWh. as compared with 18,521,577 kWh in 1920-21. The total costs per kWh sold rose from 2.110d. to 2.263d., although the actual generating cost was reduced from 1.645d. to 1.601d. per kWh.

Hastings.—Price Reductions.—The Town Council has adopted the following revised scale of charges per kWh for electricity: General lighting, 7.8d., as against 6½d. pre-war rate; arc lighting, 5.4d. as against 4½d.; power and heating, 2.4d., as against 2d. Consumers whose accounts at 7.8d. amount to £100 and upwards are to be allowed 25 per cent. discount for electricity consumed up to March 31st next.

Horwich.—Special Order.—The Urban District Council is applying to the Electricity Commissioners for authority to generate and distribute electricity for all purposes within the district.

India.—Punjab.—*Indian Engineering* reports that at a meeting of the Punjab Electricity Board earlier in the year it was resolved that the Government should create a monopoly for generating electricity from the rivers and canals of the province, and for supplying energy in bulk. The Subera Hydro-Electric & Agricultural Development Association was asked to undertake the development of the water power on the understanding that any profit made in excess of 11 per cent. (including 3 per cent. for depreciation) should be divided in the proportion of one quarter to the association and three-quarters to consumers in the form of reduced rates.

Gazipur.—The Government of the United Provinces is prepared to grant a licence in accordance with the provisions of the Indian Electricity Act, 1910, for the electrification of the town.—*Reuter's Trade Service.*

Burma.—According to *Indian Engineering* an extensive scheme is in contemplation for supplying electricity to Burma. It is proposed to divert the waters of the Yunzalin river down a slope and through tunnels, thereby supplying the motive power for the generation of electricity for transmission to Rangoon.

Inverness.—Hydro-Electric Scheme.—Sir W. G. Armstrong, Whitworth & Co. are preparing a hydro-electric scheme in connection with the Caledonian Canal. They will submit the complete scheme to the Town Council in three weeks.

Liverpool.—Special Order.—Notice is given that the Electricity Commissioners have made a Special Order under the Electricity (Supply) Acts 1882-1922, for confirmation by the Minister of Transport authorising the Corporation to supply electrical energy for public and private purposes within the county borough of Bootle and the urban districts of Litherland, Waterloo-with-Seaforth, and Great Crosby.

Llandaff and Dinas Powis.—Special Order.—The Rural Council has applied to the Electricity Commissioners for a Special Order to revoke the Llandaff & Dinas Powis Electric Lighting Orders, 1901 and 1908, to annul the deed of transfer between the Council and the Radyr Electric Co., Ltd., and to authorise the Council to purchase the undertaking of the company, and to generate and distribute electrical energy within the parish of Radyr.

London.—St. Pancras.—The Council is applying to the Electricity Commissioners for sanction to the extension of the switchboard at the King's Road station at an estimated cost of £15,000-£16,000. Tenders are to be called for on receipt of this sanction.

Nelson.—New Plant.—On October 12th new turbo-generating plant was officially started up by the chairman of the Electricity Committee in the presence of a large gathering of officials and visitors. The plant is of the Brush-Ljungstrom type, and we hope to publish further particulars next week.

New Zealand.—Hydro-Electric Development.—The Minister of Public Works recently stated that tenders would shortly be invited for work in connection with the duplication of the tunnel of the Lake Coleridge power station.—*Reuter's Trade Service* (Melbourne).

Northampton.—Special Order.—The Northampton Electric Light & Power Co., Ltd., has applied to the Electricity Commissioners for powers to extend its area of supply to the parishes of Mears Ashby, Ecton, Sywell, Earls Barton, and Overstone.

Radcliffe.—Electricity in Bulk.—The Council is to cease generating electricity and the station is to be converted into a distributing and transforming centre. The Lancashire Electric Power Co., Ltd., will supply electricity in bulk, but the Council will retain its rights under the original Provisional Order.

Rathmines (Dublin).—Lighting Scheme.—The Urban Council has applied to the Free State Provisional Government for sanction to loans amounting to £10,000 in connection with a scheme for lighting the district with electricity.

Rye.—Electricity Supply.—The Town Council has referred to the Lighting Committee the application by Mr. E. D. Sharkey and Messrs. [illegible] Ltd. for permission to lay mains in the town for the supply of electricity.

Wimbledon.—Price Reductions.—The electricity department has published a schedule of reduced tariffs which is to take effect as from the September meter readings. The new charges are as follows:—Lighting (flat rate), 7d. per kWh. Cooking and heating, 1½d. per kWh. Power (tariff "A"), 2d. per kWh, flat rate; tariff "B," 2d. per kWh for consumptions of 250 kWh or less per h.p. per quarter, graduated downwards by .10d. per kWh for each extra 50 kWh consumed, to a limit of 1.25d. per kWh for a consumption of 550 kWh or above; tariff "C," a flat rate of 1½d. per kWh provided that energy is not taken at certain stated periods of heavy load (this involves an extra charge for the rent of a time switch).

Yarmouth.—New Plant.—In order to meet the increasing demand for electricity the Town Council is installing new plant at a cost of £17,800.

TRAMWAY AND RAILWAY NOTES.

Australia.—Victoria.—Considerable public alarm was caused by a recent occurrence on the Mordialloc line of the Victorian State Railways. An electric train failed to stop at a scheduled station, and, gathering speed, crashed through some level-crossing gates and passed another station at a speed of about 50 miles per hour. It was eventually brought to a stop by the application of the brakes by the guard. It was found that the driver was missing, and his body was discovered some miles away. The train should have been stopped automatically by the release of the operating handle, but it was stated that the handle was found to be tied up in its "on" position. An inquiry was to be held.

Bristol.—Control of Tramways.—By a two-thirds majority the City Council has decided against taking over the control of the tramways.

Continental.—France.—The Paris-Orleans Railway Co. has placed an order with the Westinghouse Electric and Manufacturing Co. for the equipment of 120 electric locomotives. The order was placed through the Compagnie Electro-Mécanique, which had been commissioned to supply the electro-pneumatic equipment of these locomotives.

Italy.—A concession has been granted to the Società Anonima Industriale Ferroviaria for the construction of an electric railway from Bribano to Sedico and Agordo. The cost of the construction and equipment of the line is estimated at 9,458,897 lire.

An electric railway from Domodossola to the Italian border is to be constructed by the Società Subalpina di Imprese Ferroviaria at a cost of 11,243,397 lire. The line is to be completed by the end of 1923.

Switzerland.—According to a report of the general management of the Swiss Federal Railways, 357 km. has been electrified up to the present. During 1923 and 1924 electrification work will be concluded on 239 km. By the autumn of 1924 877 km., or about one-third of the Federal network, is to be electrified. The electrification of these lines will cost nearly 350,000,000 fr., to which 128,000,000 fr. must be added for rolling stock, making the total amount 478,000,000 fr., of which 300,000,000 fr. will be paid by the end of this year. Of the 178,000,000 fr. to be paid between 1923 and 1926, 50,000,000 fr. is for electric locomotives. The coal saved on the lines electrified up to the end of 1926 will amount to 318,000 tons yearly, *i.e.*, 45.4 per cent. of the Federal Railway's total consumption of coal in 1913.—*Reuter's Trade Service* (Zurich).

Halifax.—Year's Working.—The total revenue during the year ended March 31st last of the Corporation's tramway undertaking (manager: Mr. B. Hall) was £226,769, as compared with £229,743 in 1920-21. Expenditure upon revenue account totalled £198,292, as against £208,191, leaving a gross balance of £28,477 (£21,552). After crediting £2,912, interest on investments, and debiting capital charges amounting to £28,559, a net profit of £2,830 remained; this compared favourably with a deficit of £618 in the previous year. The deficiency on appropriation account increased from £10,875 to £13,755. The motor omnibus and trackless trolley accounts showed deficits of £172 and £405 respectively. The expenditure upon capital account amounted to £37,437, including over £32,000 for reconstruction of track. An amount of £2,565 was provided out of revenue for the purchase of land and the execution of certain works. The number of passengers carried fell from 23,823,406 to 20,799,660, and the car-mileage from 2,168,338 to 2,032,652.

Hull.—Penny Fares.—The Town Council has confirmed a proposal of the Tramways Committee to restore penny stages on the tramway system.

Japan.—Tokio Underground Railway.—*Eastern Engineering* states that the Tokio Underground Railway Co. is to commence operations early in the coming year, and the work is expected to be completed by the end of 1925. An expenditure of 189,000,000 yen (£20,475,000) is involved.

Leeds.—New Route.—The work of connecting the tramway at Halton with Templenewsam Park is to be carried out with the approval of the Light Railway Commissioners, confirmed by an Order. The connection will be upon a raised track.

West Hartlepool.—Railless Cars.—The Town Council has decided to provide railless cars on the Foggy Furze tramway route as far as the borough boundary, at an approximate cost of £9,600.

TELEGRAPH AND TELEPHONE NOTES.

Chile. Wireless Telephony.—According to the United States Commercial Attaché at Santiago (Chile), it seems probable that before long serious consideration will be given to the development of wireless telephony in Chile. Legislation is contemplated, based on the laws of the United States, and although it will not provide specifically for the establishment of broadcasting stations by private enterprise, it is possible that such a service will be available through the leasing of Government-owned stations during times of peace.

China.—New Telephone Exchange.—According to the Government Bureau of Information, Republic of China, the Tientsin Telephone Administration has made plans to install a telephone exchange at Tangshan (Chihli). A site at Nan-siaoshan has been selected for the erection of the office. Work will soon be commenced.

France.—Telegraph and Telephone Extensions.—It has been decided to reorganise and strengthen the telegraph and telephone service in the Lyons district, and two new stations are to be constructed. One, in the Place Ampère at Lyons, is in course of construction, and 300,000 fr. will be expended on it in the course of the current year. An outlay of several million francs is to be provided for in 1923. New telephone circuits are also to be set up in the department (Rhône), giving further facilities of communication between Lyons and Paris, Strasburg, Marseilles, and other important cities.

Mexico.—Wireless Telephony.—The installation of a wireless telephone service to operate between various important centres in Mexico is being contemplated, says the *Financial Times*.

The Telephone Service.—Year's Work.—In a speech at Bedford on October 12th, Mr. Kellaway, the Postmaster-General, gave an account of the work of the Post Office, and referred to the prospects for the future. The department was, the *Daily Telegraph* reports him as saying, as a whole now on a self-supporting basis, and there was every indication that the anticipation that the current year's working would show a surplus would be realised. The increase in the Post Office revenue had principally been due to an increase in telephone revenue. This side of the Post Office work was increasing in a highly satisfactory manner. There were now 1,007,000 telephone stations in the country. Although the proportion of private subscribers to the whole service was still only 23 per cent., there was unmistakable evidence that private individuals were acquiring the telephone habit. The work of laying the trunk cables underground was going on rapidly. In all about £2,250,000 was being devoted to underground trunk extension work this year, and a further £500,000 to other trunk work. The total expenditure of the department this year on telephone development of one kind and another would amount to more than £9,000,000.

United States.—Large Wireless Valves.—The *Daily Mail* announces that the Rocky Point, Long Island, wireless station of the Radio Corporation of America successfully maintained communication by means of vacuum tubes across the Atlantic for 16 hours on October 15th. The message continues: "It was the first commercial test of the 50-kW siner tube, recently invented by Dr. Irving Langmuir, research engineer of the General Electric Co. Four tubes replaced the Alexanderson alternator. The tubes, which were water cooled, were actuated at 15,000 volts."

Wireless on Tanks.—The successful adaptation of the wireless telephone for use in tanks is announced by the U.S. Army Ordnance Department, which is about to give a demonstration of the new engines of war it has produced since the war. As part of the programme, a fleet of tanks will manœuvre under the wireless orders of its commander in a flagship tank.—*The Times*.

Wireless Telephony.—Broadcasting.—In the course of his recent speech at Bedford, Mr. Kellaway, the Postmaster-General, said that if they succeeded in starting this new form of communication in this country on really sound lines, no one would regret the delay. A beginning would probably be made in London and Manchester. The seven other stations which were to cover the country would, he hoped, be ready for working in the course of three or four months. The company could not be allowed to take the property of the Press and the Press agencies, and he would see that these interests were properly protected in any arrangement made by the Broadcasting Co.

Rules for Fixing Aerials.—The Bradford Health Committee has established the following conditions and regulations in respect of the installation of wireless apparatus in houses in Corporation housing sites:—(1) A licence must be issued by the Postmaster-General; (2) no poles or aerials are to be fixed in the gardens at the front or sides of the houses; (3) all poles and aerials are to be fixed to the satisfaction of the city architect; (4) all damage done to the premises is to be made good from time to time, and upon removal of the apparatus, as required by the city architect and to his satisfaction, at the tenant's expense; and (5) all apparatus is to be removed when required by the Corporation and within seven days from the receipt of notice.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen. — November 10th. Electricity Department. One 10,000-kW turbo-alternator, with surface condenser and auxiliaries. (See this issue.)

Australia.—Melbourne.—November 21st. Postmaster-General's Department. Telephone switchboard parts.*
November 16th. Insulated signal cable (Sched. 958).
November 21st. Switchboard parts (Sched. 67).
December 12th. 1,416 switchboards (Sched. V68).
January 10th, 1923. Telegraph power plant (Sched. W.A. 647). (See this issue.)
November 29th. Victorian Railways. One industrial electric storage battery truck (4,000 lb. carrying capacity).*
Victorian Railways. January 24th, 1923. Fifty miles insulated copper wire.—*Reuter's Trade Service* (Melbourne).
January 19th, 1923. Electricity Commissioners. Steam turbine-driven boiler-feed pumps (Spec. 23/4) for the Morwell power scheme. (See this issue.)

Belgium.—November 11th. Municipal authorities of Oostham, Province of Limburg. Establishment of an electricity distribution system in the town.
November 4th. Municipal authorities of Saint-Gilles-lez-Bruxelles. Cast-iron terminal boxes, with circuit breaker, and also a number of junction boxes.

Birmingham.—November 27th. Electric Supply Department. E.h.p. switch panels, &c. (See this issue.)

Bristol.—November 14th. Electricity Department. One 4,000-kVA single-phase turbo-alternator with condensing plant. (See this issue.)

Dublin.—November 6th. Irish Postmaster-General's Department. 14,000 Leclanché cells, 3,500 dry cells, 8 tons chloride of ammonia, 40,000 Leclanché zinc rods, 3,500 Leclanché glass cells. (October 13th.)
October 23rd. Electricity and Public Lighting Committee. E.h.p. switchgear and accessories, &c. City electrical engineer, Fleet Street, Dublin.

Edinburgh.—November 1st. Tramways Department. Supply, &c., of one 20/25 h.p. motor tower wagon. Tramways manager, 2, St. James's Square, Edinburgh.
November 14th. Tramways Department. Eight automatic point controllers and 56 top-covered car bodies. The manager, Tramways Department.

Egypt.—Alexandria.—December 20th. Administration of Ports and Lighthouses. Eight travelling electric portico quay cranes, eight travelling balcony cranes, eight electric lifts, rails, &c.*
Cairo.—October 30th. Egyptian State Railways. Direct-coupled steam engine and alternator, switchboard, &c., for the power house, Gabbary, Alexandria.*

Glasgow.—October 28th. Parish Council and District Board of Control. General contracts, including electric lamps and electric fittings for six months. M. A. Reynard, inspector and clerk.

India.—October 24th. Great Indian Peninsula Railway. Supply of electric incandescent lamps. Mr. R. H. Walpole, secretary, 48, Copthall Avenue, E.C.
November 3rd. High Commissioner for India. Electric jib crane and overhead electric crane. Director-General, Stores Department, 11, Belvedere Road, S.E.

Leeds.—November 10th. Electricity Department. Iron castings for 6 or 12 months. (See this issue.)

London.—London County Council.—November 6th. Control panel and switchgear connections for No. 1 generator at Greenwich power station. (October 13th.)

Manchester.—October 24th. Tramways Department. Electric goods cage lift. Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

October 25th. Education Committee. Electric lighting installations at Seymour Road, Clayton, and Mansfield Street, Ardwick, municipal schools. Specification from the Education Offices, Deansgate, Manchester.

Neath.—Rural District Council Electricity Department. One 1,000-kW turbo-alternator, with condensing plant, foundations, switchgear, &c. (October 13th.)

New Zealand.—WELLINGTON.—November 28th. Public Works Tender Board. Two exciter transformers for the Waikato power scheme.*

December 5th. Telephone system for the Mangahao power house and sub-stations, &c.*

DUNEDIN.—December 8th. City Council. One 150-h.p. 3-phase motor and reduction gear for the Mornington cable tramway system.*

Porth.—October 23rd. Rhondda Urban District Council Electricity Department. One 100-kVA. 3-phase static transformer. (October 13th.)

Rochdale.—November 1st. Board of Guardians. Electric lift, &c., at Birch Hill, Dearnley. (October 13th.)

Romford.—October 22nd. Board of Guardians. Electric lighting installation at the hospital. Mr. R. H. Mason, clerk to the Guardians, The Institution, Romford.

South Africa. — JOHANNESBURG.—November 16th. Municipal Council. Four or more double-deck tramcar bodies or four or more single-deck ditto, 15 or more double-deck bogie tramcars, complete with truck and electrical equipment, 15 single-deck ditto, complete, 28 gear wheels.*

PRETORIA.—November 23rd. Municipal Council. H.p. and l.p. switchgear, transformers, and cables in connection with the extensions of the electric light and power supply.*

South Shields.—November 15th. Electricity Department. Two water-tube boilers with mechanical stokers, economisers, induced draught plant, and steel chimney, also ash-handling plant and extension to boiler-house. (See this issue.)

Torquay. — November 4th. Electricity Department. E.h.p. switchgear for Newton Abbot power station and main sub-station at Torquay. (See this issue.)

Warrington.—November 13th. Electricity Department. H. and l.p. paper and lead-covered cable. (See this issue.)

Wicklow.—November 4th. Urban District Council. Semi-Diesel engines and dynamos, booster, switchboard battery, overhead mains, house services. Messrs. J. P. Tierney and Co., consulting engineers, 44, Kildare Street, Dublin.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Argentina.—BUENOS AIRES.—Water works. Extension of the pumping plant, including one generating station and eight transformer sub-stations, one filtered water station and two river water stations.

	Filtered water station.	River water stations.	Generating plant and eight transf'r sub-stations.	Total.
Brown Boveri (Cia. Sudam de Elect.)	132,450.00 o/s.		685,800.00	933,450.00
	131,650.00	115,600.00	707,600.00	950,550.00
	147,250.00	111,300.60	751,300.00	
	146,400.00	c.i.f. 10 months.		
Vickers, Percy Grant and Co.	168,960.00	89,046.00	683,740.00	935,646.00
	c.i.f. 21 weeks.	c.i.f. 21 weeks.	Begin in 21 weeks, and terminate in 40.	Valid for 60 days.
Siemens Schuckert.	120,000.00	113,000.00	753,000.00	986,000.00
	132,000.00	113,000.00	764,400.00	1,009,400.00
Siemens Schuckert' Anglo-Arg. General Electric Co., Ltd.	120,512.50	111,305.00	741,705.00	983,522.50
	139,650.00	99,200.00	756,650.00	995,500.00
Gen. Sup. Elec. Co.	208,047.00		787,721.00	995,768.00
	Without electrical equipment.		10 to 16 months.	
A.E.G.	172,000.00 10 to 12 months.	83,000.00 10 to 12 months.	763,800.00 10 to 12 months.	1,018,800.00
Soc. Anon. Technique y Comercial Suiza.	128,750.00	119,600.00	776,800.00	1,025,170.00
	139,247.00	108,247.00	760,820.00	988,304.00
	120,047.00	116,300.00	798,620.00	1,033,957.00
Schneider & Cia.	162,020.00 15 to 20 months.	94,949.00 11 to 17 months.	817,923.00 12 to 17 months.	1,074,892.00
				1,120,020.00
G. E. K., Stockholm.	149,700.00	153,200.00	929,300.00	1,232,200.00
G. E. Co. of America			812,000.00	
			816,000.00	1,114,000.00
Simpson Agar, Cross and Co., Ltd.	171,404.00	142,865.00	962,190.00	1,276,459.00
			968,660.00	
			928,160.00	
Westinghouse, U.S.A.	801,205.00 9 months.	301,205.00 9 months.	813,258.00 9 months.	1,415,663.00
Franco Tosi, Bertelli, V. y. Cia.	9 months.	9 months.	9 months.	1,867,170.00
			530,000.00	

Additional bid for payment of not less than $50,000 Arg. gold.
With electrical equipment to pumping stations.

—*Review of the River Plate.*

Australia.—MELBOURNE.—Victorian Government.
400 miles steel-cored aluminium cable (£10,250).—British Aluminium Co., Ltd.

Melbourne and Metropolitan Board of Works.
Two electrical centrifugal pumping plants (capacity 12 million gallons daily each) (£11,761).—Messrs. G. P. Kelly & Lewis Pty., Ltd.—

ORANGE (N.S.W.).—Municipal Council.
Electric generating plant and machinery (£7,000).—Australian General Electric Co.—*Reuter's Trade Service* (Melbourne).

Belgium.—The Société Leodal, of Schaerbeek, submitted the lowest tender last week to the municipal authorities of Schaerbeek, Brussels, for the supply of 500 5-amp. single-phase electricity meters. The prices quoted by the eight competing firms ranged from 39 fr. 30 centimes to 56 fr. per meter.

Birmingham.—Board of Guardians. Tenders have been accepted from the following firms for the X-ray and electrical apparatus and massage appliances required for the new ward at Dudley Road Hospital, at a cost of about £4,000 :—Cox Cavendish Electrical Co., Ltd.; Watson & Sons (Electro-Medical), Ltd.; Newton & Wright, Ltd.; A. E. Dean and Co.; X-Rays, Ltd.; Schall & Sons, Ltd.

London.—LONDON COUNTY COUNCIL.—Asylum and Mental Deficiency Committee. Eleventh Mental Hospital Epsom. Electric wiring installation for the buildings, motors, &c. :—

D. Henderson	£8,700
Higgs & Hill, Ltd. (accepted)	**9,476**
Marryat & Place	9,690
J. Clarke & Co.	10,498
Brightside Foundry & Eng Co., Ltd.	10,500
Western Eng. Co., Ltd.	10,560
F. Craft, Ltd.	11,117
Electrical Installations, Ltd.	12,334
Alpha Manufacturing Co.	12,489
Malcolm & Allan, Ltd.	12,960
J. R. Dunkley & Co.	13,187
Tyler & Freeman	13,600
H. J. Cash & Co., Ltd.	14,039
G. E. Taylor & Co.	14,360
Cox Walkers, Ltd.	14,394
Pinching & Walton	14,432
G. N. Haden & Sons, Ltd.	15,179
R. Houchin	16,012
Glumart, Cox & Co.	Incomplete

The name of Mr. D. Henderson, of Glasgow, who submitted the lowest tender, is not on the King's National Roll. The Committee has, with the concurrence of the General Purposes Committee, accepted the tender, amounting to £9,476, of Higgs & Hill, Ltd.

Supplying and fixing overhead electrical conductors, &c. :—

Malcolm & Allan, Ltd.	£6,590
Cox Walkers, Ltd. (accepted)	**7,573**
Tyler & Freeman	8,020
Higgs & Hill, Ltd.	8,166
Electrical Installations, Ltd.	8,905
W. T. Henley's Telegraph Works Co., Ltd.	9,426
G. E. Taylor & Co.	9,674
Callender's Cable & Construction Co., Ltd.	9,683
Pinching & Walton	9,702
Alpha Manufacturing Co.	9,860
Marryat & Place	10,230
Haden & Sons, Ltd.	10,630
R. Houchin	10,911
Western Electric Co., Ltd.	11,628
Siemens Bros. & Co., Ltd.	11,907
Johnson & Phillips, Ltd.	12,260
T. Clarke & Co., Ltd.	12,300
J. R. Dunkley & Co.	16,143

The lowest tender, submitted by Malcolm & Allan, Ltd., was based on a misunderstanding, and has been withdrawn by the firm. The Committee has, with the concurrence of the General Purposes Committee, accepted the tender, amounting to £7,573, of Cox Walkers, Ltd.

Education Committee. Accepted :—
Renewing electric storage battery at the Avery Hill Training College (£370). —Pritchett & Gold and E.P.S. Co., Ltd.

Staffordshire.—The Staffordshire, Wolverhampton, and Dudley Joint Committee for Tuberculosis. Accepted :—
Electric wiring and fittings in connection with the new administrative block at Prestwood.—Messrs. Manley & Regulus, Ltd.

Sunderland.—Corporation. Accepted:—
L.p. cables.—Pirelli-General Cable Works, Ltd.; British Insulated and Helsby Cables, Ltd.
Feeder pillars.—Henley's Telegraph Works Co., Ltd.
Manhole frames and covers.—Ballantine & Sons, Ltd.
Creosoted redwood capping and casing.—Jos. Thompson & Co.

FORTHCOMING EVENTS.

Edinburgh Electrical Society.—Saturday, October 21st. At 3.15 p.m. Visit to Brunton's Wire Works.
Friday, October 27th. At the Philosophical Institute. At 8 p.m. Paper on "Fault Localisation," by Mr. D. M. Buist.

Institution of Electrical Engineers (North-Eastern Centre).—Monday, October 23rd. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Inaugural address by the chairman, Mr. F. G. C. Baldwin.
IRISH CENTRE, DUBLIN.—Thursday, October 26th. Inaugural address by the Chairman, Mr. E. C. H. Handcock.

Chemical Society.—Thursday, October 26th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Lecture by Sir W. H. Bragg, F.R.S., and Prof. W. L. Bragg, F.R.S.

Chelmsford Engineering Society.—Thursday, October 26th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Modern Oil Engines," by Mr. W. A. Tookey.

Junior Institution of Engineers.—Friday, October 27th. At 39, Victoria Street, Westminster, S.W. At 7.30 p.m. Questions and general discussion.

Birmingham and District Electric Club.—Friday, October 27th. At the Grand Hotel. At 7 p.m. Annual ladies' night. Whist drive and dance.

Institution of Mechanical Engineers.—Friday, October 27th. At the Institution, Storey's Gate, S.W. At 6 p.m. Adjourned discussion on Prof. A. Rateau's paper on "The Use of the Turbo-compressor for Attaining the Greatest Speeds in Aviation."

Diesel Engine Users' Association.—Friday, October 27th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Discussion on "The Care and Maintenance of Diesel Engines," to be opened by Mr. G. E. Windeler.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 28th. At the Hotel Cecil, Strand, W.C. At 5.30 p.m. for 6 p.m. Fourth annual dinner.

THE MANGAHAO TRANSFORMERS.

A Ferranti 110,000-volt Installation.

The development of electricity supply in Australasia generally is progressing at a rapid rate, and to cope with the demand large schemes are in hand and others are contemplated. In the North Island of New Zealand water power is being utilised to a considerable extent, the various generating stations being interconnected and the energy distributed by means of e.h.p. transmission lines as shown on the accompanying map (fig. 1). For such schemes larger plant and considerably higher pressures are used than we are accustomed to in this country. In the British Isles the distances over which electrical energy has to be transmitted are comparatively short, and therefore very high pressures are not necessary.

This fact is not always realised, and because we do not manufacture high-pressure plant of large capacity for our own use it is often assumed that we cannot produce it. Those who have had need of such equipment in the past have been too ready to consider that Britain has not the requisite experience to undertake the work.

That such an opinion, however, is erroneous calls for the utmost emphasis, and it is gratifying to be able to record yet another instance that will prove it so.

At the Mangahao hydro-electric generating station (see fig. 1) power is generated at a pressure of 11,000 volts, three-phase, groups of transformers being employed to raise the pressure to 110,000 volts for transmission by means of overhead lines. This is the highest voltage so far employed in Australasia, and the transformers which are being built by Messrs. Ferranti, Ltd., to the order of the New Zealand Government Public Works Department are the first of their size and voltage to be made in Great Britain. It is a matter for gratification that the order was placed in England, and Messrs. Ferranti may well be proud of having secured it, notwithstanding competition, at a price equal to, if not lower than, that quoted in the United States.

The plant that is nearing completion at Hollinwood comprises two three-phase, 50-cycle, 12,000-kVA banks of transformers, *i.e.*, seven 4,000-kVA units, one being a spare; their impedance is 6 per cent., and some idea of their size may be obtained from the fact that each transformer weighs, with its oil, 21½ tons, while the weight of each core is 7 tons, and that of each coil 1¼ tons. No less than 1,760 gallons of oil is needed to fill each tank.

The transformers are of the oil-immersed, forced-cooled, double-wound core type, connected in star on the h.p. side and delta connected on the l.p. side. On the latter side tappings are arranged for 11,000, 10,750 and 10,500 volts; the full output may be obtained from all the tappings. The neutral point is earthed. The accompanying illustrations show one complete 3-phase group (fig. 2) and parts in various stages of manufacture.



Fig. 1.—New Zealand, North Island.

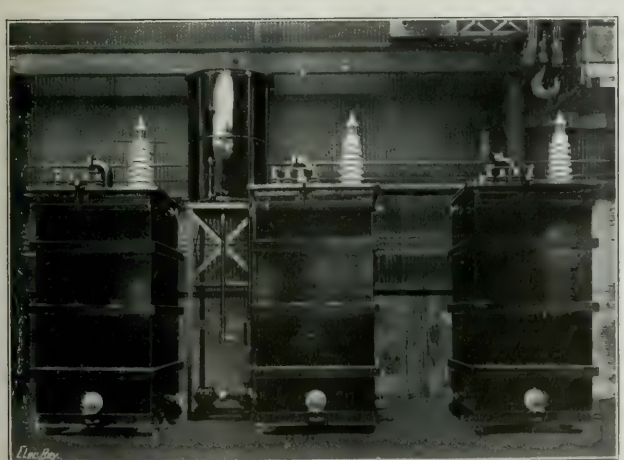


Fig. 2.—A 12,000-kVA Bank of 110,000-V Transformers.

Single-phase units were adopted owing to the difficult roads leading to the site, and the mechanical construction of the transformers is such as to allow of transport on their sides in their tanks. Easy means are provided for lifting the transformers (centre point lift), and due precautions are taken to prevent parts working loose through vibration under working conditions.

The windings are arranged concentrically on the core; the l.p. windings are of the single-layer spiral type, and ample oil ducts for ensuring uniform cooling of the windings are provided, two sides of every turn being in direct contact with moving oil. All the l.p. leads and tappings are brought to ter-

minals outside the transformer, so that the tappings may be easily changed. The h.p. side is wound in sections of disk coils of one turn per layer, thereby reducing the voltage stress between turns to a minimum. Radial

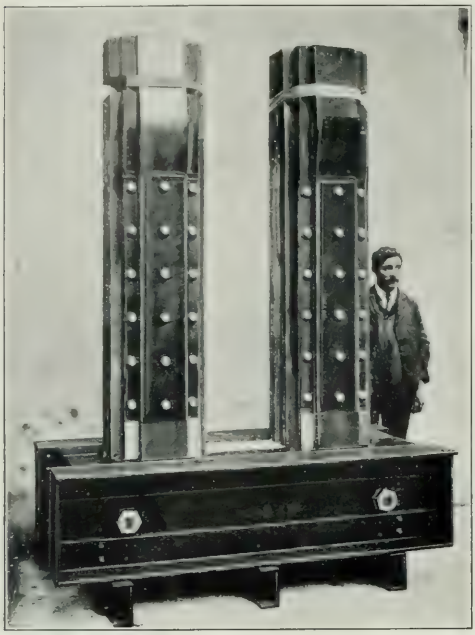


Fig. 3.—A Single-phase 4,000-kVA Transformer Core.

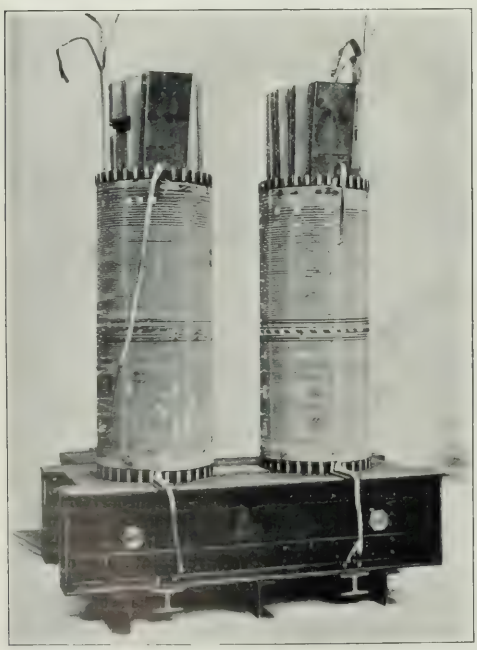


Fig. 4. Low-pressure Windings on Core.

ducts are arranged between the sections so that every turn is in direct contact with the cooling oil. The windings as a whole are designed to ensure uniform cooling throughout. The oil ducts are so proportioned in relation to one another as to size and disposition that the circulation of cooling oil is maintained constant and uniformly effective. The oil circulation is distributed throughout the whole of the transformer so that local hot spots and dangerous temperature gradients are avoided.

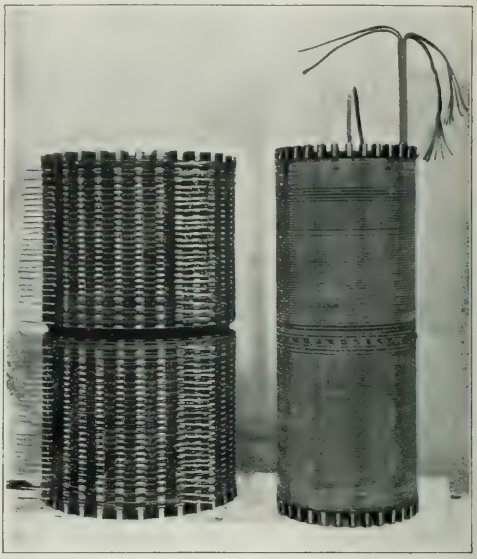


Fig. 5.—Transformer Coils.

The main transformer insulation is designed to avoid all danger of creepage along insulation surfaces and through laminated insulation in the direction of the laminæ. The end turns of both h.p. and l.p. windings are specially insulated to withstand surge voltages and transient disturbances. The coil dimensions and the relative dispositions of the h.p. and l.p. windings are so arranged that the electrostatic and electromagnetic

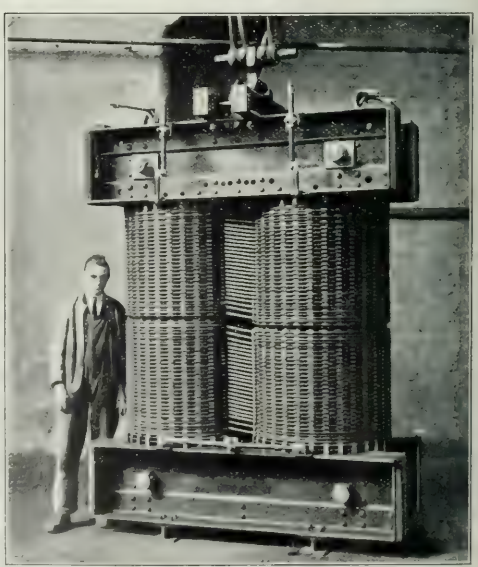


Fig. 6. Low-pressure Side of Complete Unit.

balances are preserved at all voltages. For this reason also the l.p. tappings are brought out through the middle of the windings so that the overall dimensions are not changed with the voltage ratio.

The dielectric field is so controlled as to render the voltage gradients as uniform as possible and to reduce

to a minimum the electrostatic stress between the high-potential winding and ground and between the coils and

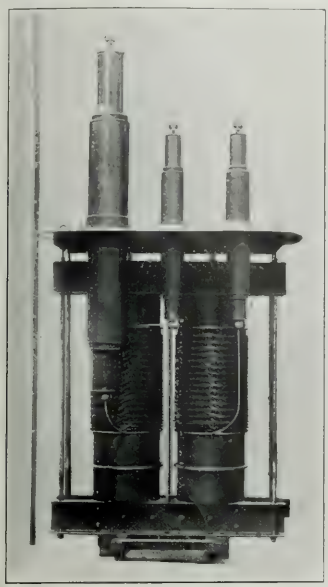


Fig. 7.—A 200,000-V Testing Transformer.

turns of each winding. The windings are adequately braced to withstand mechanical shocks which may occur under working conditions, including those produced under short circuits, while with the circular form of coils used, great mechanical strength is obtained, as under magnetic stress the coils tend to assume a circular form.

A spring clamp device is fitted between the coil sections. This device is arranged so that it takes up effectively any shrinkage which may occur in the coils. The adjustment is automatic, and therefore does not require frequent attention and tightening of bolts.

One set of oil-cooling apparatus, comprising a cooler, a centrifugal oil pump, motor, and controlling gear, is provided for each three-phase group. A conservator tank fitted with a calcium chloride breather and drier is connected to each bank to prevent moisture getting into the oil and reducing its dielectric strength, and also to prevent oxidation of the oil with consequent formation of sludge and harmful acids.

The h.p. terminals are of the oil-filled porcelain type, and as the transformers are designed with graded insulation they cannot be subjected to the usual flash test. The specification calls for the application of 23,000 volts to the low-pressure winding, and this must necessarily be of a frequency of 100 cycles, for which a special 500-kW alternator was used.

In conclusion, we have to thank Dr. Ferranti and his staff for the courteous manner in which we were received on the occasion of our visit to Hollinwood. Much of interest in connection with high-pressure work was seen and learned there, *à propos* of which fig. 7 illustrates a 200,000-volt testing transformer built for the Newcastle-on-Tyne electricity supply undertaking; the top of the tank is 8 ft. above the ground, and the top of the insulator is 13½ ft. above ground level. Several similar transformers have been built, and one for 500,000 volts is about to be put in hand.

EXTENSIONS AT STAFFORD ELECTRICITY WORKS.

The electricity undertaking of the Corporation of Stafford, which was established in 1895 under the guidance of the late Dr. John Hopkinson, originally contained three rope-driven dynamos of 63 kW each; in 1901 the plant was extended and the supply pressure doubled, and the first Highfield booster was installed, Mr. J. S. Highfield having been the first electrical engineer to the Corporation. From 1902 to 1913 the engineer was Mr. R. E. Meade, who now, as Councillor Meade, is Deputy Mayor and chairman of the Electricity Committee; Mr. Meade further extended the plant in 1906 and 1912. His successor, Mr. W. H. Robins, M.I.E.E., the present engineer and manager, experienced a rapid increase in the demand on the outbreak of war, and prepared a scheme of extensions, which was submitted to Mr. S. L. Pearce, city electrical engineer, Manchester, and a 500-kW geared turbo-generator was installed in 1916. The Ministry of Munitions, however, would not sanction the purchase of suitable boilers, and therefore the turbine, which was the mainstay of the station, had to be worked at a reduced efficiency owing to the low boiler pressure.

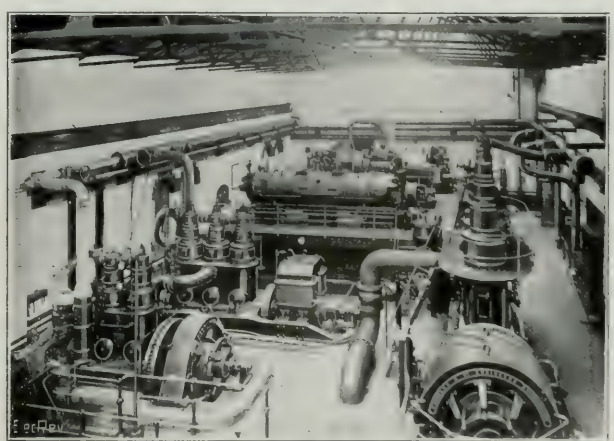


Fig. 1.—Engine-room, Stafford Electricity Works.

In 1918 further extensions were necessary, and on the recommendation of the Ministry, approved by Mr. Pearce, tenders were obtained for two 1,250-kW turbo-alternators and two water-tube boilers, each of 15,000 lb. evaporative capacity, together with a rotary converter to assist the d.c. plant. However, before the consent of the Ministry was obtained the whole of the plant offered had been disposed of elsewhere. The need for new plant was imperative, and was met by the purchase of a 1,000-kW English Electric turbo-alternator, a 1,600-kW Brush-Ljungstrom turbo-alternator, a 500-kW Metropolitan-Vickers rotary converter, and two Stirling boilers each of 15,000 lb. per hour evaporative

capacity. This is the plant which, as recorded in our last issue, was formally inaugurated on October 4th.

The generating set supplied by the English Electric Co., Ltd., comprises a disk-and-drum turbine coup'ed to an alternator built at the Stafford works, having an output of 1,250 kVA at 6,600 volts, 50 cycles per second, and is provided with Worthington condensing plant and a Heenan & Froude air filter.

For filtering the air to the alternators, a Cleworth Wheal wet air filter has been provided, and this is driven by a 1-h.p. motor.

A feature in connection with this turbo plant has been the installation of an Igranic diaphragm type oil-pressure operated apparatus and relay, so arranged that when the oil pressure in the bearings falls below a stated value, the relay operates and trips the circuit breaker on the main switchboard.

Tests taken after the set had been installed on site proved that the steam consumption of the set was well within its guaranteed limit.

The rotary converter, built by the Metropolitan - Vickers Electrical Co., Ltd., is self-synchronising, has a starting motor, and is fitted with oscillating gear. The same company supplied the high - pressure switchgear, and a d.c. feeder switchboard to replace the existing board, which was dangerously overloaded.

The new Stirling boilers are fitted with mechanical stokers manufactured by the Underfeed Stoker Co., Ltd.; these stokers have a common forced-draught plant. A steel chimney 96 ft. high, together with an induced-draught plant, has also been installed, the existing stack being inadequate to deal with the gases from all the boilers.

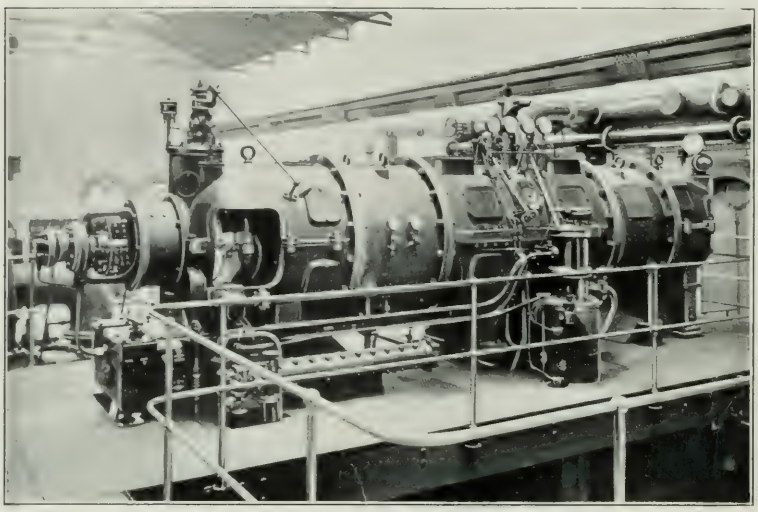


Fig. 2.—Brush-Ljungstrom 1,600-kW Turbo-generator.

The Brush Electrical Engineering Co., Ltd., Loughborough, has supplied one 1,600-kW standard Brush-Ljungstrom set, designed to work at a pressure of 170 lb. per sq. in. at the turbine stop valve, superheated 150 deg. F., and exhausting into a vacuum of 28½ in. of mercury (barometer 30 in.). The turbine is directly coupled to two three-phase alternators having a combined output of 1,600 kW at a power factor of 0.8, equivalent to 2,000 kVA. The exciter is directly coupled to one of the alternators, and the regulation of the set is effected solely by regulation of the exciter field. The combined set runs at 3,000 r.p.m., and is capable of carrying an overload of 25 per cent. for two hours.

The turbo-alternator set is mounted on a Brush surface condenser, according to the standard method adopted for this plant. The whole of the weight of the turbo-alternator is carried by the condenser, resulting in a great saving of foundation work.

The surface condenser has a cooling surface of 3,150 sq. ft., and is capable of dealing with 20,800 lb. of exhaust steam per hour, with circulating water at a temperature of 65 deg. F. The condenser is provided with a three-throw Edwards air pump driven by a Brush standard d.c. motor through gearing.

The circulating pump was manufactured by Messrs. Stone & Co., and is capable of delivering 2,775 gallons per minute against a total head of 25 ft. when running at 750 r.p.m. The pump is driven by a 30-h.p. standard Brush motor, to which it is directly coupled. The motors are controlled by panels manufactured by Messrs. Brook, Hirst & Co., Ltd.

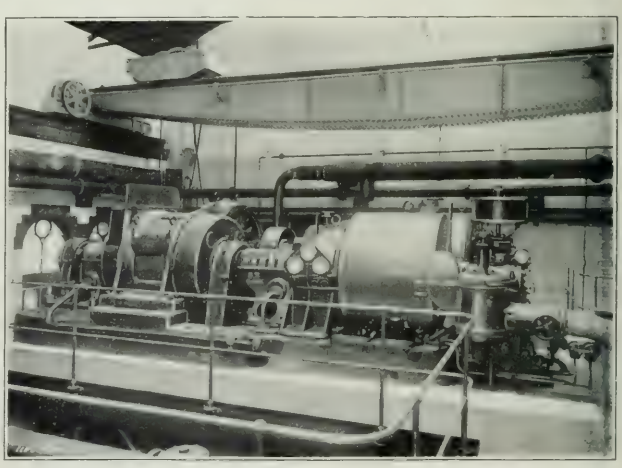


Fig. 3.—English Electric 1,000-kW Turbo-generator.

In 1921, due to the general slump in trade, the committee debated as to the advisability of proceeding with the scheme, and engaged Mr. Arthur Ellis, of Cardiff, to advise on it. Mr. Ellis generally approved the scheme, but hardly considered that the committee had gone quite far enough. He recommended a further expenditure of £45,000, this to provide for a further generator, a rotary converter, having an output of 1,000 kW, and further boiler plant in order to do away entirely with the out-of-date and inefficient plant. These recommendations will be carried out in the near

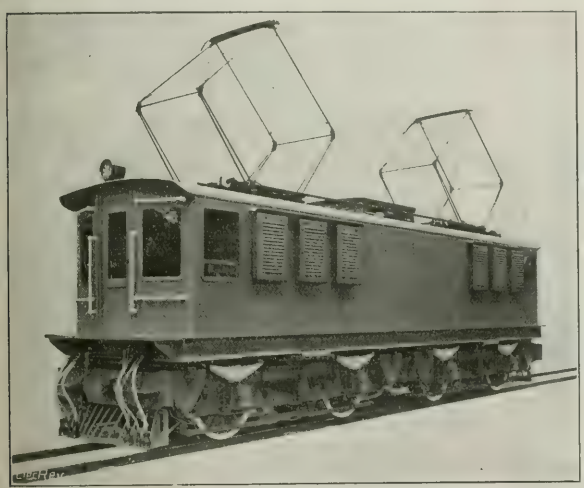
future; the four Lancashire boilers have already been disposed of, and a Stirling boiler, having a capacity of 20,000 lb. evaporation per hour, has been ordered, the foundations for which are now in progress, part of the boiler having already been delivered.

The output of the station is far greater than last year, and the manager hopes to be able to report very nearly 4,000,000 units generated for the year ending March, 1923.

AN ENGLISH ELECTRIC LOCOMOTIVE.

The accompanying illustration shows one of the 48-ton main-line electric locomotives which have been designed, built, and equipped by the English Electric Co., Ltd., for the Arthur's Pass Section of the Midland Railway of New Zealand.

Each of these locomotives will be equipped with four 1,500-V, 170-h.p. direct-current motors of the ventilated type, with controlling gear of the cam-shaft type devised by the English Electric Co.



An "English Electric" Locomotive for New Zealand.

The contract in connection with which these locomotives are being constructed comprises the supply of the generating plant, the transmission line, and the complete equipment for the electrical operation of the section, including the locomotives for both passenger and goods trains. Particulars of the contract were given in our issues of September 17th and November 12th, 1920.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:—

The Gibson patent terminals.
The Ozon electric lamp.
Galalith insulation.
The Collins universal travelling iron.
A ceiling rose enclosing a switch operated by a chain.
Also the address of Electric Scaling Hammers, Ltd.

London 'Bus Guide.—The London General Omnibus Co. has issued a re-modelled guide to its services. The new guide is much clearer than its predecessors owing to the strengthening of the colour tones in the map and the re-lettering of the names of districts, &c.

NOTES.

Ilford Super Kinema.—The opening ceremony of the above new theatre was performed on October 14th by Mr. [illegible] Pitt, chairman of the Ilford District Council, who was supported by the Marchioness of Queensbury and Mr. Frederick Wise, M.P. It has been built by Messrs. Sheffield Kinemas, Ltd., for Super Cinemas (Ilford), Ltd., the architect being Mr. W. E. Trent, F.S.I. At the point of the triangle on which the building has been erected is the main entrance to the theatre. A series of glazed swing doors lead to the foyer and lounge. At the end of the foyer is the grand staircase leading to the café lounge on the first floor, and thence to the balcony of the theatre. From the top of the grand staircase, on both sides, vaulted corridors lead to the two side entrances, with exits at both the proscenium and operating ends. Over the café lounge and approached by staircases from each end a roof garden is planned to be formed next year. Excluding the main entrance, there are ten separate exits leading direct to a public thoroughfare, which would enable the building to be emptied in two minutes in an emergency. The exceptional size of the foyer and lounge should obviate the necessity for forming waiting queues outside the theatre. The building is treated externally on rather severe lines. The building is dominated by a copper-covered cupola supported on open columns and floodlighted by means of 24 lamps, in addition to six flambeaux at the corners. The seating accommodation on the ground floor is 1,800 and in the balcony 700, a total of 2,500.

The internal decoration is in the "New Art" style. The colourings are daring in harmonies and quaint in form. Groups of quaintly-designed lanterns and erratic colourings hang from the ceiling, bays, and wall brackets, and suspended balloon lights and an aerial fountain complete an original electric lighting scheme. Quaint designs also come into the leaded window lights, whilst the draperies are in jazzy colouring. The entire decoration scheme has been carried out by Val Prince Decorations, Ltd., Birmingham.

In the lighting of the theatre some novel points have been introduced. The ceiling lights are an integral part of the design of the ceiling instead of being merely suspended therefrom, and additional light is obtained from the bull's-eye windows in the frieze and from vases round the balcony front. It is all electric, and no white light is used anywhere. The system of heating and ventilation is that known as the "semi-plenum" fresh-air supply with mechanical foul-air exhaust. The plant is electrically driven and capable of dealing with two million cubic feet of air per hour, and will change the atmosphere once every ten minutes in the more important parts of the theatre. The air is drawn from outside at a height of 30 ft. above ground. It is then filtered, washed, and purified, and, in cold weather, warmed by being drawn through a heating battery. It may be added that a complete electrically-driven vacuum-cleaning installation has been fitted throughout the building.

A large three-manual electrically-driven orchestral organ has been installed by Messrs. Henry Speechly & Sons.

Messrs. Harrison Bros., Middlesbrough, carried out the electrical work. Two Kershaw projectors by the Sun-Light Arc Corporation are installed, in addition to an advertising lantern and four spot lights. The theatre light dimming is operated in conjunction with electric screen curtain lowering gear. Two Electric Construction Co.'s motor generators serve the projectors. "Welco" ironclad gear has been installed, and the 14 motors in the building demand about 150 A at 460 V. The lighting load of 200 A is balanced on the two sides of the 460-V mains, while a Fuller 600-Ah battery serves lights that are distributed over the building so as to provide sufficient illumination in the event of a failure of the supply—an unlikely event since three separate sources of supply have been arranged for. Callender's cable has been used throughout.

The Reinartz Tuner. The first meeting of the new winter session of the Leeds and District Amateur Wireless Society was held on October 13th, and was devoted to the presidential address of Mr. A. M. Baige. His subject was "The Reinartz Tuner," the recent one-valve American development calculated to cut out interference and allow very fine tuning. Though it had novel features, he thought in its present form it was hardly likely to replace the existing types, even though its price was a little less than the feed-back or regenerative set.

Ore Smelting in Switzerland.—The management of the Lauffen Electro-Chemical Works at Laufenburg states that as a consequence of the present unfavourable economic conditions the experiments which were to have been made with the smelting of Swiss iron ores have been postponed. Technical difficulties are said not to stand in the way of the experiments.

The Engineers' Club, London.—The first annual report of the directors of The Engineers' Club, for the period ending August 31st, 1922, shows a surplus of £431, after making ample provision for maintenance, all possible contingencies, and the amortisation of the leases. Second debentures to the value of £82,975 have been taken up, and £10,000 reserved for an applicant, leaving a balance of £32,025, which it is hoped will be readily subscribed for now that the success of the Club is assured. When the whole of the second debentures have been taken up, they will automatically become first debentures and constitute the sole charge on the property of the Club.

The General Committee reports that Sir Robert A. Hadfield, Bart., F.R.S., has consented to take office as president for the ensuing year, and expresses the gratitude of the members to Mr. E. Manville, M.P., the retiring president, for his pluck and foresight in giving his support to the Club in its initial stages. At the date of opening (September 1st, 1921) the elected members of the Club numbered 2,615; losses through death and resignations during the year amounted to 161, and owing to the severe depression in trade, 493 would-be members had to cancel their applications, leaving a net total of 1,961; new members were elected during the year to the number of 1,224, making the total membership at August 31st, 3,185. The premises have been maintained in the highest state of efficiency, and the annexe has been completely redecorated and refurnished.

Minor alterations to the rules will be submitted for approval at the general meeting, which will be held on November 3rd at 12 noon, at the West End Cinema, Coventry Street.

Lectures.—On Wednesday last Mr. R. Borlase Matthews was to give a lecture on "Auto-countancy, or Semi-automatic Double Entry Book-keeping" (by the aid of an electrically-operated machine) before the Office Machinery Users' Association.

At the Birmingham and District Electric Club on October 14th a lecture upon "Alternating Current Apparatus" was given by Mr. F. R. Unwin, A.M.I.E.E. The lecture dealt in particular and in some detail with the problems which confronted designers of a.c. apparatus, and gave much interesting and valuable information as to the principles which underlay the solution of these problems. The vexed question of power factor and the use of synchronous motors was treated at some length.

Swedish Hydro-Electric Works.—A report has just been presented to the Swedish Parliament by the State Hydro-Electric Administration in relation to the power sale possibilities in the new financial year, and the conclusion is reached that no new generating stations are necessary. At the outset the report points out, in explanation of this decision, that the consumption of energy last year considerably decreased in certain industries, particularly the iron and engineering trades, owing to the great depression. As to the electrification of the railways, the report submits that the work on the Stockholm-Gothenburg railway cannot be completed before the first section of the Lilla Edet power station is finished in two years, when this station, in conjunction with the Trollhattan works, would be able to provide the power required by the railways. It is uncertain whether any arrangements will be made for the delivery of power to the South, as agreements have hitherto not been made either with the South Swedish Power Co. or with possible Danish consumers. It would be possible to supply the power which would be sent along the proposed main transmission line to the South from the power works in the Gota River at Trollhattan and Lilla Edet, particularly as the profile regulating works between Trollhattan and Vargon have been put in hand. Under these circumstances the administration is unable to recommend the establishment of any new power stations either in the South or in Central Sweden, or in Norrland. A grant of 2,600,000 kronen is asked for in 1923-24 for the completion of the first section of the Lilla Edet station, which is to be finished in 1924 at a total computed expenditure of 13,830,000 kr.

A Large Colliery Winder.—On the occasion of the recent visit of the South Staffordshire and Warwickshire Institution of Mining Engineers to the Hilton Collieries of the Holly Bank Coal Co., Ltd., the Metropolitan-Vickers Electrical Co., Ltd., issued a souvenir booklet containing details of the 1,350-h.p. geared electric winder. This consists of a synchronous induction motor running at a speed of 300 r.p.m. driving, through reduction gears, a drum at 35-45 r.p.m. The shaft depth is 1,800 ft.; the net weight of coal per wind is 13,440 lb.; and the number of winds per hour 50; giving an output per hour of 300 tons. The drum is of the cylindro-conical type, the diameter falling from 21 ft. 6 in. to 11 ft. The energy consumption per wind is estimated at 16.4 kWh. The controlling apparatus is of the weir type, with fixed electrodes, and adjustable pumping arrangement for the electrolyte, whereby the rate of acceleration of the winder is not entirely dependent upon the driver. The "M.-V." patent overspeed and slow-brake device has been fitted in order to give additional protection during the full-speed running and retardation periods. The switchgear controlling the winder is mounted in sheet-steel cubicles, and provision is made for a duplicate supply at medium pressure for the auxiliaries of the winder. A slip-reducing device adds considerably to the efficiency of the equipment.

Scientific Illumination.—A representative gathering assembled at the new showrooms and laboratories of Messrs. Holophane, Ltd., Westminster, on October 10th, in response to an invitation by the company. After the visitors had been received by Mr. H. H. Thompson, the managing director, an address was given by Capt. E. Stroud, who recalled that the arrival of the electric incandescent lamp had been largely responsible for the development of more scientific methods of shading. When the metal-filament lamp, and later the gasfilled lamp, with its still greater brilliancy, came on the scene, the use of globes and reflectors, in order to avoid glare, became necessary. At the same time, the value of a properly-designed reflector in directing light where it was needed, came to be more fully appreciated. Early pioneering work on prismatic glassware was done in this country by Mr. A. P. Trotter, and afterwards Prof. Blondel and Mr. Psaradouki, in Paris, developed the idea more fully. The Holophane Co. based its efforts on the collective experience of nearly 30 years, and had developed a great variety of lighting units for special purposes, one great advance being the introduction of reflectors with an inner smooth surface and prisms on the outside, operating by total internal reflection. Capt. Stroud's remarks were illustrated by numerous lantern slides and by exhibits of glassware, some of historical interest, others of the latest design. Among the latter special interest attaches to a new form of flood-lighting unit, and to the unit equipped with Chance daylight glass to yield "artificial daylight." Special reference was made to the principle, adopted by leading firms concerned with lighting, of giving service as well as supplying goods. New units were constantly being developed to meet new problems, and they aimed at keeping abreast of progress in illuminating engineering, as illustrated by the discussions of the Illuminating Engineering Society.

A visit was afterwards paid to the laboratory, where the apparatus for taking out polar curves was exhibited and the operation of the Holophane Lumeter for measuring illumination described. An interesting exhibit was a series of boxes in which coloured goods were mounted, illuminated respectively by artificial daylight and by various modern illuminants.

Mr. L. Gaster returned thanks on behalf of the visitors, and remarked that lighting was of interest to all sections of the community. Illuminating engineering had, therefore, a special interest for technical journalists. The appointment, in 1913, of the Home Office Committee on Lighting in Factories and Workshops illustrated the importance attached to the subject. One point which he wished to emphasise was the need for co-operation between the lamp-maker and the manufacturers of globes and reflectors, as the distribution of light might be radically altered if a lamp of an entirely different type and size from that for which a reflector was intended was used. He hoped that in future each scientific advance would be brought to the notice of the technical Press, which acted as an important educational link between the expert and the general public.

Non-Ferrous Metals Research.—An interesting pamphlet, entitled "Research Work in Progress," has just been issued by the British Non-Ferrous Metals Research Association of Birmingham. The investigations in hand cover many problems of the copper, brass, aluminium, nickel, and lead industries, as well as subjects of importance to all users of such metals. The support given to the Association by the leading firms seems to be most encouraging, but the field covered is very wide, and many of the researches, such as those on the improvement of brass, on metal polishing, and on soldering, should attract the attention and support of many other sections of industry. The user is apt at first sight to overlook the fact that he is even more interested in the improvement of quality of his raw material than the manufacturer of the metal. In the case of failure, it is the user who always bears the greater loss, since he sacrifices all the time and workmanship which has been expended on the article being manufactured. The Bureau of Information of the Association also seems to be doing excellent service in distributing to members reports of the results of the experimental researches and acting as an intelligence service collecting and distributing information likely to be of service to the industry from the far corners of the world. Finally, some indication is given of the further work which the Council hopes to take up when additional financial support is forthcoming, which includes matters of moment to the electrical industries, to die casters, and to the tinplate trade.

Birmingham Electrical Golfing Society.—The autumn meeting was held on Walmley links, in delightful weather. The Dr. Railing Cup was up for competition, this being won by Mr. W. L. Topple, with a very steady card of 72. The second and third prizes were taken by Mr. J. H. Berry, and Mr. E. L. Ball, the sealed nine holes being won by Mr. W. A. Millinger. In 1923 there will be a fourth cup up for competition, presented by Mr. Topple.

A Well-prized Electric Vehicle.—At the Liverpool parade of commercial motor vehicles (organised by the C.M.U.A.), held a few days ago, the first prize in the electric vehicle class was won for the third consecutive year by a five-ton Electromobile vehicle belonging to Messrs. Tate & Lyle, the well-known firm of sugar refiners. This machine is used for the transport of produce between Messrs. Tate & Lyle's works and the docks

Electricity Districts.—North-East Midlands Inquiry.—At the Town Hall, Sheffield, on October 17th, Sir John Snell (chairman), Sir H. Haward (vice-chairman), and Messrs. H. Booth and A. Page, accompanied by Mr. E. W. Hudson (solicitor) and Mr. D. S. Cumberlege, sat as an Electricity Commission to inquire into the scheme submitted by the Sheffield Corporation for the constitution of a Joint Electricity Authority for the above-named area. The scheme, which was outlined in our issue of July 15th, 1921, is the only one that has been put forward with respect to the district, and it is supported by the Rotherham Corporation. Further details will be published in our next issue.

North Wales and Chester.—The Electricity Commissioners intend to hold a second local inquiry at the Town Hall, Llandudno, on November 14th, with reference to the scheme published by them for the improvement of the existing organisation for the supply of electricity in the North Wales and Chester District (see Elec. Rev., April 29th, 1921). A draft order constituting the district and establishing a Joint Electricity Authority therefor has been issued, which we hope to review next week.

Procedure at Local Inquiries.—In December, 1920, the Commissioners issued a memorandum dealing mainly with the procedure at local inquiries held under Section 5, Sub-Sections (1) and (2) of the Act of 1919. Under the procedure followed at first inquiries, consideration and evidence were mainly directed to questions of principle or preamble involved, and to the technical scheme or schemes submitted to the Commissioners. Matters of detail (in some cases important details) and what may be termed "clause points" were generally excluded from consideration or expressly reserved for the second inquiry. The approval of the Commissioners to the scheme published by them for the purposes of the second inquiry must, therefore, be regarded as an approval subject to consideration in the light of the further representations and evidence (if any) that may be forthcoming at that inquiry.

With regard to the form of the various clauses in the published scheme, the Commissioners, in dealing with items likely to be common to all (or the majority of) schemes for the reorganisation of supply, have endeavoured, we are officially informed, to frame "common form" clauses capable of adaptation (where necessary) to the special circumstances of any particular district. As the approved scheme published for the purposes of the second inquiry is based on and gives effect to decisions arrived at by the Commission as a result of the first inquiry, it is unnecessary that previous evidence should be repeated at the second inquiry. On the other hand, the Commissioners will be prepared to hear any general statement which any interested party may desire to make by way of objection on matters of substance or principle dealt with in the decisions of the Commissioners. It will not be necessary for evidence to be given in support of any such objection unless so desired by the party concerned, and then only for the purpose of substantiating matters on which evidence was not tendered at the first inquiry.

Any objections on matters of principle having been dealt with in the manner above indicated, the clauses of the approved scheme and of the draft Order to give effect thereto will then be taken *seriatim* and representations thereon heard. In cases where written representations on particular clauses have been made to the Commissioners prior to the second inquiry, they will announce, before such clauses are taken, whether they are prepared to accept the proposed amendments. The Commissioners suggest that unless important new issues are proposed to be raised, it will ordinarily be unnecessary for parties to be represented by counsel at the second inquiry.

Educational.—London.—The first of a series of lectures by Mr. Theodore Stevens, M.Inst.C.E., upon the utilisation of water power was delivered at University College on Monday last. This dealt with "Fundamental Principles and Practice." Subsequent lectures will deal with: "Measurement and Survey"; "Best Utilisation of Available Power"; "Storage of Water *v.* Auxiliary Power"; "Dams, Waterways, Tunnels, and Pressure Pipes"; "Equipment of Low-head Plant"; "Equipment of Medium-head Plant"; "Equipment of High-head Plant"; "Niagara Plant, 1851-1922"; and "Future Water Power Developments." The lectures will be illustrated by lantern slides. The course is open, without fee, to engineering students of University College who have paid a third-year composition fee. To registered students in the faculty of engineering at other colleges the charge is £1 11s. 6d.; to others, £3 3s. Application for tickets of admission should be made to Mr. Walter W. Seton, M.A., secretary, University College, Gower Street, W.C.1.

University College.—A Goldsmid Engineering Entrance Scholarship at University College, London, value £30 a year, tenable for three years, has been awarded to Mr. T. A. L. Paton, of Cheltenham College.

West Bromwich.—Recognising the growing importance and popularity of wireless, the West Bromwich Education Committee has included in its evening schools curriculum for the coming winter a series of 25 lectures on the fundamental principles of wireless telegraphy and telephony. A large number of students have enrolled, and the class will probably form the nucleus of a wireless club for the town at the end of the session.

Liquid Fuel Congress.—The International Liquid Fuel Congress opened on October 10th at the premises of the International Exhibition, Paris. In the afternoon members attending the Congress visited the Liquid Fuel Exhibition.—*The Times.*

Appointments Vacant.—General manager, director of programmes, chief engineer, and secretary, for the British Broadcasting Co. (in formation); clerk of works, for the Conway Corporation electricity department; cost clerk (£256) and clerk to assistant secretary (£215), for the Edinburgh Corporation electricity department; jointer (90s. 1d.), for the Wimbledon Borough Council electricity works; engineer to take charge of design (£300), for the Admiralty Mining School, Portsmouth; lecturer in electrical engineering (£300), for the Armstrong College; power station chemist (400 taels per month, tael = 3s.), for the Shanghai Municipal Council electricity department. (See our advertisement pages to-day.)

Legal.—British Thomson-Houston Co., Ltd., *v.* The Emergo Economic Lamp Co., Ltd.—In the Chancery Division on Tuesday, this case came before Mr. Justice Russell in the form of a motion for judgment, there being no defence. Mr. Whitehead, for the plaintiff company, said it had been decided by both sides to take a judgment by consent. He had agreed with Mr. Courtenay Terrell (for the defendants) as to the form of the order, which was based upon agreed minutes.—His Lordship: Very well.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The opening meeting of the 1922-23 session of the Institution will take place on November 2nd, when Mr. Frank Gill will deliver his inaugural address as president. This will be followed by an ordinary meeting on November 16th, when a paper by the late Dr. G. Kapp on "Phase Advancing" will be read by Prof. Miles Walker.

Wireless Section.—The Wireless Section will commence its meetings on November 8th, with a paper by Messrs. R. L. Smith-Rose and R. H. Barfield on "The Effect of Local Conditions on Radio Direction-finding Installations."

Annual Dinner.—The annual dinner of the Institution will be held on Tuesday, February 6th, 1923, at the Hotel Cecil.

North-Eastern Centre. *Students' Section.*—The first general meeting of the session was held at Armstrong College, Newcastle-on-Tyne, on October 13th, when the chairman, Mr. W. N. Kilner, delivered his inaugural address on "Homopolar Generators."

Chief Technical Assistants' Association.—The subject for discussion at the next meeting of the Association (November 2nd) will be "Consumers' Problems," instead of the subject previously announced. The discussion will be opened by Mr. E. R. Ingram; all meetings take place at the Engineers' Club.

Wireless Society of London.—The Society, which has some 120 suburban and provincial affiliated clubs, announces a new class of membership that will be open to all who hold broadcast receiving licences. Designated associates, they will be able to attain associate membership and full membership when qualified to do so. They will enjoy special elementary lectures and will be welcome to attend the ordinary monthly meetings of the Society. They will be represented on the Council of the Society so soon as their numbers justify it. The Society is to change its name shortly to "The Radio Society of Great Britain."

Faraday House Dinner.—The 14th annual dinner of the Faraday House Old Students' Association will be held at the Hotel Cecil on November 17th, when the president, Mr. P. V. Hunter, C.B.E., M.I.E.E., will take the chair. Members are reminded that they may introduce guests, who need not be Faradians, and the dinner will be followed by a musical programme.

Chelmsford Engineering Society.—Capt. H. Riall Sankey, C.B., C.B.E., &c., delivered his presidential address at a meeting of the Society on October 5th. This took the form of the relation of personal reminiscences which went so far back as 1869. Capt. Sankey's connection with the firm of Willans & Robinson and the growth of that concern occupied a large part of the address.

Association of Mining Electrical Engineers.—On October 7th Mr. G. Henderson, A.M.I.E.E., delivered his presidential address on "Insulation" at the Heriot-Watt College, Edinburgh. Afterwards Mr. R. Rogerson, M.I.Min.E., read a paper on the "Stabilisation of the Mining Industry."

Edinburgh Electrical Society.—At the meeting held on October 13th, at the Philosophical Institute, Mr. G. P. Barton lectured on "The Walkerburn Hydro-Electric Works." The paper was illustrated with lantern slides. The author stated

the peculiar conditions which led to the adoption of the unique method of storing energy at the Walkerburn Tweed Mills, and indicated that the experience gained in erection and working would be invaluable in dealing with future water plants. With regard to the meeting on October 27th, it was announced that Mr. Buist's paper would not be available, but that Mr. J. G. Burchell would lecture on "Country House Plants."

Manchester Association of Engineers.—On Saturday last the members of the Association visited the new electric power station of the Manchester Corporation at Barton, and were shown over the undertaking, so far as it has been completed, by the departmental staff. The station occupies 14½ acres of Trafford Park, and it will probably be completed by December, 1923. The officials hope to make some use of the station by the spring of next year if operations are then sufficiently advanced.

On October 13th Mr. Daniel Adamson, M.I.Mech.E., delivered his presidential address, and medals were presented to members for papers read during the last session.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. B. D. F. DOCKER has joined the board of the Anglo-Argentine Tramways Co., Ltd., in place of the late Mr. W. F. Hamilton.

MR. J. T. G. MURISON informs us that he has relinquished his connection with the Electrical Mineral Products.

COUNCILLOR W. J. TALBOT, chairman of the Electric Supply Committee of the Walsall Town Council since 1920, is not seeking re-election in November.

It is announced that MR. STURDEE, of Coventry, is to succeed Mr. W. Parker as works manager of the English Electric Co., Ltd., at Stafford.

MR. J. W. TOWNLEY, chief assistant electrical engineer to the Sunderland Corporation Electricity Department, has been appointed deputy city electrical engineer to the Bradford Corporation (see our last issue) at a salary of £800, rising in two years to £1,000. Mr. Townley is a native of Paisley, and has held appointments at Paisley, Manchester, Newcastle-under-Lyne, Sunderland, and Barnsley, where he was acting electrical engineer to the Corporation, before returning to Sunderland as chief assistant in 1919.

MR. R. D. SPURR, of Bradford, has been appointed to succeed Mr. Townley as chief assistant at Sunderland at a salary of £608 per annum.

To fill the vacancies on the Special Committee on London Electric Supply caused by the resignations of Mr. W. O. Nicholson and Mr. E. Sanger, J.P., the Council is recommended to appoint MR. J. PERRING and MR. MARSHALL J. PIKE.

MR. J. C. FLETCHER having relinquished his position with the Metallic Electrical Engineering Co., has now taken up the position of representative for Price's Electrical Supplies, Ltd., of Birmingham, for the Midland counties.

A marriage has been arranged, and will take place early in December, between MR. ERNEST GOSLIN, J.P., M.I.E.E., and MISS CATHERINE GLEN REID (Daisy), daughter of the late Mr. Peter Reid, consulting engineer, Glasgow. Mr. Goslin is the general manager of the Clyde Valley Electrical Power Co., and was formerly the chief electrical engineer of the Glasgow Corporation Tramways Department.

Leeds University has conferred the honorary degree of Doctor of Science on SIR DUGALD CLERK and SIR RICHARD A. GREGORY, and that of LL.D. on MR. HENRY MCLAREN.

The Institution of Mining and Metallurgy has awarded the Gold Medal of the Institution to SIR ALFRED KEOGH, C.H., Hon.M.Inst.M.M., on his retirement from the Rectorship of the Imperial College of Science and Technology, in recognition of his great services in the advancement of technological education. The Institution of Mining Engineers has awarded the Medal of the Institution to SIR GEORGE BEILBY, LL.D., F.R.S., in recognition of his valuable contributions to science, with special reference to his researches on fuel.

MR. FRANCIS G. C. BALDWIN, whose portrait herewith appears, is the chairman of the N.E. Centre of the Institution of Electrical Engineers, and he is to deliver his inaugural address at Newcastle-on-Tyne on Monday next. He was born in 1878, and received his training in general science and engineering at Sheffield Technical School (which subsequently became the Technological Department, Sheffield University) in 1893-1895. He continued at the same institution for his training in electrical science and engineering. After being for a short time with Messrs. Thos. Nash & Sons, Sheffield Testing Works, in 1895, he entered, at the beginning of 1896, the service of the National Telephone Co. as draughtsman. In 1899 he was appointed engineer for that company at Sheffield, and in that capacity completed the metallic circuiting of the subscribers' lines in the area; planned and superintended large extensions of the underground system in Sheffield and vicinity; and planned and superintended the earlier part of a scheme of decentralisation for Sheffield, involving the opening of additional exchanges for relief of the central exchange. In 1906 he was appointed district engineer to the Telephone Co. for Birmingham, a district having at that time 26 exchanges, approximately 14,000



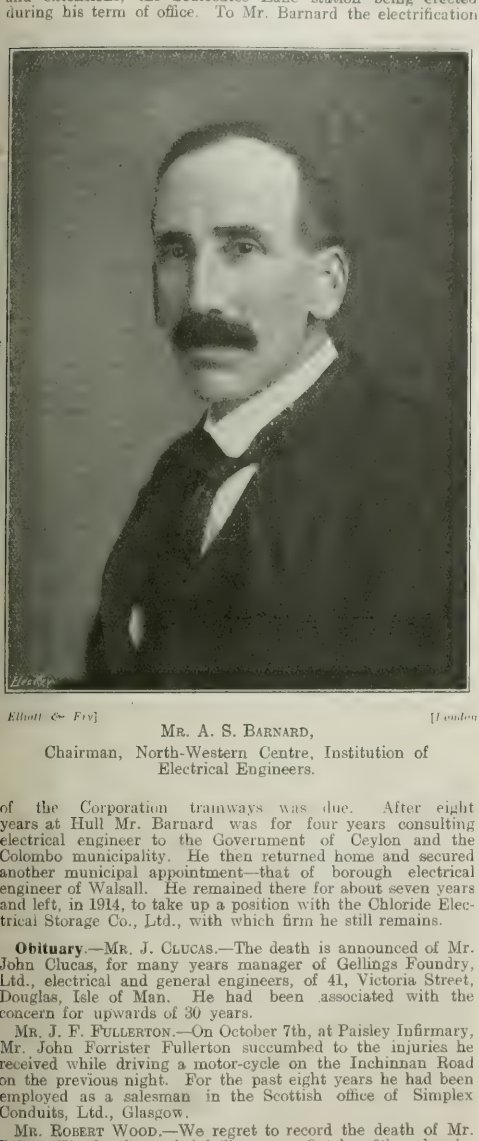
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MR. F. G. C. BALDWIN,
Chairman of the N.E. Centre of the I.E.E.

subscribers' stations, and a total wire mileage of 52,000, of which nearly 49,000 miles was underground. He completed the work of decentralisation which had been begun, and planned schemes for, and superintended the work of installation of extensive underground works. He also superintended the execution of the first comprehensive scheme of line loading (with Pupin coils) carried out in this country, which was associated with the junction line system of the Birmingham district, and he reorganised the existing underground work in Birmingham and prepared schemes for conversion from magneto to common battery working on a large scale. In September, 1909, Mr. Baldwin was appointed assistant Metropolitan engineer, and when the task of preparing an inventory of the National Telephone Co.'s plant was commenced in 1910, he assumed charge as acting Metropolitan engineer of the whole of the line plant in the Metropolitan area under the superintendence of Mr. C. B. Clay. Shortly after the acquisition by the State of the National Co.'s system in January, 1912, he assumed charge as sectional engineer of the City external section of the London Post Office engineering district, under the superintendence of Mr. Alex. Moir. In December, 1913, he was appointed assistant superintending engineer of the Northern District of the Post Office Engineering Department, and still remains in that capacity. In 1909 he read a paper on "Some Considerations in the Manipulation of Telephone Dry Core Cables" before the Birmingham Local Section of the Institution of Electrical Engineers, and in 1918, before the I.E.E., one on "Telephone Exchange Transfers and their Organisations"; for the latter the Fahie premium was awarded. For several years Mr. Baldwin officiated as lecturer and demonstrator at evening classes in electrical engineering at Sheffield Technical School. During the past two years he has been devoting his spare time, assisted by numerous friends, to the compilation of a "History of the Telephone in the United Kingdom," which will be published shortly.

MR. A. S. BARNARD, who has been elected chairman of the North-Western Centre of the Institution of Electrical Engineers, has had a long and varied experience in the electrical industry. After serving an apprenticeship with Messrs. Sydney F. Walker & Olliver, Cardiff, he left the firm to take up a partnership with Messrs. Wynne & Barnett, Newcastle-on-Tyne, whose business was the installation of electric lighting and power systems. Subsequently he went to the Corlett Electrical Engineering Co., a firm for which he

superintended many important undertakings. Mr. Barnard's connection with municipal work commenced in 1893, when he was appointed borough electrical engineer of Lancaster. He carried out the erection of the works and superintended the system for two years, after which he moved to a similar position at Hull. There he effected a number of improvements and extensions, the Sculcoates Lane station being erected during his term of office. To Mr. Barnard the electrification



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Mr. A. S. Barnard,
Chairman, North-Western Centre, Institution of Electrical Engineers.

of the Corporation tramways was due. After eight years at Hull Mr. Barnard was for four years consulting electrical engineer to the Government of Ceylon and the Colombo municipality. He then returned home and secured another municipal appointment—that of borough electrical engineer of Walsall. He remained there for about seven years and left, in 1914, to take up a position with the Chloride Electrical Storage Co., Ltd., with which firm he still remains.

Obituary.—Mr. J. Clucas.—The death is announced of Mr. John Clucas, for many years manager of Gellings Foundry, Ltd., electrical and general engineers, of 41, Victoria Street, Douglas, Isle of Man. He had been associated with the concern for upwards of 30 years.

Mr. J. F. Fullerton.—On October 7th, at Paisley Infirmary, Mr. John Forrister Fullerton succumbed to the injuries he received while driving a motor-cycle on the Inchinnan Road on the previous night. For the past eight years he had been employed as a salesman in the Scottish office of Simplex Conduits, Ltd., Glasgow.

Mr. Robert Wood.—We regret to record the death of Mr. Robert Wood, after a brief illness, on October 6th, whereby Messrs. Callender's Cable & Construction Co., Ltd., lost one of their eldest and most valued officials. Mr. Wood, who recently attained his 73rd birthday, went to the Anchor Cable Works 14 years ago as superintendent and chief of the engineering department, a position for which his inventive genius and practical knowledge of cable machinery eminently fitted him. He had previously held appointments with Messrs. W. T. Glover, Ltd., Manchester, and the St. Helens Cable and Rubber Co., Ltd., Warrington. The extensive additions and improvements at the Leigh works during the last 14 years made heavy claims on the chief engineer, but at all times the late Mr. Wood gave of his best, and he was never happier than when devising mechanical schemes for the benefit of the concern in which he was so deeply interested. At the funeral the firm was represented by Mr. J. Bowyer, J.P. (works manager), Mr. Arthur Crooke, and Mr. Wm. Hurst (foreman of the engineering department). Wreaths were sent by the directors and management of Callender's Cable & Construction Co., Ltd., London and Leigh; the members of the Anchor Works staff; employés in the braiding and flexible section; and from the engineers' department.

NEW COMPANIES REGISTERED.

Wireless Installations, Ltd. (184,847).—Private company. Registered October 6th. Capital, £100 in £1 [illegible] To [illegible] ness of [illegible] manufacturers, [illegible] sets, &c. [illegible] H. C. [illegible] 12, [illegible] hill, Essex, [illegible] Mrs. Brown; A. Principe, 12, [illegible] hill, Essex. Qualification, [illegible]

Portmadoc Electrical and Wireless Supplies Co., Ltd. (184,857). Private company. Registered October [illegible] £500 in £1 shares. To [illegible] directors are H. [illegible] "Royal Sportsman" Hotel, Portmadoc; G. O. Brown, "The Ship" Inn, 14, Lombard Street, [illegible] £60 per annum, director [illegible] £50 per annum. Registered office: New Street, Portmadoc.

Anode Wireless and Scientific Instruments, Ltd. (184,820). Registered October 6th. Capital, £10,000 in £1 [illegible] goodwill of the business of scientific instrument makers, &c., carried on by Anode, Ltd., and to carry on the business of electricians, manufacturers of generators, suppliers and distributors of electrical energy for lighting, heating, telegraphy, telephony, or any other purpose, telegraphists, telephonists, & c. The subscribers [illegible] Road, Kilburn, N.W.6, electrical engineer; A. H. Lunniss, 74, Minford Gardens, West Kensington, W.14, scientific instrument maker; J. H. Reyner, 69, Station Road, E.4, electrical engineer; C. L. Grey, 113, Selborne Road, Palmers Green, N.13, advertising agent; G. D. Brewster, 3, King's Bench Walk, Temple, E.C., solicitor; J. H. Brewster, 33, St. Germains Road, Forest Hill, S.E.26, commission agent; C. G. Cherry, 101, Hibbert Road, E.10, solicitor's clerk. Minimum cash subscriptions, £7. The first directors are: Pherozshaw Ruttinjee Minvalla, W. E. Peek, A. H. Lunniss, C. L. Grey and J. H. Reyner. Qualification: £500. Remuneration: £150 each per annum (chairman, £200) and a percentage of the profits. Registered office: 29, Strand, W.C.

Power Securities Corporation, Ltd. (184,817).—Registered with a nominal capital of £2,000,000 in £1 [illegible] (100,000 6 per cent. cumulative preference and 1,000,000 ordinary). The objects are: To adopt an agreement with George Balfour, M.P., Andrew H. Beatty, William Shearer and Hugh L. Williams, and to carry on the business of a financial and investment company in all its branches with the object (amongst others) of assisting in the development of engineering and electrical industries; also the business of financiers, bankers, capitalists, underwriters, dealers in land, businesses, concessions, mines and stock, manufacturers, merchants, traders, importers, exporters, shipping agents or ship owners, concessionaires and contractors for public and other works, &c. Purchase consideration: £220,000. G. Balfour, M.P., A. H. Beatty and W. Shearer are the holders respectively of 22,050, 12,500, and 9,200 fully paid shares in Balfour, Beatty & Co., Ltd., and the said vendors to the company of such shares, £97,020, £55,000 and £40,480 respectively. H. L. Williams is to receive £27,500. The minimum subscription upon which the directors may proceed to allotment is 7 shares. The first directors are: Sir James Kennal, K.B., Oriel House, Farringdon Street, E.C.4 (managing director, Babcock & Wilcox, Ltd.); H. C. Lewis, Crown House, Aldwych, W.C.4 (chairman and managing director, British Thomson-Houston Co., Ltd.); J. H. Brunel Noble, 8, Great George Street, Westminster (vice-chairman, Sir W. G. Armstrong, Whitworth & Co., Ltd.); G. Balfour, M.P., 66, Queen Street, E.C. (chairman, Balfour, Beatty & Co., Ltd.); A. H. Beatty, 66, Queen Street, E.C. (managing director, Balfour, Beatty & Co., Ltd.); W. Shearer, 66, Queen Street, E.C. (managing director, Balfour, Beatty & Co., Ltd.). Qualification: 1,000 shares. Remuneration as fixed by the company. Solicitors: Romer & Co., 42, New Broad Street, E.C. The registered office is at 66, Queen Street, E.C.

Bartrum Roylance & Co., Ltd. (184,762).—Private company. Registered October 4th. Capital, £5,000 in £1 shares. To take over the business of an electrical engineer and contractor carried on by D. H. Bartrum at Victoria Buildings, Manchester, as "Bartrum Roylance & Co." The first directors are: D. H. Bartrum, 61, Cyprus Road, Southport (permanent governing director subject to holding £1,000 shares or stock); A. B. Waldron, 17, Langdale Avenue, Levenshulme. Qualification: £500. Remuneration as fixed by the company. Secretary: D. H. Bartrum. Registered office: 46, Victoria Buildings, Manchester.

J. Jones & Co. (Nottingham), Ltd. (184,876).—Private company. Registered October 9th. Capital, £3,500 in £1 shares. To take over the business of an electrical engineer, colliery and mill furnisher, iron founder, and manufacturer of and dealer in machinery, carried on by J. Jones, at Canal Street, Nottingham, as "J. Jones & Co." The subscribers (each with one share) are: J. Jones, 97, Wilford Crescent, Nottingham, electrical engineer; C. Jones, 97, Wilford Crescent, Nottingham, electrical engineer. The subscribers are to appoint the first directors. Qualification: £250. Remuneration: £25 per annum. Solicitor: J. A. Simpson, Parade Chambers, South Parade, Nottingham.

Henrion Carbons, Ltd. (184,964).—Private company. Registered October 12th. Capital, £5,000 in £10 shares. To carry on the business of manufacturers, importers and exporters of and dealers in carbon and bronze brushes, arc-lamp carbons, and all electrical carbon manufactured articles. The subscribers are: R. A. Serena, 18, Davies Street, W., director, 10 shares; J. Faggie, 34, Victoria Street, S.W.1, secretary, one share. The first directors are: L. Levi (chairman), R. A. Serena (managing director), R. Hecker, P. Gravier, and E. Chedeville. Qualification: £100. Remuneration as fixed by the company. Registered office: 34, Victoria Street, Westminster, S.W.

H. Stanley Prince, Ltd. (184,874).—Private company. Registered October 9th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in electrical machinery, mechanical and electrical engineers, &c. The subscribers (each with one share) are: H. S. Prince, St. Davids, Montague Avenue, Brockley, S.E.4, wireless manufacturer; A. F. L. Crawford, Dallas House, Dallas Road, Hendon, N.W.4, estate agent. The first directors are not named. Registered office: 59, Chancery Lane, W.C.

Taylor's Engineering Co., Ltd. (184,886).—Private company. Registered October 9th. Capital, £2,000 in £1 shares. To acquire the business of hydraulic and electrical and general engineers carried on by J. H. Taylor, F. Taylor and H. Taylor at 56, Canal Street, Manchester, as "Taylor and Co." The first directors are: J. H. Taylor (managing director), 21, Hythe Road, Cheadle Heath; H. Taylor, 78, Vienna Road, Edgeley, Stockport; F. Taylor, 78, Vienna Road, Edgeley, Stockport. Remuneration as fixed by the company. Secretary: H. Taylor. Registered office: 56, Canal Street, Manchester.

Rowe, Hyde & Co., Ltd. (184,818).—Private company. Registered October 6th. Capital, £800 in £1 shares. To carry on the business of telegraph, telephone, radiographic, electric and general engineers, &c. The subscribers (each with one share) are: H. G. Cookson, 46, Airedale Road, Ealing, W.5, accountant; L. A. Anderson, 23, Fleming Road, Kennington, S.E.17, clerk. The first directors are: D. S. Rowe, H. Hyde and J. W. Gomer. Solicitor: W. A. Zabell, 11, Queen Victoria Street, E.C.

Markethill Electric Light & Power Co., Ltd. (N.I. 52).—Private company. Registered in Belfast September 23th. Capital, £2,500 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: G. Marshall, Markethill, [illegible] medical practitioner; J. Morgan, Markethill, Co. Armagh, merchant; W. Sinton, Markethill, Co. Armagh, merchant; Q. H. Edwards, Markethill, Co. Armagh, merchant. The first directors are: G. Marshall, J. Morgan, W. Sinton, W. H. Edwards, R. Doyle, R. Small, T. Willis, J. Mallagh and M. Curran. Qualification: 25 ordinary shares. Secretary: [illegible] Taylor, F.S.I. Registered office: Markethill, Co. Armagh.

Irradiant Lamp Works, Ltd. (184,935).—Private company. Registered October 4th. Capital, £5,000 in £1 shares. To carry on the business of manufacturers of, and dealers in, electrical engineers, electricians, &c. The first directors are: W. Wesson, 48, Exeter Road, Brondesbury, N.W., A. R. Warner, 24, Upper George Street, W.1; J. D. Hauptman, 5, Broadhurst Gardens, Hampstead, N.W. Qualification, £1. Registered office: 4, Vernon Place, Southampton Row, W.C.1.

Charles Bell, Ltd. (184,925).—Private company. Registered October 11th. Capital, £15,000 in £1 shares. 7,500 6 per cent. cumulative preference shares. To take over the business of a machine tool and engineers' accessory manufacturer carried on by Lazarus Bell at Bradford, Yorks, as "Charles Bell." The first directors are: Lazarus Bell, 1, Carlton Drive, Shipley (permanent governing director); Leonard Bell, 20, Redburn Drive, Shipley; H. H. Cassé, 11, Woodview, Manningham, Bradford. Qualification of governing director: 1,000 of the shares to be allotted to him under purchase agreement. Remuneration of governing director: £600 per annum. Registered office: Iron Works, Bath Street, Leeds.

Ernest Mote & Co., Ltd. (184,980).—Private company. Registered October 12th. Capital, £2,500 in £1 shares (2,000 cumulative 10 per cent. participating preference). To adopt an agreement for the sale of all the property, undertaking and assets of Mote, Miller & Robinson, Ltd., and to carry on the business of merchants, manufacturers and agents of fancy or other articles in Erinoid, Galalith, bone, ivory, ebonite, vulcanite or other materials, &c. The permanent directors are: E. M. Mote, 18a, Blackheath Vale, Blackheath, S.E.3; A. Anderson, 5, Essex Court, Temple, E.C.4. The said E. M. Mote is first managing director at a remuneration in addition to his remuneration as director of £250 per annum and a further 15 per cent. of the certified net profits remaining in any year after a dividend of 40 per cent has been paid on the issued ordinary shares, options and Remuneration of above named directors: 100 guineas each per annum; of other directors as fixed by the company. Registered office: 18a, Blackheath Vale, Blackheath, S.E.3.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dictograph Telephones, Ltd.—Particulars of £15,000 debentures authorised July 10th, 1922, charged on the company's undertaking and property, present and future; the whole amount being now issued. (The debentures were dated July 10th, but executed September 18th, as appears from a statutory declaration by the secretary.)

T. Jackson, Sons & Co., Ltd.—First mortgage debenture, dated October 2nd, 1922, to secure £2,000, charged on the company's undertaking and property, including uncalled capital (if any). Holders: Bank of Liverpool and Martins, Ltd.

Thor Electric Safety Lamp Co., Ltd.—Particulars filed of £3,000 debentures authorised September 20th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Radio Appliances, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated September 11th, 1922, to secure £1,000. Holder: K. J. Hayward, Vicarage, Bruton, Somerset.

Acme Welding Co., Ltd.—Issue on October 4th, 1922, of £900 debentures, part of a series already registered.

Enterprise Manufacturing Co., Ltd.—Debenture dated September 29th, 1922, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. W. Abbott, 2, Roxburghe Mansions, Kensington Court, W.

Moodys, Ltd.—Debenture dated October 2nd, 1922, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. A. J. Osborne, Balfour House, 219, Finsbury Pavement, E.C.

Cox-Cavendish Electrical Co., Ltd.—Issue on September 20th, 1922, of £2,600 debentures, part of a series already registered.

Electrical Engineering (West Bromwich), Ltd.—Further charge on £02. High Street, West Bromwich, dated September 27th, 1922, to secure £1,300. Holders: T. A. Nightingale, 5, Bilhay Street, West Bromwich; and L. J. Nurse, Princess End, Tipton.

Ely Gas and Electricity Co., Ltd.—Issue on October 2nd, 1922, of £1,600 debentures, part of a series already registered.

Specialities (Liverpool), Ltd.—Debenture dated September 28th, 1922, to secure £500, charged on company's undertaking and property, including uncalled capital. Holders: Anti-Vibration Electric Lamp Co., Ltd.

G. H. T. Petersen (Engineers' Merchants), Ltd. (formerly Electric Pulley-Block Co., Ltd.).—Particulars filed of £2,500 debentures authorised September 19th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,500.

Egham and Staines Electricity Co., Ltd.—First mortgage debenture dated September 25th, 1922, to secure £50,000, charged on certain land in Egham, Surrey, and company's undertaking and other property, including uncalled capital. Holder: The Treasury Solicitor.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

The directors propose to raise additional funds by the creation of £3,000,000 short-term convertible debenture stock, of which it is intended to issue £1,500,000 forthwith, the balance remaining available for issue as and when circumstances may require. In a circular to the shareholders the directors state that the important developments of the company's business which have recently taken place, and the further developments which are pending, will involve considerable additional capital outlay. In particular the substantial business, both at home and abroad in broadcasting, though adding materially to the company's revenue, will call for considerable finance, at least for some little time to come. These proposals will involve an extension of the borrowing powers of the directors which are, at present, limited to one-half of the nominal amount of the issued capital, and also, in order to provide for conversion rights, an increase of the ordinary share capital of the company. An extraordinary meeting of the company was held to-day at the Connaught Rooms, for the purpose of passing the necessary resolutions, one of which provides for increasing the capital to £4,000,000 by the creation of £1,000,000 ordinary shares of £1 each.

Electrolytic Zinc Co., of Australia.

The report for the year ended June 30th states plant has been in operation for seven months only and the production represents relatively about one-fourth only of the estimated annual output with the full 30,000 h.p. Constructional work is approaching completion and the full plant, with an estimated output of 120 tons zinc daily, should be ready before January 1st next, when the full 30,000 h.p. should be available. Profit on the working accounts for seven months' operating, after allowing £29,000 for depreciation, was £393,811. After adding £1,492, income from property and sundry receipts, and deducting £12,789, the proportion of administrative expenses chargeable to productive operations, and providing £5,950 for income tax, the balance transferred to appropriation account is £76,594. Two dividends have been declared on the preference shares, totalling £76,518, leaving £28,298, or 6.1742d. per share of accrued dividend to June 30th, 1922, inclusive.

Drake and Gorham, Ltd.

The report for the year ended June 30th, 1922, shows that after payment of all charges and making provision for contingencies there is a profit of £4,005, plus £5,768 brought forward, and £3,669 reserved but not required for excess profits duty, making a total of £13,441. A dividend at the rate of 4 per cent. for the year requires £5,000; there is put to writing down goodwill to £15,000, £1,237; to special reserve, £3,750; and there is carried forward £3,454. "The past year has been unusually difficult owing to the over-taxed condition of those upon whom the company relies for lighting orders, and the stagnation in industrial concerns. There has been a considerable fall in prices during the past twelve months, and consequent reduction in installation costs; these are now unlikely to become lower, as trade generally is improving, and coal—which is the basis of all raw material prices—will probably rise in value. The company has been engaged in the development of broadcasting receiving sets, which are being manufactured at its works."

Eastern Telegraph Co., Ltd.

The annual meeting was held on Tuesday last at Electra House, Finsbury Pavement, Sir John Denison-Pender, G.B.E., K.C.M.G., in the chair. Proposing the adoption of the report, which was summarised in our last issue, the chairman said that he referred at the last meeting to the work on hand in connection with the laying of additional cables and the renewal of certain sections of main line cables. In addition to the £1,000,000 provided by the increased capital, they had since the armistice met out of the general reserve fund an additional sum of over £2,250,000. Up to the date of the accounts they had expended a further sum of £700,000, which would be dealt with at a later date, together with the balance of the cost of the new cables to be laid to complete the programme previously foreshadowed for strengthening their main lines to the Far East in conjunction with the Eastern Extension Co. When the whole work was completed it would place them in a very strong position and enable them to cope with a heavy traffic. It would also provide sufficient capacity to deal in the same way with the increase in the volume of traffic which they hoped would result when the general trade of the world recovered its normal condition and automatically expanded with the reign of peace. He was glad to be able to say that the new cables already laid, the extensive renewals which had been carried out in some of the older sections, the introduction of additional automatic apparatus, and bringing the staff up to its normal complement, all of which were held up during the war, had had a beneficial effect in reducing the delay in the transmission of telegrams and had improved the system generally. They hoped to complete their programme early next year, when they would be in a position to deal satisfactorily with any eventuality that might arise. They had been working in close co-operation with the Post Office, acting on behalf of the various Government Departments and with India and South Africa, and it had been agreed to extend their landing licences for a period of 25 years subject to the right of the British Government to acquire by purchase the whole of their cables, plant, land and stations, &c., or such part as would be mutually agreed. They did not think that the Post Office was treating them fairly in the matter of competition for Australian traffic. Owing to the practical monopoly they had for the collection and delivery of telegrams at their offices all over the country they were actively supporting the Pacific Cable Board route against the company's route to Australia. To meet the abnormal expenditure on new cables, &c., they had realised part of their reserve fund investments, and incurred thereby a loss of £122,798, but as provision had been made in past years for the depreciation in the value of the securities, they withdrew £90,000 from that special fund and charged the balance of the loss against

the general reserve fund. There still remained £1,000,000 in the fund set aside as a provision on account of investment fluctuations, which at the date of the accounts was more than sufficient to meet the difference between the cost of the reserve fund investments and their value as at December 31st, 1921. They had been informed by the Indo-European Telegraph Co. that the latter hoped to have its line between Great Britain and Teheran restored shortly. This line, in conjunction with the Indo-European Telegraph Department's system *via* the Persian Gulf, would restore the alternative route to India, which was interrupted when war broke out. Mr. F. A. Johnson seconded the motion, which was carried without discussion.

German Companies.

The *Nassau Cable Works Co.*, of Halger, which was constituted in 1920, reports net profits of 713,000 marks for 1921-22, and a dividend at the rate of 20 per cent.

The *Brandenburg Carbide & Electricity Works Co.*, of Berlin, earned net profits of 1,280,000 marks in 1921-21, as contrasted with 810,000 marks in the previous year. The dividend is at the rate of 10 per cent., as in 1920-21.

The report of the *Rheydt Cable Works Co.*, of Rheydt, refers to the increases in the share capital to 84,000,000 marks, which were carried out in 1921-22, and states that the net profits amounted to 18,830,000 marks, as contrasted with 9,120,000 in 1920-21. It is proposed to pay a dividend at the rate of 20 per cent. and a bonus of 100 marks per share on 24,000,000 marks and 10 per cent. on 49,500,000 marks. A large number of uncompleted orders is stated to have been brought over into the new financial year.

Shropshire & Worcestershire Electric Power Co.—According to the *Financial Times*, an extraordinary meeting of this company is to be held on October 25th for the purpose of considering a resolution that the Severn Main Power Supply be a separate undertaking of the company. The capital and moneys authorised to be raised, 150,000 shares of £1 each, numbers 660,001 to 810,000 inclusive, and borrowing powers to the extent of £850,000 are to form the separate capital of the company in respect of the Severn Main Power Supply.

Zurich Electrical Bank.—The accounts of the Bank für Elektrische Unternehmungen, of Zurich, after the allocation of 3,012,000 fr. to the fund for uncovered differences in exchange, as compared with 2,086,000 fr. in 1920-21, show a surplus of 162,000 fr. for 1921-22, as against 112,000 fr. in the preceding year. Under the circumstances the shareholders remain without any dividend also for the past year.

Montreal Tramways Co., Ltd.—Accounts to June 30th show net income $524,004, out of which four quarterly dividends of 2½ per cent. have been paid, plus $916,709 brought forward. After deducting $198,388 for two deferred quarterly dividends on common stock to September 30th, 1919, the carry-forward is $844,983.

West African Telegraph Co., Ltd.—Gross revenue for 1921, £76,323; expenses, £46,521; profit, £29,801, plus £4,176 income tax refunded. £1,154 has been allocated to corporation tax charges, and £20,000 transferred to general reserve. After payment of dividend of 4 per cent., free of tax, £3,599 is carried forward.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The profit for 1921 totalled £438,888, against £675,180 for 1920, plus £921,329 brought forward. The total dividend for the year on the ordinary shares amounted to 5 per cent., as against 10 per cent. for the previous year, and £832,092 is carried forward.

Costa Rica Electric Light and Traction Co.—It is stated that the directors have decided to pay fourth issue of deferred interest warrants, Serial No. 43, due July 1st, 1919, on November 1st, together with accrued interest for three years and three months to October 31st, 1922.

Victoria Falls and Transvaal Power Co.—The net earnings of the company, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended June 30th, 1922, amounted to £225,226, before providing for taxation.

Indo-European Telegraph Co., Ltd.—Interim dividend for the half-year ended June 30th at the rate of 5 per cent. per annum, free of tax.

Brazilian Traction, Light & Power Co.—The directors have declared a dividend of 1 per cent. on the ordinary stock.

Yates & Thom, Ltd.—Dividend of 7½ per cent. actual for the year; £50,000 to reserve, carrying forward £1,507.

Vera Cruz Electric Light, Power & Traction Co., Ltd.—Interim dividend of 5 per cent. actual on ordinary shares.

Cuban Telephone Co.—A dividend of $1.50 per share, less income tax, on the common stock is to be paid.

STOCKS AND SHARES.

Tuesday Evening.

The prospect of a General Election before the end of the year has not affected the Stock Exchange markets to any particular extent. Politics mix ill with finance, and the invariable result of a General Election is to unsettle men's minds, diverting their attention from the more practical things of life to the controversies of the rival political parties. Were there to be any general expectation of a return to power of the Labour party, the stock markets would probably show an easier tendency, but in the majority of cases, prices are well maintained, and there is a lot of business doing in the popular favourites. So far as investment values are concerned, these are well held, and in the big markets the only section to show any languor on account of public neglect is that for Home Railway stocks.

Undergrounds are easier on the week, but heavy dealings occurred in Metropolitan ordinary, District and Underground shilling shares. So far as the trunk lines are concerned, this week's conference of managers in connection with fare revision is not viewed with any particular favour, since nobody can tell what effect a reduction in charges would be likely to have upon dividends. Nothing more has been heard of the possibility of the South-Eastern Railway starting its anticipated scheme for extensive electrification, nor is it thought that any announcement will be made until after the terms of the grouping of the Southern railways have been made public.

It was an unpleasant surprise for Marconi shareholders to be informed that the company intends to take powers for the immediate issue of 1½ million debentures, convertible into shares. Before this was known, the price of Marconis hardened a trifle over 50s.; the announcement caused a drop to 2 5/16, from which a recovery to 2 7/16 ensued. On Friday in this week, the directors meet the shareholders in order to lay before them full particulars of the board's intentions, when, no doubt, a comprehensive speech from the chairman will clear up some of the points upon which there is at present confusion and uncertainty.

The mild boom in broadcasting, especially amongst those who like to dabble in electrical matters, continues throughout the country, but it has not attained anything like the dimensions to which it has risen in America. New York, according to an American just over, has dozens of broadcasting stations. In the circumstances, it is not surprising that Radio Corporations should have been in demand in New York. The price has risen to 22s., the preferred being stationary at 14s. 9d.

Several of the Eastern stocks and shares are decidedly better, though the improvement is not particularly noticeable in the official quotations. There is, however, a demand for Eastern ordinary, Extensions, and Westerns. In other cable issues, the market is as quiet as usual.

Charing Cross ordinary shares are ¼ up at 7¼. County ordinary has recovered to 28s. 9d., and the new shares are a little better at 3s. premium; the preference keep firm at 2s. premium. Metropolitans continued their advance, and stand now at 6¼. South Londons have been dealt in round about £4 per share, and Londons are in anxious demand up to 56s. 3d. Westminsters have begun to move up again, and now command 7¾. The strength of the market is pronounced.

Anglo-Argentine Tramways, after a prolonged period of neglect, have come to life, and the first preference at 3⅛ show a rise of 5s. The seconds are steady at 3⅛. Brazil Tractions rose to 49, on the announcement of what is now coming to be regarded as the usual quarterly dividend of 1 per cent. The preferred, however, drooped to 90½. In British Columbia Railways, the preferred stock at 68 is 2 points higher. Mexicans are also a little better, a gain of 2¼ to 42¼ in Mexico Trams seconds being the outstanding feature. The news from the country, however, is still meagre, and bondholders in its utility companies begin to get restive about the long suspense.

Babcock & Wilcox at 3 1/16 are ⅛ up, favourable rumours being circulated with regard to the next dividend. Iron and steel shares generally are a little better. Armstrongs advanced upon the announcement of a substantial new contract. Callenders rose to 2¼, and British Insulated ordinary at 43s. 3d. are 6d. lower. Cromptons, although quoted at 15s., changed hands at 18s. 9d. the other day, the same price, by the way, to which English Electric preference have drooped. No further change has occurred in Metropolitan-Vickers preference or other of the manufacturing companies' shares.

The rubber market has come along with a rush. The popular fancy, stirred by the possibility of rubber rising

once more to 1s. and over per lb. has gone "all out," in order to be early in the field with purchases of the better-class shares. In the excitement, practically everything has been advanced, and the burning question of the moment is whether this is going to be maintained or not.

British Electric Traction ordinary at 59½ is 1½ higher. The 6 per cent. participating preference stands at 90½, the 5 per cent perpetual debenture having gone back to 89½. London and Suburban Traction preference have improved to 9s. 3d. Shanghai Electric Construction ordinary shares are 10s. better at 19½, and Yorkshire West Riding ordinary at 15s. have gained a shilling.

On the other hand, Para Electric Railway 5 per cent. first debenture stock has fallen to 52½; Midland Counties Electric ordinary at 15s. 6d. and the 7½ per cent. mortgage debenture stock at 102 are both slightly better. New Midland Electric 7 per cent. preference have gone back to 21s. 3d., Newcastle-on-Tyne 5 per cent. preference to 14s. 6d., though the last-named company's debenture stocks have improved to 90½ for the 4½ per cent. first debenture, and 104 for the 6 per cent. second debenture. North Metropolitan preference are in request up to 21s. 3d. Notting Hill ordinary remain at 2½, the 6 per cent. preference at 9½ showing a rise of the fraction on the week. South Metropolitan ordinary went back to 27s. 6d., Urbans to 22s. 6d. The 4½ per cent. first debenture stock of the latter company has gained 4½ points at 70, and Yorkshire Electric 5½ per cent. debenture stock at 101 is slightly better. These prices are mentioned because they do not occur in a good many of the share-lists that are published, and the market in most of them, being restricted, alterations are liable to be overlooked by those who are interested.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price Oct. 17,	Rise or	Yield
	1920.	1921.	1922.	fall.	p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	85	—	£7 1 2
Charing Cross Ordinary	8	9	77	+ ½	6 0 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	+ ½	4 12 4
City of London	14	14	29	—	6 18 0
do. do. 6 per cent. Pref.	6	6	28/-	—	5 4 4
County of London	8	8	15	+ ½	5 11 4
do. do. 6 per cent. Pref.	6	6	1½	—	5 4 4
Kensington Ordinary	9	10	7½	—	6 13 4
London Electric	2½	4	25	—	4 11 5
do. do. 6 per cent. Pref.	6	6	5	—	5 17 1
Metropolitan	7	7	6¼	+ ¼	5 12 0
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9½	—	6 11 6
South London	7	7	4	—	7 0 0
South Metropolitan Pref.	7	7	13½	—	5 18 0
Westminster Ordinary	10	10	7¼	+ ¼	6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	102	—	5 17 8
do. Def.	1½	84/6	23½	—	7 8 6
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8 4xd.	—	8 12 4
Eastern Extension	10	10	18⅞	+ ¼	5 6 8
Eastern Tel. Ord.	10	10	186½	+2	5 7 3
Globe Tel. and T. Ord.	10	10	18½	—	5 6 8
do. do. Pref.	6	6	11½	—	5 4 4
Great Northern Tel.	24	22	28½	— ½	7 15 6
Indo-European	10	10	6⅝	+1	7 1 0
Marconi	25	15	2⅞	+ 1/16	6 3 0
Oriental Telephone Ord.	12	12	28	—	*5 1 1
United R. Plate Tel.	8	8	6⅝	—	*5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18½	—	*5 8 1
Home Rails.					
Central London Ord. Assented	4	4	77	—	5 19 5
Metropolitan	1½	2½	52½	−3½	4 5 9
do District	Nil	1	40	−1	2 10 0
Underground Electric Ordinary	Nil	Nil	3/-	—	Nil
do. do. "A"	Nil	[Nil	7/6	—6d.	Nil
do. do. Income	2	4	86½	+1	*4 12 7
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	82	+ ½	7 11 9
do. do. 2nd Pref.	Nil	5½	8¼	—	7 2 0
do. do. 5 per cent. Deb.	5	5	80½	—	6 4 3
Brazil Tractions	Nil	Nil	49	+ 2	8 3 4
British Columbia Elec. Rly. Pcs.	5	5	76½	—	6 9 9
do. do. Preferred	5	98/-	68	+2	*7 0 0
do. do. Deferred	8	124/-	71½	—	*8 12 6
do. do. Deb.	4½	4½	75xd	—	5 13 4
Mexico Trams. 5 per cent. Bonds	Nil	Nil	72¾	+2	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	42½	+2½	Nil
Mexican Light Common	Nil	Nil	19½	—	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds	Nil	5	65½	+1	7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	15	3⅛	+ ⅛	5 4 0
British Aluminium Ord.	10	5	17/9	—	5 12 8
British Insulated Ord.	15	15	148/-	—6d.	6 18 7
Callenders	15	15	2½	+ 1/16	6 13 4
6½ Pref.	6½	6½	1¼	—	5 15 7
Crompton Ord.	10	5	16/-	—	6 18 4
Edison-Swan	10	Nil	8/-	—	Nil
do. do. 5 per cent. Deb.	5	5	84	—	7 16 4
Electric Construction	10	10	25/6	—	7 17 0
English Electric	8	5	16/6	—	6 1 0
do. do. Pref.	8	6	18/9	— 9d.	6 8 0
Gen. Elec. Pref.	6½	6½	21/8	—	6 2 4
do. Ord.	10	5	18/6	—6d	5 8 1
Henley	15	15	2½	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	1⅜	—	—
Mex.-Vickers Pref.	8	8	92	— ½	6 14 9
Siemens Ord.	10	10	25/9	—	*7 15 4
Telegraph Con.	20	20	26½	—	*4 13 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, October 18th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	7½d.	...
a Ammoniac, Sal	per ton	£63	...
a Ammonia, Muriate (large crystal)	,,	£48	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£30	...
a Copper Sulphate	,,	£26 10s.	...
a Potash, Chlorate	per lb.	5d. to 5½d.	...
a ,, Perchlorate	,,	7½d.	...
a Shellac	per cwt.	£14 15s.	...
a Sulphur, Sublimed Flowers	,,	£9 10s.	20s. dec.
a ,, Lump	,,	£8	£2 dec.
a Soda, Chlorate	per lb.	3½d.	...
a ,, Crystals	per ton	£6	...
a Sodium Bichromate, casks	per lb.	5d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£100	...
b ,, Wire	per lb.	1/9 to 2/6	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£159	£5 inc.
Grade II	,, ,,	£114	£3 inc.
Grade III	,, ,,	£65	£2 inc.
c Brass (rolled metal 2' to 12' basis)	per lb.	9½d.	...
c ,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c ,, Wire, basis	,,	9¾d.	...
c Copper Tubes (solid drawn)	,,	1/1½	...
c ,, Bars (best selected)	per ton	£96	...
c ,, Sheet	,,	£96	...
c ,, Rod	,,	£96	...
d ,, (Electrolytic) Bars	,,	£71 15s.	15s. dec.
d ,, ,, Sheets	,,	£145 10s.	...
d ,, ,, Wire Rods	,,	£81 15s.	15s. dec.
d ,, ,, H.C. Wire	per lb.	10½d.	½d. dec.
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	2/6	...
h Gutta-percha, fine	,,	12/6	...
h India-rubber, Para fine	,,	1/-	1¾d. inc.
i Iron Pig (Cleveland Warrants)	per ton	92s. 6d. to 95s.	...
i ,, Wire, galv. No. 8, P.O. qual.	,,	£24	...
g Lead, English Pig	,,	£26 10s.	5s. inc.
g Mercury	per bot.	£14 10s.	15s. dec.
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/1	...
p ,, drawn bars and rods	,,	1/3	...
p ,, rolled strip & sheet	,,	1/2½	...
p ,, wire	,,	1/3½	...
o Platinum	per oz.	£26	...
d Silicium Bronze Wire	per lb.	1/1	...
r Steel, Magnet, in bars	,,	1/-	...
n Tin, Block (English)	per ton	£170 10s.	£7 15s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	8/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r, W. F. Dennis & Co.

London Electrical Engineers.—After an interval of four years the old headquarters of the London Electrical Engineers has once more assumed its normal appearance and recruiting is in full swing. The unit forms the Searchlight Contingent of the 3rd Air Defence Brigade, whose *rôle* is the defence of London against aircraft. It has an establishment of about 800 all ranks, under the command of Lieut-Col. K. Edgecumbe, who, it may be added, joined the London Electrical Engineers as a sapper nearly 25 years ago. The conditions of service are practically the same as they were in pre-war days, except that the pay and allowances are on a considerably more liberal scale. Application for further particulars should be made to 46, Regency Street, Westminster, between the hours of 6 and 8 p.m. on any week-day except Saturday.

The London Electrical Engineers Old Comrades' Association is holding the final concert of the 1921-22 season at the Bridge House Hotel this (Friday) evening, when full particulars of the new unit will no doubt be announced.

Unemployment Returns.—The Labour Ministry reports that on September 25th there were 1,319,900 persons registered at the Employment Exchanges in Great Britain as wholly unemployed. The corresponding figure for September 18th was 1,321,667, an increase of 3,190, as compared with September 11th, and on September 25th a decrease of 1,767, as compared with September 18th. The total for September 25th was 503,833 less than at the beginning of last January. The number working short time and drawing benefit for intervals of unemployment was 58,900 on September 25th, as compared with 58,902 on September 18th, and 934,786 on July 1st, 1921.—*The Times.*

THE WIRELESS EXHIBITION.

The First All-British Show.

(Concluded from p. 564.)

The Metropolitan-Vickers Electrical Co., Ltd., had a display of "Cosmos" radiophones, including crystal and valve sets, note amplifiers and loud-speaking attachments. The firm has devised a mains attachment to enable a d.c. supply from the house mains to be used and thus avoid batteries and dry cells in connection with valve sets. A feature of the exhibit was the scale model of the well-known Metropolitan-Vickers water tower, aerial, and mast by means of which the firm's experimental work is done. The smallest type of radiophone made by the firm will enable the user to hear anything from a broadcasting station situated within a radius of approximately ten miles. Material for the aerial and earth system is provided with these sets. The receiving instrument consists essentially of a tuner, detector, and a telephone, to which is added the aerial outfit. The tuner consists of a variometer made up of two coils of insulated wire mounted concentrically, one of which can be turned with respect to the other by a handle into any position so that the current in the turns of the moving coil either opposes or assists that in the stationary coil. A series condenser is provided with alternative aerial terminals arranged so as to permit equally satisfactory tuning on either a long or short aerial. The tuning handle operates over a graduated scale, and a slot is provided in the pointer through which this scale can be marked by the operator to show the tuning position for any particular station. This mark will enable the same station to be easily picked up on future occasions. The detector is of the crystal type, and a spare crystal is provided with each set. No batteries are required.

The whole of the apparatus is completely self-contained in a neat wooden case in which there is also space to pack away the head telephones when not in use.

The "Cosmos" valve set has a radius of approximately fifty miles, using head telephones, and this range may be

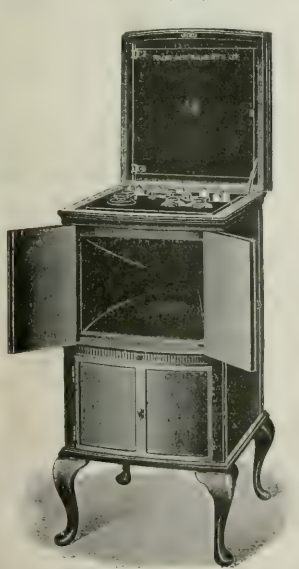


Fig. 9.—Frame Aerial Cabinet Receiver.

increased by the addition of an amplifying unit up to about 200 miles, or for distances up to about fifty miles a loud-speaking telephone can be used. In accordance with the regulations laid down by the Postmaster-General, the "Cosmos" valve sets are not fitted with reaction circuits and are incapable of generating oscillations in the aerial.

The set consists of a compact two-valve receiving and amplifying unit, comprising a tuning variometer, one high-frequency amplifying valve and one rectifying valve, and a filament regulating rheostat, all mounted in a neat hardwood case, together with batteries and a pair of high resistance head-telephones. Material for the aerial and earth system is provided with each set. The tuning variometer has all the features of the crystal set. The valves are of the Mullard "Ora" type, and are interchangeable.

Residents in flats, hotel apartments, and places where the erection of an aerial is out of the question will be interested to learn that a complete receiving set housed in a [illegible] without any external wire of [illegible] has been designed by [illegible]. The principle of which is [illegible] a frame aerial [illegible] other design in which [illegible] necessary high [illegible] accommodated [illegible] To receive broadcast [illegible] the lid of the instrument and to manipulate three knobs which control the [illegible] loud speaker which can be opened or closed thereby reducing or increasing the sound as required. Three high-frequency intervalve transformers fitted with tapping points on the windings and controlled by a coupled switch for simultaneous operation, are connected with the first three valves; the fourth valve acts as a detector, the last three valves being coupled through audio-frequency transformers. The frame aerial in the lid is hinged so that it can swing through an angle of 90 deg. for obtaining the maximum volume of sound according to the direction of the transmitting station.

The Dubilier Condenser Co. (1921), Ltd. [illegible] products are too well known to need any introduction, but a novel pattern of variable air condenser (known as the "Sphericon") was shown, in which the electrodes are in the form of hemispherical shells, fixed and movable shells being interleaved with one another somewhat similarly to the arrangement of the moving-vane condenser. This arrangement secures great mechanical rigidity and ensures constancy of calibration.

An apparatus of special interest which was also exhibited, is a device for enabling the ordinary house electric lighting wires to be used as radio receiving aerials. In the ordinary way it is not possible to utilise the house wiring as a receiving aerial without first switching off the current at the main switch where it enters the building, as otherwise a short circuit would result and the receiver would be damaged. The use of the "Ducon" attachment obviates this. It is tested to withstand 2,000 volts so that safety is assured with no possible risk of shocks when handling the apparatus with the current switched on. The attachment is designed for inserting directly into an electric lamp-holder and is provided with terminals for attaching a wire to the aerial terminal of the receiving apparatus.

The Automatic Telephone Manufacturing Co., Ltd., exhibited a range of practical accessories. The method of securing the A.T.M. telephones to the headbands is worthy of note. This permits of instantaneous adjustment and, combined with the absence of weight, makes the set comfortable to wear.

In spite of their simplicity crystal receivers suffer from the disadvantage that the tuning adjustment has to be made simultaneously with the adjustment for finding the most sensitive point on the crystal. Consequently, crystal sets are sometimes rather puzzling to the novice. It will be readily appreciated that a crystal receiver in which the detector is always automatically set in its most sensitive position and requires no adjustment of any kind, constitutes a big advance.

The T.M. Co. has produced and patented such a detector. The principle of this new detector is roughly that instead of depending on means to find one sensitive point on the crystal, a number of points of contact are always available, consequently this particular detector is automatic in its adjustment as one of the points of contact can be relied upon always to provide the necessary rectifying action.

This new detector is made up in cartridge form like a small fuse, and is held between two clips.

On this stand was also displayed a range of "Radiak" products manufactured by the Ashley Wireless Telephone Co., Ltd., including receiving apparatus. The "Radiak" 1 to 5 valve unit system will appeal to the enthusiast on account of the easy way in which it is possible to add a unit at a time just as one would add to a sectional bookcase.

Mr. H. W. Sullivan had on view an improved crystal receiver (patents applied for) that has been designed with a view to simplicity, efficiency, and reliability. By means of a switch the set is adapted for use on aerials varying in dimensions and shape; the operation consists of only one adjustment for tuning. A sensitive and robust type of crystal, which requires no extreme delicacy of adjustment, is employed. This receiver forms a miniature nucleus cabinet complete in itself, but to which [illegible] cabinet units may be added [illegible] the strength of reception and to enable many [illegible] receivers to be used.

The high power amplifying receiver cabinet [illegible] lengths is a self-contained receiver [illegible] the aerial and earth leads are brought direct [illegible]

additional apparatus required being the batteries and telephones, or [illegible]. Two separate sets of tuning adjustments are provided, one for wavelengths up to 1,000 metres, and the other for wavelengths from 1,000 to 20,000 metres. The change-over switch [illegible] reception to long wave length [illegible] is effected by means of a simple change over [illegible]. The set is [illegible] broadcast transmissions, the Eiffel Tower Paris concerts, The Hague concerts, and [illegible] Marconi Writer and amateur transmissions. The long-wave range of adjustment tunes to the [illegible] wavelengths. The aerial oscillatory circuit is loosely coupled to a primary oscillating circuit, the tuning for both circuits being conveniently arranged in the set. A system of speech control is adopted which gives, on this power, very clear modulation.

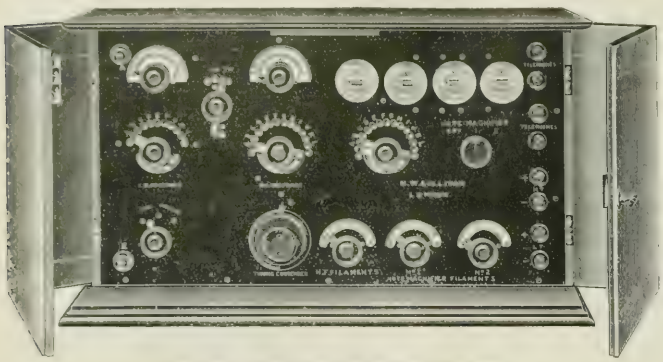


Fig. 10.—A Set of Valve Amplifying Receiver.

amplifier portion of the receiver employs four valves, the first of which functions as a high-frequency amplifier, the second as a detector, and the third and fourth as note magnifiers. This combination gives powerful magnification, and a multi-tap tuning switch is provided to cut out one or two valves in order that very loud speech and signals may be more comfortably and economically received. The set is mounted in a cabinet, which measures 28 in. by 13 in. by 16 in. high. A self-contained [illegible] cabinet, similar to

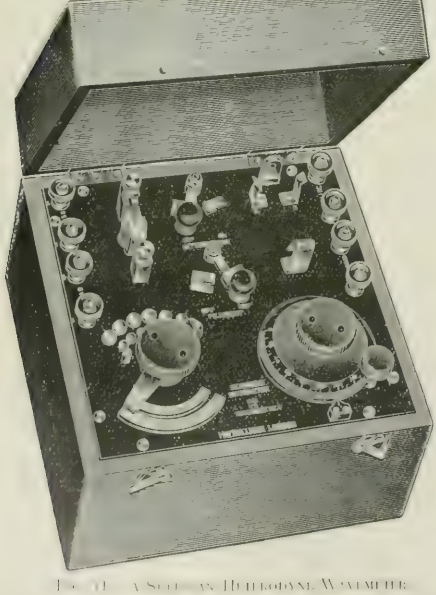


Fig. 11.—A Set of Heterodyne Wavemeter.

the above, but smaller and much simplified, is being designed specially for broadcast reception.

The Sullivan standard heterodyne wavemeter (150-20,000 metres) [illegible] its land produced for commercial use, and is a self-contained standard for pre-[illegible] and spark waves. The instrument (fig. 11) is accurately calibrated against an N.P.L. standard and a full range of seven calibration curves is supplied.

The radio telephone transmitting set (10-50 watts) is [illegible] 200 or 440 metres. It is a self-contained set ready for attachment to the aerial.

The following firms also exhibited:—

The Wireless Supplies Co.—"Crystophone" receivers, cowl insulators, "Multicryst" crystals.

The Anode Wireless and Scientific Instruments, Ltd.—Crystal and valve receivers, batteries, condensers, &c.

The Zenith Manufacturing Co.—Valve receivers, rectifiers, resistances, transformers, &c.

The Radio Service Co., Ltd.—Valve and crystal sets, and accessories.

The "K.B." Radio Equipment Co.—Accessories and component parts.

Mr. T. H. Isted.—Crystal and valve receivers, amplifiers, and accessories.

Fellowes Magneto Co., Ltd.—"Fellocryst" and "Fellophone" valve receivers and accessories.

The Ever Ready Co. (Great Britain), Ltd.—Dry cells and accumulators.

Messrs. Hambling, Clapp & Co.—"O.K." portable crystal receiver and accessories.

Messrs. Burndept, Ltd.—Transmission and receiving sets for experimental use; accessories.

The Wireless Equipment, Ltd.—Crystal and valve receivers and accessories.

Messrs. Watts Bros.—Valve receivers, "Sphinx" batteries, "Ideal" accumulators, &c.

Messrs. Peto Scott Co.—Crystal and "unit" receivers and components.

The Hart Accumulator Co., Ltd.—Batteries and accumulators.

Messrs. J. A. Coomes & Co., Ltd.—"Ionophone" receiver, "Hightensite" specialities, &c.

Messrs. J. B. Bower & Co., Ltd.—Crystal and valve receivers, condensers, high frequency machines, glass electrodes, instrument wire, &c.

Messrs. Mitchell's & Wireless, Ltd.—Crystal and valve receivers, dynamos, motors, transformers, "Lokap" coil-winding machines, and components.

Messrs. Rogers, Foster & Howell, Ltd.—"All-on" valve sets, knapsack receivers for tourists, crystal sets, and parts.

Mr. W. B. H. Tingey.—Receivers.

The General Radio Co.—Cabinet-type receiving sets, portable crystal sets, loud speakers, variometers, varicouplers.

Messrs. A. C. Cosser, Ltd.—Valves and accessories.

Messrs. W. A. Gamage, Ltd.—Valve and crystal sets, and parts.

Messrs. H. P. R. Wireless, Ltd.—Tuners, amplifiers, magnifiers, valve detectors, "Simplex" receivers.

Messrs. Leslie McMichael, Ltd.—Valve and crystal sets and accessories.

The Western Electric Co., Ltd.—Cabinet valve sets, crystal receivers, loud speakers, aerials, &c.

The British Wireless Supply Co., Ltd.—"Britwire" receivers, coils, &c.

Messrs. S. G. Brown, Ltd.—Telephones, loud speakers, microphone amplifiers.

Messrs. Alfred Graham & Co.—Loud speakers, telephones, microphones, transformers, &c.

Messrs. G. Z. Auckland & Son.—Accessories.

Messrs. Gambrell Bros., Ltd.—Crystal and valve receivers and components.

The Econ Manufacturing Co., Ltd.—Receivers, insulators, aerials, and lightning conductors, &c.

The Economic Electric, Ltd.—Receivers, accessories, "Nirandian" valves, &c.

Messrs. Pettigrew & Merriman, Ltd.—Crystal and valve sets, "Gramaphix" for loud speakers, and accessories.

Messrs. H. Stanley Prince & Co.—Crystal and valve receivers.

Miners' Electric Lamps in Australia.—Coalminers' representatives from the northern, southern, and western districts of New South Wales, Australia, waited upon the Minister for Mines (Mr. J. C. L. Fitzpatrick) recently, and asked him to assist miners to use electric light in the mines. The deputation accepted the Minister's suggestion that a conference should be held. Mr. D. Rees, president of the Coalminers' Federation, said that the old type of oil lamp was mainly responsible for the large number of miners who were incapacitated annually by nystagmus. Electric lamps would be more efficient and would reduce this disease by at least 25 per cent. Mr. Fitzpatrick: "It is admitted that there should be a change in the system of lighting; the only thing is how that change can be brought about. Several collieries are investigating the matter of electric lamps."

SALESMANSHIP IN RELATION TO LIGHTING.

The first of a series of lectures organised by the British Electrical Development Association, following on the success of last year's lectures, was given by Mr. W. E. Bush, of the British Thomson-Houston Co., Ltd., at Caxton Hall, on October 13th. Mr. Ll. B. Atkinson (Chairman of the E.D.A.) was in the chair, and the attendance was even larger than most of the attendances last year.

The lecturer confined himself to dealing with the business to be obtained in modernising and adding to existing lighting equipments, as distinct from the development of entirely new business, which was dealt with last year in a lecture by Mr. Haydn Harrison. The branch of the business which Mr. Bush dealt with he considered badly neglected. Generally speaking, he regarded the progress in the sale of good lighting during recent years, in spite of the vast amount of publicity given to it, as very slow, which was probably due, in a large measure, to the apathy shown to the merchandising side of the business by the retail trade. The lecturer stated that, in his opinion, only 30 per cent. of the factories of the country had proper lighting equipment; 60 or 70 per cent. of our shop windows needed new gear; in the majority of shops the internal equipment was obsolete and inefficient, and the intensity of illumination hopelessly inadequate; and the majority of private houses had been wired for the minimum number of outlets for the use of electricity, and equipped with the simplest forms of lighting apparatus. One important reason why, the speaker said, was that there was a lack of first-rate lighting salesmen, and it would pay handsomely if contractors and supply authorities would send their salesmen periodically to the manufacturers for instruction. He did not suggest that the lighting salesmen should have an extensive theoretical training in the design of equipment, but a short course covering the demonstration of lighting fundamentals and instruction in simplified methods of designing illumination.

As to the market available, the lecturer said that extraordinary care was taken to see that the generating plant was of the highest possible efficiency, but when it came to lighting it was considered sufficient to state the number of "points" without regard to efficiency. When the points were installed it was often left to the manager, or even the workmen, to fit them with lamps and shades to suit their particular fancies. In the lighting industry appliances installed 30 years ago were still in use, and, worse still, similar apparatus was being installed to-day. It could be proved that modern installations of high-intensity lighting increased production from 15 to 20 per cent., thus easily paying for the installation and operating costs. An installation was mentioned in which 200-watt lamps with industrial reflectors had been installed at 10-ft. centres, giving an intensity of illumination approximating to daylight. In the old system, which these lamps replaced, 30 kW for local lighting was used. With the new system 150 kW had been installed, so that all branches of the industry, central station, manufacturer and contractor, would benefit. The same charge of obsolescence of much of the equipment of offices and public buildings was made. In all directions the endeavour should be made to educate the public to an appreciation of higher illumination intensities. As in offices and public buildings, so in shops; the shopkeeper must have new and modern appliances brought to his notice or he would not otherwise be made aware of them. The aim should be to light every window like a stage, sometimes introducing artistic colour effects, spot lighting, and other attractive combinations. Inside, thousands of small shops required properly lighting. Incidentally, it was urged that an attempt should be made to popularise the term "foot-candles" amongst the users of electric lighting apparatus. Numerous directions were indicated in which new business was available, *i.e.*, in churches and public buildings, and in the home, the latter presenting the greatest opportunity of all, and the general arguments applied to schools, theatres, &c. A sales campaign was outlined, by which consumers should be canvassed first by post ,and immediately afterwards by calls from salesmen. After disagreeing with the view often expressed that nowadays lighting could look after itself and that the heating and cooking load should be developed mostly, Mr. Bush made a strong criticism of the trade Press. His words were as follows: "Before concluding I would make an appeal to the electrical Press to give the question more prominence and help to foster greater interest in merchandising light. Our trade journals devote plenty of space and attention to developments of a scientific and technical nature, but when it comes to purely commercial matters it is not easy to secure their interest. The editorial departments of these papers seem to look upon the electrical industry as a kind of subsidised organisation engaged primarily in abstract research. What we want is that our papers should frankly commercialise themselves and deal at greater length with what is, after all, the main concern of the industry, the sale of its products. I do not mean simply by the publication of trade 'puffs,' but rather by a definite diversion of editorial policy from technics to trade. Let the papers investigate, propound, and develop new selling ideas for the benefit of their trade readers. In the domain of lighting there is enough scope for journalistic enterprise. It is a subject which has never adequately been treated.

Finally, he said that we were just entering upon a new lighting season the market was waiting and the goods were ready. What is required is the enthusiastic co-operation of contractors, supply companies, and manufacturers, backed up by the E.D.A. and the trade Press.

In a subsequent discussion the Chairman drew attention to the importance which the E.D.A. attached to the whole question of salesmanship, and said that the industry had suffered more from inefficient and insufficient salesmanship than from any other single defect.

Mr. W. E. Rogers (Electricity Department, West Ham) said that, speaking from the electricity supply point of view, supply authorities had had to turn to the development of the power load in order to improve their load factors and make the business pay.

Mr. Joyce appealed for co-operation between supply authorities, manufacturers, and contractors, and for their support of the E.D.A., which body should carry out the propaganda work on behalf of all of them.

Mr. E. Stroud emphasised the importance of educating the salesmen and the public, and asked that manufacturers of lighting appliances should publish distribution curves.

Mr. L. L. Robinson (Borough Electrical Engineer, Hackney) said that he objected to salesmen talking to the consumer about foot-candles, and so on. They should talk to him in a practical manner and show him what was wanted.

Mr. H. W. Gregory did not quite agree. They should try to educate the consumer, to a certain extent, as to what a foot-candle was, and he suggested that there should be a photometer or a similar instrument in every showroom for the free use of any consumer or prospective consumer.

Mr. W. E. Warrilow agreed with Mr. Robinson. Referring to trade discounts, he said that it seemed to be possible for anybody who bought a lamp to get a trade discount, whether from the manufacturer, the factor, or the contractor. As to education on lighting, he advised that they should start in the schools, and so educate the light user from the beginning. The question was the sale of light, and not merely the sale of lamps. They must also educate architects on lighting, and ask them to attend the conferences. He asked Mr .Bush if he had heard of an insurance company giving a special rebate in a works so well lighted that accidents were greatly reduced. Such a rebate would be of great value to the lighting salesman.

Mr. Mann, dealing with trade discounts, said that manufacturers allowed varying discounts, which resulted in contractors pushing the sale of those articles which gave them most profit. Therefore discounts should be standardised, and contractors would feel that they were pushing articles on their merits. He agreed that it was difficult to explain to the consumer the meaning of such expressions as "foot-candles," and appealed for simplicity.

Mr. H. T. Young said that supply authorities, manufacturers and contractors were not pulling together, and they must come to a definite decision as to the function of each. He had found that when a man wanted an odd lamp or some fuse wire he went to the contractor, but when he wanted something more the manufacturers were after him. The contractor must be given a chance to sell his goods, and must be given reasonable trade terms for the work he did. He agreed that it was desirable to send out circulars, but they must be followed up. It was important, when trying to convince a man that it would be better to have his lighting rearranged, to offer to fit it up for him as an experiment, and in 99 cases out of 100 the client would keep it and pay for it. He emphasised the importance of holding staff conferences, so that the men could make suggestions to clients with whom they came in contact; and, finally, called attention to the fact that money was saved on decorations where electric lighting was installed, as compared with gas.

Mr. W. F. T. Pinkney (Newcastle) said the whole tone of the conference at Newcastle on the previous evening was co-operation, and emphasised the need for it. He suggested that wiremen, meter readers, &c., should be trained in salesmanship.

Mr. Stephens said the manufacturers recognised the need for co-operation as much as the contractors. He suggested that the industry should arrange one or more electrical weeks, when co-operative efforts should be made by the whole industry to "boost" electric lighting.

Mr. H. J. Cash pointed out that contractors were afraid of the manufacturers taking their business, and asked that manufacturers and contractors should investigate the cause together. The E.D.A. could help more by drafting sales letters and offering them to contractors. He suggested that it would be cheaper to convince a shopkeeper that he needed better lighting by fitting up an installation free of charge for a year (the supply authorities supplying the energy, the manufacturers the fittings, and the contractors the wiring) than by argument.

Mr. R. B. [illegible] asked that manufacturers should help to extend the knowledge of salesmen by supplying blue prints of illuminating curves, &c. He welcomed the suggestion made recently in the Electrical Review that contractors should combine together and run showrooms jointly.

A speaker who preceded the suggestion that wiremen and meter readers should be trained in salesmanship, because they would have to be given commission on sales, and would take more interest in that than in their real job.

Mr. A. W. Hedgman (*Electrical Times*) urged that the point of salesmanship should be kept in mind at the conferences, or they would fail in their object to a large extent. They should talk about selling points, and leave trade discounts and other matters alone.

Mr. A. Cowans Wyatt (*Electrical Industries*) considered Mr. Bush's criticism of the electrical Press as ingratitude.

Mr. Bush in reply to the discussion, said that America was making great efforts to increase the lighting load; if it paid there why not here? Distribution curves would probably not be appreciated. He believed in giving contractors more cut-and-dried information. He defended his advocacy of the use of the term "foot-candles," and said they must have some method of measuring, or they would not know what light they were getting. Salesmen should offer the architect more elaborate schemes, with which he was not competent to deal. He had done that himself, and architects had had to come to him for advice. He did not know of an insurance company giving a special rebate for a well-illuminated works, but had read that such things were done in America. With regard to trade discounts, his company did its utmost to prevent those who were not entitled to discount from getting it, but mistakes might happen sometimes. On these questions of discount and trade conditions he suggested that at these conferences they should settle matters of policy, and, having agreed upon those, let their trade organisations settle the details. He agreed with the training of wiremen and meter readers in salesmanship, and did not think they would waste much time. He pointed out that there were hundreds of proprietary articles on the market which were distinctive in character, and the manufacturers of them could draft letters better than anybody else. He did not agree with the suggestion of fitting out shops free of charge. There were some well-lighted shops about, and he did not see why these should not be used as examples. As to his remarks upon the electrical Press, he had particularly said "some" papers. Even so, he thought that still more attention could be given to this vital subject by the electrical papers. The electrical Press had a tremendous responsibility, because it had it in its power to make or mar any particular part of the industry.

ELECTRIFICATION SCHEMES IN CZECHO-SLOVAKIA.

A Large Programme.

By W. LEAVIS.

The task of intensifying industrial production in Czecho-Slovakia and of placing the manufacture of goods on a cheaper basis has long since led to comprehensive plans on the part of the Government for the gradual electrification of the country. In recent years the scheme received a further stimulus through the separation of Czecho-Slovakia from the Galician oilfields, which necessitated an annual import of naphtha amounting to 500 million Czecho-Slovak crowns, and through the loss of some of the coalfields in Silesia, assigned to Poland. According to official information the limited funds at the disposal of the Government rendered it necessary to proceed cautiously, and although Moravia, Silesia, Slovakia, and Carpathian Ruthenia are eventually to benefit from the scheme, the immediate work is confined to Bohemia. Even here, the southern part, owing to different local conditions, will have to exercise patience until circumstances permit of its thorough participation in the scheme. South Bohemia, which comprises nearly one-third of the whole area, is comparatively poor and sparsely populated, while its industries are chiefly concentrated in the larger towns. The electrification of these districts is, therefore, of the utmost economic importance, but, as it would involve more extensive and costly work than in the other parts, a thorough application of the scheme will have to wait until the work in Northern and Central Bohemia is carried out, or, at least, more advanced.

The work of electrification in Bohemia is being pursued in two directions: the harnessing of water-power and the erection of steam generating stations, together with a network of distributing stations. The erection of hydro-electric power stations is being chiefly undertaken by the State in conjunction with the district authorities, assisted by individual municipalities and private undertakings. The electrification law, which was passed in the National Assembly some time ago, provides for this purpose a sum of 75 million crowns, which is to be apportioned to the budgets between 1919 and 1928, though about one-half of this amount has already been disbursed. Apart from this Government subsidy the district authorities, towns, co-operative societies, and private establishments, will bear a share of the outlay, in consideration of which electrical undertakings of public utility are granted certain expropriation rights, a rebate in rates and taxes, and other benefits. Up to the present 14 electrical undertakings of this kind have been founded.

The projects for opening up the Vltava to navigation between Prague and Melnik and the Labe from Melnik to the Saxonian frontier, and the execution of the respective works, have been entrusted to a commission for the canalisation of the two rivers. Two-thirds of the cost is borne by the State, and one-third by the district administration.

The work which has been actually started, or the execution of which is imminent, includes the following:—

A hydro-electric power station at Kralovstvi (on the Labe), with a maximum output of 12,000,000 kWh per annum, and at an estimated cost of five million crowns. This station is to be connected with the [illegible] transmission station of the East Bohemian electric [illegible] (30,000 volts).

A hydro-electric power station at Podebrady (on the Labe) with an annual output [illegible] kWh which, by the aid of two transformers, will be transformed up to a pressure of 15,000 volts and fed into the network of the Central Labe districts at Kolin.

A hydro-electric power station at Nymburk (on the Labe) with an annual output of 5,000,000 kWh, transformed up to the same pressure; and similarly conducted as the foregoing.

Plans for the immediate future include hydro-electric stations at Prelouc and Smirice, with an output of 6,400,000 kWh per annum and of 5,000,000 kWh respectively.

The hydro-electric power station at Strekov is reckoned to produce 62,000,000 kWh per annum, and the estimated cost ranges in the neighbourhood of 300 million crowns.

On the Vltava a hydro-electric power station near Mirovice, on which work has already been started; maximum output 17,500,000 kWh per annum; estimated cost 32 million crowns. The plan for the erection of a hydro-electric power station near Troja has been abandoned in view of a larger programme.

Further, the technical department of the district administration has elaborated plans for the utilisation of the water-power of other rivers in Bohemia, and these have partly been put in hand or are awaiting realisation in the near future.

A hydro-electric power station near Spalov (on the Jizera) with a maximum annual output of 14,500,000 kWh, and at an estimated cost of 46,700,000 crowns. The work has already been started.

A hydro-electric power station near Sedlice (on the Zelivka), with an output of 6,000,000 kWh per annum, and at an estimated cost of 26,200,000 crowns. The current will be fed into the network of the South Bohemia Electricity Works at C. Budejovice.

A hydro-electric power station near Kaplice (on the Cerna), with an annual output of 6,000,000 kWh, and at an estimated cost of 9,000,000 crowns. The current to be distributed as above.

The river Sazara is to be utilised for electric power near Smrcena (6,000,000 kWh), near Privlsky (3,200,000 kWh), and near Kamenny Oujezd (8,000,000 kWh), the river Divoka Orlice near Litice (7,200,000 kWh), and the rivers Vydri and Kremelna at their most advantageous points.

Taking the total capacity of the electric installations in the southern districts of Bohemia, we find that it amounts to 4,580 kW, or 0.307 kW per square kilometre, as compared with an average of 2.6 kW per square kilometre if the whole of Bohemia is taken into account. For generating purposes, water-power, peat, and the cheaper kinds of coal enter into consideration. There is plenty of water-power in these parts of Bohemia, but its adaptation to electrical purposes will require both time and money. There is, first of all, the Vltava, which can be tapped at several places. On five points alone this river is capable of supplying about 200,000,000 kWh per annum. Considerable water-power might also be obtained by the utilisation of the rivers Otava, Luznice, Malse and Vydra, and work on some of these is already in progress. However, in view of the costly and lengthy proceedings which the opening-up of these sources would entail, the plans for the immediate future are restricted to smaller work, which lends itself to quicker and cheaper treatment. To this category belongs a hydro-electric station near Letosice, on the Vltava, which is estimated to produce about 6,000,000 kWh per annum. The construction of this station is in progress. Two other (smaller) stations are to be built near Smrcena, on the Upper Sazava, and near Sedlice, on the Zelivka. The water-power of the river Cerna is also to be utilised.

All these hydro-electric stations must have some reserve power, and for this purpose the large peat and lignite beds of Southern Bohemia might be utilised.

The large central power station at Mydlovary, near C. Budejovice, in conjunction with smaller stations on the rivers Vydra, Zelivka, Smrena, and Cerna, is intended to furnish South Bohemia with electrical energy. The erection of the station at Mydlovary, together with the outlying stations, as well as the exploitation of the water-power in South Bohemia, will be undertaken by the South Bohemian Electrical Co., of C. Budejovice. This undertaking has at its disposal an initial capital of 10,000,000 crowns, which is to be trebled in the near future.

The municipality of Kaaden has commenced the erection of a hydro-electric power station near Lametice, on the Ohre (Eger), with a maximum output of 35,000,000 kWh, and at an estimated outlay of 80,000,000 crowns.

The following works are to be built by corporations or private enterprise :—

A hydro-electric station near Letosice, on the Vltava, with an output of 6,000,000 kWh, the current—at a pressure of 22,000 volts—to be fed into the network of the South Bohemian Electrical Works.

A hydro-electric station near the Bretmerence Weir, on the Labe, with a capacity of 1,000 h.p.

On the Jizera (Iser) the engineering firm of Laurin and Klement is building several power stations, partly for its own use, and partly for the supply of the surrounding district. For instance, this firm has erected a small power station at Rozatov (370 h.p.), and another at Bakov (500 h.p.), while the utilisation of the water-power at Haskov is in contemplation.

A hydro-electric power station is in course of construction on the Rozemberk pond (which forms part of the Schwarzenberg estate), with utilisation of the river Luznice. The annual output of this station will be 3,000,000 kWh, the current at 22,000 volts—to be fed into the network of the South Bohemian Electricity Works.

The systematic electrification of Bohemia is to be carried out by several large companies, which, later on, are to be amalgamated into a single concern. With this view, both the State and the district administrations are participating in the scheme, and lending every support in their power to the companies in existence or to be founded. In this way, shortly after the foundation of the Republic, the East Bohemian Electricity Works at Trutnov, together with the works at Poric, were taken over by the district authorities, and have since been enlarged. In 1919 these works had a maximum output of 18,500,000 kWh, while a year later this had risen to 22,100,000 kWh. With a view to the rational electrification of the Turnov district to the Eastern County border the Association of Consumers of Electric Energy at Hradec Kralove has been transformed into a large association of electrical works belonging to the districts, communities, co-operative societies, and other consumers of electrical energy at Hradec Kralove, and is now engaged upon the enlargement of the conducting network in the North-Eastern part of Bohemia.

The Association of Electrical Works of the Districts situated on the Middle-Elbe, at Kolin, a limited company, produced in 1919, 4,882,000 kWh, and in 1920, 5,385,281 kWh.

The hydro-electric power station at Drazice, which supplies the communities situated on the lower Jizera, produced in 1919 2,000,000 kWh, and in 1920, 2,500,000 kWh.

The Central Bohemian Electricity Works, Ltd., at Kolin, and the Association of Electricity Works of the Central Bohemian Districts, Ltd., at Prague, are co-operating concerns, of which the former has taken up the erection of power stations on the lower Vltava, between Prague and Melnik, while the latter is to supply twenty districts in Central Bohemia.

The Central Power Station at Reichenberg (Liberec), a limited company, is to undertake the enlargement of the electricity works (driven by steam) at Engelsberg. The central station furnishes power chiefly to the municipality of Reichenberg and the surrounding districts. In 1919 it produced 11,400,000 kWh.

The North Bohemian Electricity Co., at Bodenbach (Podmokly), supplies the northern part of Bohemia, and is enlarging its station (steam) at Trnice. In 1919 it produced 48,900,000 kWh, and in 1920 55,550,000 kWh.

The Association of Western Bohemian Electricity Works, Ltd., at Pilsen, has taken over the power station at Harova Brasy, whose production in 1919 was 310,000 kWh, and in 1920 850,000 kWh, while another large increase took place last year.

The above concerns comprise only those that are to form a basis for the electrification of Bohemia. Besides these, other electricity works and electrical undertakings have of late considerably enlarged their scope. At the end of 1918 the total length of the conducting networks of 30 of the larger power stations in Bohemia was 2,061 kilometres; by the end of 1920 these had been enlarged by 1,321 kilometres. While in 1918 these works had a capacity of 78,800 kW (steam) and 7,100 kW (water), this was increased by the end of 1920 by 50,800 steam and 2,940 water kW.

Considerable importance attaches to the supply of electricity to Central Bohemia, and, in particular, to the capital, Prague. The present installation is entirely insufficient, and a comprehensive scheme is to be put in operation. A large central power station is to be erected on the State-owned coalfield near Seestadtl with a capacity of 45,000 kW, [illegible] pressure hydro-electric power station, a 75,000 [illegible] average annual production of 350,000,000 kWh, at Steeken, on the Vltava, above Prague, and a hydro-electric power station of 20,000 kW, [illegible] 41,000,000 kWh per annum, near Vrane, [illegible] above Prague. These [illegible] are to be connected [illegible] by a 154 pressure line. The station at Seestadtl is to be completed [illegible] the hydro-electric stations near Steeken and Vrane are to be [illegible] These stations [illegible] company, [illegible] electric works at [illegible] works, and to other [illegible] the current is left to the associations of electricity works, in so far as they [illegible] own [illegible]

The power station at Seestadtl, which at first will be equipped with two turbo-generators, will use the coal produced from the mine. As the necessary quantity of water is not available on the spot, a pipe, many kilometres long, is to be laid to a pumping station, situated near [illegible] on the river Eger. The main part of the electric power will be transformed to a pressure of 100,000 volts, which, by means of a transmission line 100 kilometres long, is to be conducted to Prague, while on the way, near Kladno, a large transforming station, for the supply of local industrial establishments, has been planned. The total cost of these installations is estimated at about 300,000,000 crowns, which is to be raised by a loan bearing interest at 9 per cent. per annum. The project is to be carried out by a joint stock company with an initial capital of 200,000,000 crowns, in which the municipality of Prague is to participate with 20 per cent., the State with 60 per cent., and the Province of Bohemia with the remainder. In this scheme the Ministry of Public Works proposes to connect the larger electricity works, situated in the lignite districts, with each other, and also with the central power station to be erected with a common connecting [illegible] so that the whole installation will become part of a single system.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Western Centre Chairman's Address.

The opening meeting was held in Bristol on October 9th, when Mr. F. Tremain, the new chairman, delivered his inaugural address. There was a large attendance, and in the course of his speech Mr. Tremain explained that it was nearly forty years since he was elected a member of the Society of Telegraph Engineers and Electricians. As he had been prevented from attending the Institution Jubilee Commemorative Meetings, at which he was invited to speak, he enumerated some of the difficulties students experienced in the early days, soon after the passing of the Elementary Educational Act. The Chairman continued: I wonder if our captains of industry realise the tremendous potentialities of all the well-equipped engineering students who come to them from the technical colleges? I have an uneasy feeling that they are better utilised on the whole in other countries. We want more engineering research and some industrial psychology if this country is to hold its own in the application of electricity to the service of man. If our industrialists in the electrical field would only spend 1 per cent. of their net revenue in research work and propaganda I believe they would be rewarded a thousand-fold.

The progress made in the 17 years since I left London for Newcastle-upon-Tyne, on being appointed as superintending engineer, is certainly very remarkable. Electricity supply engineers have some leeway to make up if they are to progress as much in their art as telephone engineers have in theirs. Until they obtain a 24-hour load for their generating stations the capital expended on their generating plant, substations, mains, networks, and equipment cannot possibly earn a full and adequate return, so as to bring down the cost of energy to a competitive figure.

I was pleased to see in a recent local newspaper reference to a suggestion I have been making to supply engineers for several years. I refer to the supply of hot water for domestic purposes by the use of immersion heaters operated at night, when so much generating and other plant is, to a large extent, idle. Thermal storage is well worthy of industrial research. There are probably in Bristol alone, for instance, 80,000 30-gallon hot-water tanks out of use, due to the very extensive substitution of gas and electric cookers for the kitchen range. I suggest that if these were recovered and converted to lagged tanks, or otherwise made "thermproof," and fitted with heating elements, and such a valve [illegible] fitted in gas and electric steam radiators for turning [illegible] gas or cutting off the electricity when a temperature [illegible] ing boiling point is reached, an extremely valuable [illegible] of energy would be provided. The electrical energy stored by two and a half million gallons of water [illegible] in temperature is not to be despised. To compete with gas-

heated water electrical energy would probably have to be supplied at one-third of a penny per kWh. It might be worth a halfpenny in view of immunity from fire risks, but the fact that it can be controlled from a distance is an immense advantage, as is also the fact that it can be turned completely off, whereas thermostatically-controlled gas is only turned down.

My suggestion is that a simple vibrating relay be devised to cut the heaters into circuit, one for each tank, at the will of the switchboard attendants, district by district. This could probably be done by superimposing on the supply network a signalling current, which would possibly be sent over the network in certain areas in turn, so as to spread the supply for this purpose over the slack hours. In fact, if this plan is feasible, energy for this purpose could be supplied at any time of the day or night when spare energy happened to be available. The thermostat would cut out individual tanks when sufficiently heated. For bringing this stored hot water up to boiling point, necessitating the addition of cold water, and so conserving the supply, I would suggest the use of small super-heaters on each hot-water tap in a house.

As regards the insulation of the tanks, it might be practicable, now that aluminium is becoming cheaper and more plentiful, to provide an inner lining to existing tanks, on the thermos principle, exhausting sufficiently the space between the inner and outer walls. A recommendation for this system, if it can be successfully introduced, would be the fact that if hot water is not used, due to a day's absence from home, only the small leakage of heat would be made up and charged for, whilst during prolonged absence the supply should, of course, be cut off at the main switch.

Another utility suggestion might be worthy of industrial research and exploitation. We have heard of the superimposing of telephonic speech with the necessary calling facilities by ringing bells, &c., on transmission lines operated at 30,000 or even 110,000 volts. Now, of course, on underground power cables of any length or networks, speech probably could not be superimposed. The electrostatic capacity of such cables is too high, but signals of a moderate periodicity probably could, and there are buzzers on the market which operate at the supply frequency, and are intended to take the place of house-bells and their batteries. If a buzzer could be designed which would operate at this frequency and no lower I would suggest its use for waking people up instead of doing so by alarm clocks. If one could be made to operate at two frequencies a little above and two a little below, these frequencies could then be sent over the network at, say, half-hour intervals from 6 a.m. to 8 a.m., and the renter would be supplied with a small instrument, which he would plug in, or turn a pointer to the time on a dial, at which he wished to be called. If in a city the size of Bristol 50,000 renters of this service could be obtained at, say, 10s. a year, a very nice additional revenue would accrue to the supply company for a small expenditure of energy. Until we can get the "cheap and abundant" supply of electrical energy we hear so much about, but see so little of, we might try to increase the utility of what we have.

I will conclude with something in the nature of a vision: When I was in the North of England I erected for telephone purposes trunk lines of H-poles braced with iron rods and from 40 ft. to 60 ft. in height. One line from Shap through Penrith, Carlisle, and Gretna, to Scotland, and on the East Coast a second line from North Allerton through Bishop Auckland and Newcastle over the Cheviots to Jedburgh; south and north in other districts they proceeded into Lancashire and Yorkshire respectively, and both into Scotland. Now, Prof. Robertson, in his inaugural address a few years since, spoke of various ways of getting cheap power, and he suggested that the Clyde might be dammed. I have heard the Clyde anathematised—and perhaps there is some reason for it when one is on it for pleasure—but if its great tidal energy could be converted and sent south over these lines, which I suppose the Post Office will not require when it can provide trunk lines underground—it should be possible to supply energy without undue expense to Manchester and Lancashire in general, as well as to the East Coast and Yorkshire. There are also the poles and the lines to every town and village in the country, and my dream is that nearly all overhead plant of this kind will in the future be used for power transmission. Much thicker conductors would have to be employed in some cases, but only in a few of them, and the total weight and strain on the poles would probably be much less than at present. The Shap-Carlisle line probably carried four tons of copper to the mile. On the minor cross-country lines energy for lighting and power could be conveyed to every town and village. Over these minor lines it will, no doubt, be possible to provide the telephone service by means of high-frequency carrier currents, or by means of telephone cables suspended on the poles when the latter are used for power transmission. This double utility should cheapen both services, and might lead to the repopulation of our rural districts, reviving their industries, and greatly increasing the amenities of country life.

No doubt main lines all over the country would similarly become available for other than their original purpose. The turn of the tide of population, at least in part, back from our great centres to the smaller towns and villages would undoubtedly help towards the greatest happiness to the greatest number. The increased modern facilities for travel will also help this, but nothing so much as the widespread provision of cheap electrical energy for light and power, and the revival of rural industries.

THE NEW B.L.I.C. MAGNETO.

ROTATING MAGNET TYPE.

It will be recalled that in order to assist in meeting the enormous demands for magnetos that arose when it was realised that mechanical transport was one of the essential factors in war operations, the British Lighting & Ignition Co., Ltd. (proprietors: Vickers, Ltd.), commenced the manufacture of magnetos in this country during the early part of the European war. It was appreciated, however, that the pattern then produced had by no means reached finality, and Mr. E. O. Turner, the firm's chief electrical engineer, therefore set himself the task of evolving a new design, and Mr. B. Callard, managing director, is to be congratulated on his firm's achievement.

The form of construction employed is almost the inverse of that adopted in the older type of rotating-armature machines with which all motorists are familiar. In the new B.L.I.C. magneto, fig. 1, the magnet, the most robust part of the machine, is made to rotate, while the armature, with its low- and high-pressure windings, remains stationary. All fragile insulated parts, such as slip rings, lengthy rotating brush holders, collector brush holders, and so on, have, by careful design, been entirely done away with. In their place is a short stationary connector piece (fig. 2) leading the high-pressure current from the stationary armature to the stationary distributor terminal; this arrangement is so great an improvement as practically to prevent, it is claimed, the possibility of breakdown.

The contact breaker is of an improved pattern, and is also stationary, the cam being revolved instead; this not only enables the sticking contact breaker lever—a trouble which so many motorists have experienced in the past—to be entirely eliminated, but enables a much more robust unit to be made, requiring less attention either for cleaning or for resetting the contacts.

Fig. 2 shows two sectional views of a standard G.J. B. type magneto and fig. 3 shows in diagrammatic form its connections. The path of the flux from the N pole of the magnet F, through the stator pole shoe N, armature core A, and back through the right hand stator pole shoe to the S pole of the magnet, may be followed from the right hand

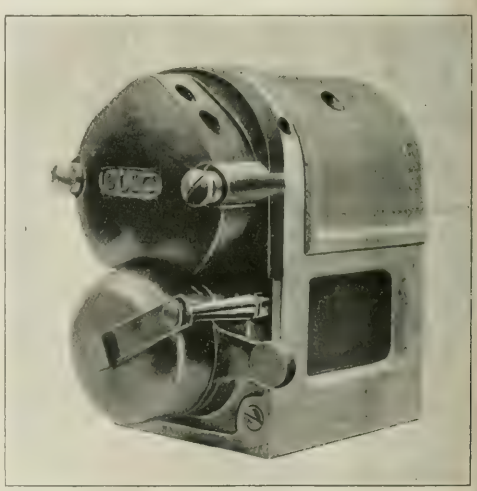


Fig. 1.—The New B.L.I.C. Magneto.

drawing in fig. 2. Referring to the left hand view in fig. 2, the armature core A carries two windings—B, the low pressure and C, the high pressure. One end of the l.p. winding is connected to the earthed moving point of the contact breaker, and the other end to the stationary insulated point. The start of the h.p. winding is connected to the end of the l.p. winding and the end of the h.p. winding to the connecting piece D. A condenser E across the contact points prevents sparking taking place when the primary current is interrupted. On turning the rotor F with the contact breaker points separated a voltage is induced in both windings; this pressure, however, is generally too small to produce a spark at the plug points. When the rotor is turned with the contact points closed a current flows in the primary winding, its effect being to delay the decay of the

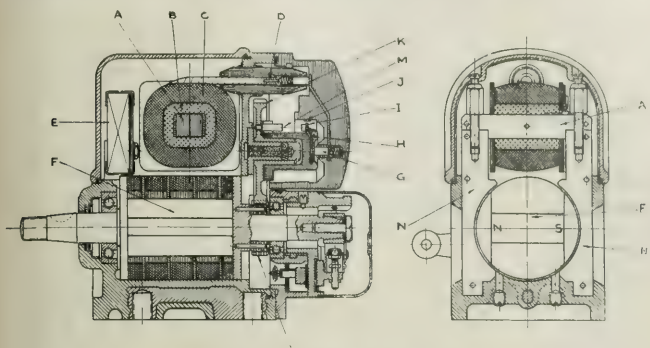


Fig. 2.—Sectional Views of Magneto.

magnetic flux. If, now, at a suitable position of the rotor the contact points are made to open, the armature current being near its maximum value, the flux threading the primary winding will change suddenly and will cut the secondary winding with great rapidity, producing the high voltage necessary to jump the sparking plug gap. The most suitable position to open the points is found to be when the trailing tips of the rotor have left the armature pole shoes by a few millimetres. The h.p. current so generated is led from the armature through the connecting piece D to the centre brush on the distributor G; thence by means of the rotating arm H and its brush I it passes to the brass segments J of the distributor, to which the plugs are connected.

Since the primary current in the armature is a maximum twice during each revolution, it is possible to obtain two sparks per revolution; a 4-cylinder magneto, therefore, runs at engine speed in order to produce four sparks during the two revolutions of the engine.

The distributor brush arm is mounted on a gear wheel K, which is driven from the rotor by means of another gear wheel, L. The distributor runs at half engine speed, since

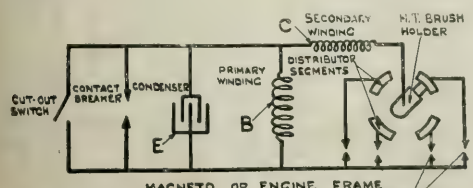


Fig. 3.—Diagram of Connections.

it has to complete one revolution during two revolutions of the engine. The cut-out device consists of an insulated terminal connected to the insulated end of the primary winding. If the earthing wire is connected to this terminal, on closing the switch the contact breaker is short-circuited, thus rendering the magneto inoperative. Reference to fig. 3 will make this clear. The safety spark gap is shown at M (fig. 2). If the h.p. circuit were broken, either through any of the cables becoming detached from the plugs, or from any other cause, the spark would occur between the serrated pins, thus protecting the insulation of the machine from excessive strain.

The chief component parts of the magneto are shown in the illustration of a partially dismantled machine seen in fig. 4.

It has been possible to supersede the old design because use has been made of a cobalt steel magnet, the superiority of which over tungsten steel is so great that the new magnet is only about 1/6 the size of the discarded one. The result is that the new [illegible] lower speed than that.

The armature being stationary enables much more thorough provision for [illegible] does not [illegible] condensers [illegible] evils [illegible] slip rings, brush holders, pick-ups, and rotating pieces have been superseded by a single, short, stationary connector piece between the armature and the distributor. This feature ensures increased reliability as well as greater simplicity.

The magnetic structure is effectively laminated, the fan-shaped stationary pole-shoes, and the construction of the rotor shoes, bring about superior lamination of the magnetic structure; this arrangement [illegible] the excellent sparking characteristics of the machines notwithstanding their light weight.

Since the contact breaker is stationary—the interruptions being caused by the cam, which revolves with the magnet—the contact opening [illegible] affected by wear to so great an extent as the older type. There is only one rubbing carbon brush, in place of the five or more employed in the older type of machine. The heel piece, lever arm, and pivot brush, together with a miniature reservoir of grease for lubricating the pivot, are formed in a single element, consisting of bakelite-dilecto laminæ; this arrangement eliminates the sticking contact lever, and a laminated gear wheel damps out the ringing sound which the impulsive

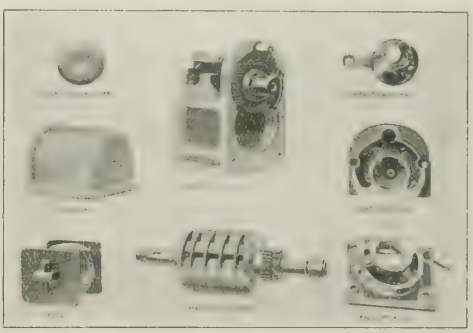


Fig. 4.—Component Parts of Magneto.

drive of the magneto induces in solid metal wheels, and ensures quiet running at all speeds.

All types of the new magneto are watertight and dustproof, and are covered by a twelve months' guarantee for perfect running.

The Volta Electric Furnace.—The first installation in Great Britain of the new Volta electric steel furnace, made by the Volta Manufacturing Co., Ltd., of Ontario, Canada, is to be at the works of Messrs. Denton & Baxter, of Bathgate, Scotland, who have ordered one of three tons capacity. Messrs. T. Rowlands & Co., Ltd., of Sheffield are the agents in Great Britain for this furnace, says the *Sheffield Daily Telegraph*.

A Large Flood lighted Sign.—The sign erected by the British Thomson-Houston Co., Ltd., at its Rugby works, indicating that "Mazda" lamps are made there, is the largest of its kind in this country. It measures 33 ft. by 22 ft., and consists of [illegible] lamps on a framework bolted to the factory roof. The initial letter "M" is 11 ft. in height. To convert this into an ordinary electric sign would require at least 500 ten-watt lamps [illegible] a load of 8 KW. By the B.T.H. flood lighting [illegible] half this power is required, [illegible] four 1,000-W. [illegible] filled lamps.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Complete Specifications left [illegible] by Messrs. Sefton-Jones O'Dell and [illegible], 285, High Holborn, London, W.C.1.

26,478. "[illegible]." V. F. Munro and J. G. Marchand. [illegible] M. A. 22nd, 1921. October 2nd.

26,482. "[illegible]." J. B. Garnett. October 2nd.

26,48[illegible]. "[illegible]." W. A. Cooke and F. H. Morse. October 2nd.

26,487. "[illegible]." L. Rossi, A. V. Kemp[illegible]. October 2nd.

26,48[illegible]. "[illegible]." S. K. Barraclough. October 2nd.

26,[illegible]. "[illegible]." Campbell A. Isbe[illegible]. October 2nd.

26,528. "Electrical advertising and illuminating devices." E. V. Hayes-Gratze. October 2nd.

26,[illegible]. "[illegible]." Delange. October 3rd, 1921.

26,537. "Recording attachment for standard telephone sets." R. S. Tharp. October 2nd.

26,547. "Electric lock and indicator." E. Dwyer and W. Dwyer. October 2nd.

26,552. "[illegible]." I. K. [illegible]. October 2nd. (Germany, October 4th, 1921.)

26,[illegible]. "[illegible]." October 2nd.

26,[illegible]. "[illegible]." October 2nd.

26,584. "Passing electric current through petrol." W. L. Morgan. October 2nd.

26,587. "Wireless apparatus." W. F. Horsley. October 2nd.

26,596. "Rotor winding for asynchronous motors without starters." C. Shenfer. October 2nd.

26,432. "Wireless receiving apparatus." British Thomson-Houston Co., Ltd., and R. C. Clinker. September 30th.

26,444. "Attachment for [illegible] wireless apparatus, &c." J. A. Sibthorpe. September 30th.

26,445. "[illegible]." R. C. Milliken. September 30th.

26,450. "Transformers for wireless apparatus." C. W. Clarabut, A. H. Curtis, [illegible] Electric Co., Ltd. September 30th.

26,451. "Frame aerials." C. W. Clarabut, A. H. Curtis, and Igranic Electric Co., Ltd. September 30th.

26,452. "Inductance coils for wireless receiving apparatus." A. H. Curtis, Igranic Electric Co., Ltd., and S. K. Wright. September 30th.

26,472. "Coil-holder for wireless receiving sets." W. W. Nicoll. September 30th.

26,474. "Wireless receiving systems." C. B. Guest and F. L. Guest. September 30th.

26,602. "Ignition devices for explosion motors." E. von Lepel. October 2nd. (Germany, October 6th, 1921.)

26,604. "Electric conductor terminals." British Thomson-Houston Co., Ltd. (General Electric Co.). October 2nd.

26,609. "Insulators for suspended high-tension wires." A. Renaudin. October 2nd. (France, October 3rd, 1921.)

26,611. "External spark-gaps for internal-combustion engines." J. Robinson and J. B. Wright. October 2nd.

26,638. "Wireless telegraph apparatus." T. Houghton and F. W. Longworth. October 3rd.

26,658. "Clips and terminals for electric leads." S. W. Bussell. October 3rd.

26,674. "Relaying devices." A. R. Angus. October 3rd.

26,678. "Measured service devices for automatic telephone systems." J. H. Jones. October 3rd.

26,679. "Measured service devices for automatic telephone systems." J. H. Jones. October 3rd.

26,682. "Axles for electrically-driven road vehicles." H. M. Butler. October 3rd.

26,692. "Electrical systems and apparatus for chemical treatment of non-conducting liquids." W. McMullen and W. J. Ricketts. October 3rd.

26,695. "Ironclad electric switches." A. Willmott. October 3rd.

26,696. "Electric condensers." L. von Kramolin. October 3rd. (Germany, July 10th.)

26,707. "Variable condensers." M. V. Pirie. October 3rd.

26,711. "[illegible]." J. P. Howarth. October 3rd.

26,719. "Telephone, &c., head-pieces." R. F. Tunmer. October 3rd.

26,724. "Radio-[illegible]." W. B. Morton and C. H. Stave. October 3rd.

26,734. "Arrangement for regulating speed of alternating-current motors." N. [illegible], and M. Kostitzin. October 3rd.

26,744. "Microphonic transmitters." E. A. Graham. October 3rd.

26,745. "Combined gramophone and telephonic apparatus for use with wireless telephonic apparatus." E. A. Graham. October 3rd.

26,753. "Magneto inner ball race remover." A. C. Abel. October 4th.

26,765. "Electric motors." N. W. Bairstowe. October 4th.

26,766. "Electric motors." N. W. Bairstowe. October 4th.

26,790. "Electric clock." A. B. Harje. October 4th.

26,806. "Adjustable electric resistances." H. V. Albrow. October 4th.

26,808. "Method of telephonic communication on fire alarm systems." E. E. Moore. October 4th.

26,818. "Electric welding apparatus." A. E. Cutler and P. A. Marsden. October 4th.

26,819. "Electric welding apparatus." A. E. Cutler and P. A. Marsden. October 4th.

26,831. "Dynamo-magneto units for lighting and ignition in motor vehicles." Scintilla. October 4th. (Switzerland, October 4th, 1921.)

26,832. "Sparking plugs." R. E. Aqudio. October 4th. (Italy, November 26th, 1921.)

26,838. "Insulating materials." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. October 4th.

26,839. "Dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd., and G. M. Pestarini. October 4th.

26,842. "Thermionic valve circuits." P. W. Willans. October 4th.

26,843. "Galvanic cells and batteries." F. Fischer and R. Porscke. October 4th.

26,844. "Galvanic cells and batteries." F. Fischer and R. Porscke. October 4th.

26,849. "Projection lamps." H. Workman. October 4th.

26,850. "Head-lights for motor vehicles." M. J. Williams. October 4th.

26,852. "Electric gas lamp." G. F. Dobinson. October 4th.

26,857. "X-ray apparatus." British Thomson-Houston Co., Ltd. October 4th. (United States, October 10th, 1921.)

26,859. "[illegible] for electric railways, &c." Siluminite Insulator Co., Ltd., and E. V. Wythes. October 4th.

26,866. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 4th. (United States, January 27th.)

26,868. "Carbon-holder for arc lamps having rotary carbons." Anciens Etablissements Barbier, Benard et Turenne Soc. Anon. October 4th. (France, August 23rd.)

26,898. "Motor-car head lights, street lamps, &c." H. J. Sherborne. October 5th.

26,905. "[illegible]." [illegible]. October 5th.

26,921. "Electric controllers." J. Munn. October 5th.

26,927. "Electric primary batteries." E. E. Dutt. October 5th.

26,928. "Electric storage batteries." E. E. Dutt and S. H. Godfrey. October 5th.

26,929. "Electric batteries." E. E. Dutt and S. H. Godfrey. October 5th.

26,937. "Ignition device for internal-combustion engines." G. W. Corless. October 5th.

26,969. "Stands for adjustably supporting X-ray tubes." J. B. Bower. October 5th.

26,970. "Selective switching apparatus." J. B. Bower. October 5th

26,972. "Wireless receiving apparatus." R. C. Congdon and P. L. G. Johnston. October 5th.

26,980. "Telephone receivers." British Thomson-Houston Co., Ltd., and A. P. Young. October 5th.

26,986. "Sparking plugs." R. Colin. October 5th.

26,990. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 5th. (United States, February 11th.)

27,000. "Electro-magnets." H. J. Norballe. October 5th.

27,001. "Electric discharge tubes." Naamlooze Vennootschap Philips Gloeilampen Fabrieken. October 5th.

27,006. "Distillation of zinc, &c., by electrical means." F. J. C. Jones. October 6th.

27,011. "Suspension or connection device for electric fittings, &c." A. N. Haddow and A. P. Rutherford. October 6th.

27,016. "Electric traction systems." E. M. Munro. October 6th.

27,020. "Electric switches." O. W. H. Page. October 6th.

27,021. "Head-lights of vehicles." C. J. Witherspoon. October 6th.

27,039. "Power transmitters." W. Farquharson (Singer Manufacturing Co.). October 6th.

27,041. "Electrical device for external bolting of railway-carriage doors." G. E. Skinner. October 6th.

27,050. "Derailed tram adjuster." J. Davies and E. M. White. October 6th.

27,068. "Electric [illegible]." L. J. Hargreaves and T. R. Hancock. October 6th.

27,070. "Protectors for connecting ligatures of suspended insulators." A. Renaudin. October 2nd.

27,071. "Suspending [illegible] electric conductors." A. Renaudin. October 6th. (France, October 8th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed or abridged, and all subsequent proceedings will be taken.

1921.

10,399. "Apparatus for regulating the phase-compensation of synchronous electric machines by means of commutator machines connected in cascade with the rotor circuits thereof." E. C. R. Marks (Siemens-Schuckertwerke Ges.). April 8th, 1921. (186,087.)

10,585. "Apparatus for regulating the speed and phase-compensation of asynchronous electric machines by means of a commutator machine connected in cascade therewith." E. C. R. Marks (Siemens-Schuckertwerke Ges.). April 11th, 1921. (186,088.)

11,192. "Fusible safety cut-out for electric motors." B. Platschick. April 18th, 1921. (186,091.)

11,700. "High-frequency telephone transmitters." R. B. Ramsford (Naamlooze Vennootschap Nederlandsche Radio-Industrie). April 22nd, 1921. (186,094.)

16,011. "Electric switches." P. B. Handley. June 10th, 1921. (186,108.)

16,425. "Electric resistances." S. G. Frost. June 15th, 1921. (186,117.)

16,639. "Means for producing alternating electric currents." H. J. Round. June 16th, 1921. (186,129.)

16,799. "Means for indicating the period of, and for controlling electrical oscillations." A. M. Young and N. W. Simpson. June 18th, 1921. (186,134.)

16,874. "Utilisation of surplus power from hydroelectric plant for the preparation of peat or similar fuel." Peat, Heating and Techno-Chemical Laboratories, Ltd. June 20th, 1921. (186,137.)

16,879. "Thermionic signal-receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 20th, 1921. (186,138.)

16,882. "Apparatus for separating or sorting fragmentary materials by electric conductivity." H. L. A. Schweitzer. June 18th, 1920. (Patent of addition not granted.) (186,018.)

16,888. "Terminal connections for electric wires." Dr. A. H. Moll & Co. and Merz-Werke (Geb. Merz). October 11th, 1920. (170,266.)

16,907. "Automatic telephone exchanges." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. June 20th, 1921. (186,141.)

17,024. "Ignition devices for internal-combustion engines." C. Pressland. June 21st, 1921. (Cognate application, 32,845,21.) (186,155.)

17,045. "Surgical illuminating and optical appliances." W. P. Rees. June 21st, 1921. (186,158.)

18,082. "Electric lighting and heating system for railway and the like vehicles." A. Spencer. July 13th, 1921. (186,194.)

19,070. "Electric-wave filter." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 14th, 1921. (186,198.)

20,369. "Electric heaters." W. J. Spicer and L. S. Rogers. July 29th, 1921. (186,211.)

20,790. "Antenna system for wireless signalling." Ges. für Drahtlose Telegraphie. August 8th, 1920. (167,190.)

20,972. "Contact device for electrical télegraph transmitters." H. J. Hansen. August 8th, 1921. (186,219.)

21,120. "Thermally-controlled electric-circuit interrupters." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 9th, 1921. (186,224.)

21,681. "Electrical plug and socket connections or couplings." J. A. Crabtree. August 16th, 1921. (186,229.)

22,722. "Electric and gas fires." H. H. Berry. August 26th, 1921. (186,234.)

22,858. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 29th, 1921. (177,130.)

23,004. "Alternating-current track signalling." L. H. Peter and Westinghouse Brake and Saxby Signal Co., Ltd. August 30th, 1921. (186,239.)

23,069. "Motor-car or like lamps." E. A. Orr. August 31st, 1921. (186,240.)

23,321. "Electrical connectors and terminal blocks." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (186,245.)

26,307. "Combined electric switches and fuses." Phi-Kappa Syndicate, Ltd., and J. J. J. M. Kluijtmans. October 5th, 1921. (186,256.)

27,058. "Casings for transformers and other electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). October 12th, 1921. (186,259.)

33,151. "Apparatus for electrically precipitating suspended particles from fluids." Siemens-Schuckertwerke Ges. January 4th, 1921. (174,046.)

34,053. "Oil switches." Sachsenwerk Licht und Kraft Akt. Ges. December 17th, 1920. (172,982.)

1922.

8,211. "Electrical insulators." Metropolitan-Vickers Electrical Co., Ltd. (Railway and Industrial Engineering Co.). March 21st, 1922. (186,285.)

8,304. "Braking systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. (Compagnie Française Thomson-Houston). March 29th, 1922. (186,286.)

10,677. "Apparatus for preventing the unauthorised operation of electric appliances on motor vehicles." Scintilla (firm of). May 20th, 1921. (180,307.)

THE
ELECTRICAL REVIEW.

VOL. XCI. OCTOBER 27, 1922. No. 2,344.

ELECTRICAL REVIEW.

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THE BRITISH TRADE OUTLOOK IN CANADA.

READERS of the ELECTRICAL REVIEW will agree that it is not through any lack of attention to the matter in these pages that Canada has not been a larger buyer of British-made electrical goods. The reasons for making an effort to meet the special requirements of the market; the classes of manufactures which stood a better chance than others of succeeding; the influence of the Chicago Underwriters on the situation, and the means for meeting this difficulty; suggestions for establishing a branch of the B.E.A.M.A. over there; the vastness of the territory to be covered; and the best means of organisation for selling British-made goods in competition with U.S. goods coming over-night from over the border—all of these and many other points have been amply covered—some have thought *too* amply covered because their own experience had not seemed to justify serious attention being given to the subject.

We confess that sometimes we have despaired of much good being done after so many efforts had been made and had failed. But we are at heart optimists, because we believe blood to be thicker than water and than American influence, and because we believe that thousands of Canadians would far rather use an electrical article emanating from the British Isles than one coming from South of the border line.

Not only are these patriotic sentiments stronger, for obvious reasons, than they were before the war, but Canada is far more industrial than she used to be, thus furnishing new business opportunities, although also adding to her own internal productive capacity. It has always seemed that lack of efficient selling organisation on our part has been a failing which prevented British trade expansion there, and schemes promising enough at the time have proved to be born out of due season. But it need not follow that to-day, when the new U.S. Tariff is creating an atmosphere favourable to our operations and when Canadian sentiment is so strongly British, a new well-thought-out plan along somewhat different lines should not stand a better chance. We give some brief particulars of such a scheme in our "Business Notices" this week, and our readers will be able to form their own judgment concerning it.

Simultaneously with the launching of this new enterprise for the distribution, and in some cases production, of British electrical manufactures, there is being placed before the readers of a financial contemporary a defence of British companies and firms against repeated charges of lack of interest in the Canadian market. We are more concerned with the question of electrical and allied goods than with general manufactures, and probably the case which is taken in hand by the Federation of British Industries may be less electrical than general because of the constitution of the F.B.I., notwithstanding the relation of the B.E.A.M.A. to that organisation. We may, however, record the findings of the F.B.I., which have been arrived at after full consideration. First, the close proximity of the United States must always be reckoned as an important advers[illegible] on that point the Federation considers [illegible] unnecessary- the advantage to Canada is [illegible] provided she can get the article that she requires and the pro-British sentiment is outweighed by [illegible]

siderations. Secondly, the rapid development of manufacturing in the Dominion itself, already mentioned above, is a policy much favoured in recent years not only by Canada, but by Australia, and India too, though it has not been carried very far in connection with the electrical industry. Until we can know how far the movement will go and whether it will or will not be permanent, British development along the same line is quite naturally restrained. Canada with her hydro-electric resources, and Australia with the prospect of very cheap power under the Morwell brown coal scheme, are both anxious to induce our manufacturers to start works in the cheap power areas, but our firms will have to consider the matter from many points of view.

But what calls for the fullest defence from the F.B.I. is the charge of failure on the part of British firms to study the Canadian market thoroughly and to adapt themselves to its needs. The Federation describes this criticism as unjust, and it is so large and so representative an organisation that it ought to be in a position to speak authoritatively. Indeed, it possesses concrete evidence of "the large amount of interest taken at the present time by British firms in the Canadian market, an interest which has been steadily increasing with the slight upward tendency in trade" (*Financial Times*, October 23rd). With regard to the proposals which have been made for opening branches there carrying stocks of British goods, and the establishment of British factories, it is pointed out that the erection of branch factories necessitates considerable capital expenditure, which, in the present position of British trade, the great majority of firms are unable to afford. Our readers have lately had before them the financial results of the operations of a number of enterprising British electrical companies. The times have been unfavourable to them, and what they require as much as anything is more good-paying export business to occupy their works and give employment to their own workpeople. Under such circumstances their present disinclination to lay out capital for *productive* purposes in overseas markets in which they require to *sell* goods is easy to understand. The British manufacturer is trying to stabilise business under extremely adverse conditions, and this is, therefore, an unfair moment to criticise him for not establishing branches in the Dominion.

It is stated that the F.B.I. is acquainted with a great many firms which are going seriously into the question. But the whole question of the establishment of factories in Canada, however welcome to the Canadian as a further development of his country, is entirely a business proposition, and must always be viewed from the point of view of supply and demand, and it is only recently that there has been any evidence that Canadian capital may be available to co-operate with British firms in establishing new industries in the Dominion.

The solution of the question is stated to be entirely dependent on purely economic considerations, and whether or not the reasonable defence set up by the Federation of British Industries relates to the manufacture of electrical goods as well as to general products, it is satisfactory to read that the subject has been thoroughly investigated. At a later date when conditions are better it may require re-investigation. We have long looked for good results to follow the export trade operations of the Federation, and not the least useful part of its work is the deep representative study of such a question as the difficulties confronting us in such a market as Canada.

Small Cookers and Heaters.

We are pleased to see that the point mentioned in our last issue—that the salesmanship lectures of the Electrical Development Association have at times shown rather too great a tendency to wander from salesmanship—has been taken to heart by those responsible for the conduct of these lectures. Mr. L. L. Robinson, of Hackney, who presided at the second lecture, given by Mr. R. Smith, of "Tricity," reported on another page, put the position correctly when he pointed out that the lectures were not arranged to discuss trade disputes, and that there were other means for dealing with these. As a result, we may be said to have had a real salesmanship lecture. The subject chosen by Mr. Smith, *viz.*, small electric cookers and fires, is probably one of the most difficult, if not the most difficult, of all domestic applications of electricity, inasmuch as it involves questions both of wiring and charging. If we take, for instance, a person using electricity for lighting and a convert to its advantages generally, but now using gas for cooking, he is disinclined to face the cost of special wiring for cooking and heating on the one hand, or, on the other, to pay lighting rate for cooking and heating, especially when that happens to be in the region of 8d. per kWh. It will at once be seen that the supply authorities will have to play a prominent part in this development of cooking and heating in small houses or even large ones. It is an old story, but it remains true to-day, that some tariff must be devised which will enable electricity to be used for all purposes in the home through one set of wiring and one meter. Perhaps the advent of the multi-part tariff, compulsorily, will do what is necessary, but there is little doubt that there is a really considerable amount of business to be obtained practically at once if only this difficulty can be got over. One point brought out in the discussion, *viz.*, that of service to the customer, is of vital importance to success. Too often electrical apparatus is sold to a customer and no more interest is taken, nor does the seller seem as if he wishes to hear any more about it. Unfortunately, much apparatus of various sorts is sold nowadays by various people who simply act as a sales medium between the manufacturer and the actual user, and have no knowledge of its construction or use. When anything goes wrong the user is referred to the manufacturer, and usually the blame for any fault is placed upon either of the three by the others. This sort of thing suggests that the supply authority should provide this class of service for the customer if only in the interests of the sale of electricity. That electricity will provide cooking as cheaply as gas is now an established fact: the impediments to progress are outside the questions of efficiency and reliability, and the industry as a whole must work together to remove them.

Dear Japanese Labour.

That Japan is no longer a country of cheap labour is evident from Sir E. T. Crowe's latest report on the economic condition of that country, which is summarised in another column. The fact will still come as a surprise to those who remember the extraordinarily low-priced electric lighting fittings and accessories which reached this country from Tokio workshops during the war. Japan did not escape the general rise in commodity prices which occurred all over the world as a result of the war, and since then little reduction has taken place in the cost of living there owing to a number of circumstances, prominent among which are the expenses of an extravagant naval and military administration and a pernicious policy of restricting the output, notably of coal and copper. The whole subject is of considerable interest to British trade from the point of view of Japan's potential purchases of our goods and of her future competitive power in foreign markets. Paradoxical though it may seem, both aspects are fairly favourable to the United Kingdom. Japan still has plenty of money to spend, and although she has lost much of her war-time trade, her consuming capacity is unlikely to be seriously impaired whilst the American demand for silk materials remains good. Since Sir E. T. Crowe's report was written there have been signs that the saner element will succeed in frustrating the policy of curtaling output and will bring prices down.

Taxation Problems.

The burden of general taxation has fallen heavily upon individuals, firms and companies as a result of the war and the absence of real and substantial economies in departments of State. In particular, industrial establishments and works continue to suffer from imposts which prevent development and hamper them in the promotion of the export trade in competition with foreign rivals, and at the same time place a check on private enterprise in new directions. Under these circumstances any efforts made with the object of securing a reduction in the level of taxation are very welcome. What the new Parliament will bring forth after the prospective General Election remains to be seen, but the Federation of British Industries, even before there was any immediate prospect of a dissolution of the existing House of Commons, had already inaugurated a campaign in order to obtain the views of manufacturers on questions of taxation. The meetings organised for this purpose in different parts of the country commenced at the beginning of October, and are being continued for at least one month. The Federation hopes to be able to secure a mandate to press for further State economy, a reduction of one shilling in the income tax, and the revocation of the corporation profits tax.

We believe the corporation tax was an importation from Germany, and, like many other imports from that country, it could with advantage be dispensed with. Many, indeed, are the Reich taxes in Germany, but after they have been paid, the industrial companies are able to pay high dividends—in paper marks, of course—as is shown by the rates of distribution now being made by the colliery, iron and steel and engineering companies for the year 1921-22. But if the standard of taxation in Germany, reckoned in sterling, were the same as in Great Britain, it is unlikely that even the high paper mark dividends would be available for distribution. On the one hand, there are many and insignificant taxes accompanied by very busy industries; and on the other a few and heavy taxes and an immense amount of unemployment. It is to be hoped that it will be possible for the new Parliament so to adjust the degrees of taxation as to impart that stimulus to industries of which the country stands so much in need.

Commercial Arbitration in Foreign Trade.

Since referring to this subject in our issue of October 13th, some particulars have become available concerning the court of arbitration which has been established by the International Chamber of Commerce in Paris, which aims at the friendly settlement of disputes arising between firms located in different countries, without the formalities of legal procedure. The particulars have been supplied to a French contemporary (*L'Information*, of Paris) by M. de Lavergne, general secretary of the French committee associated with the court of arbitration.

M. de Lavergne is reported to have stated that the rules of the court provide for three cases: Conciliation, arbitration without legal sanction, and arbitration with legal sanction. In the first instance the conciliation procedure is as simple as possible. When a dispute arises on the question of the interpretation of a contract between business men in different countries, the one party or the other, through the intermediary of his national committee, can apply for the good offices of the administrative commission of the International Chamber of Commerce. This commission, whose president is the general secretary of the International Chamber, is the assembly of the administrative commissioners who are appointed by the various national committees and who represent the latter in a permanent manner at the seat of the International Chamber.

Arbitration without legal sanction, M. de Lavergne says, is effected by the delegates of a court presided over by M. Clémentel and composed only of personalities whose word ranks authoritative in commercial matters in their respective countries. The French arbitrators are M. Roger, president of the Paris Chamber of Commerce; M. du Pasquier, president of the Havre Chamber of Commerce; M. Pradel, president of the Lyons Chamber of Commerce; M. Porte, president of the Tribunal of Commerce for the Seine; M. Duchemin, president of the Union of Chemical Industries; and M. Waddington, formerly president of the Normandy Syndicate of Cotton Weaving.

Awards given under arbitration without legal sanction pledge the honour of the parties who are compelled to comply with them. In the event of the party against whom an award has been made not conforming to the terms of the award within a period of thirty days, the opposing party can inform the International Chamber of the fact. The court then applies to the Chamber of Commerce or other commercial organisation to which the defaulting party belongs, asking this chamber or organisation to adopt suitable disciplinary measures in regard to this member. It is also possible for the court to exact that the name of the defaulting party should be printed in the publications of the International Chamber, as well as the text of the award which has not been complied with.

Concerning the third class, M. de Lavergne states that arbitration with legal sanction takes place under the same conditions, but is necessarily only possible for countries whose laws give to arbitration the force of a legal decision with all its penal consequences. Owing to the non-validity of the arbitration clause in certain countries, and particularly in France, the rules applicable in the latter case provide for the drawing-up of a deed of mutual agreement, the essential conditions of which are fixed by the rules. This arrangement can naturally be modified or amplified should the necessity arise.

The New Session of the I.E.E.

On Thursday next week the Institution of Electrical Engineers will open the new session at headquarters; some of the Territorial Centres have already held their first meetings, and the huge machine will shortly be in full operation. We sincerely trust that the resumption of the professional proceedings will be accompanied by a similar revival of activity in the electrical industry, which has so long been marking time, impatiently awaiting the return of normal conditions.

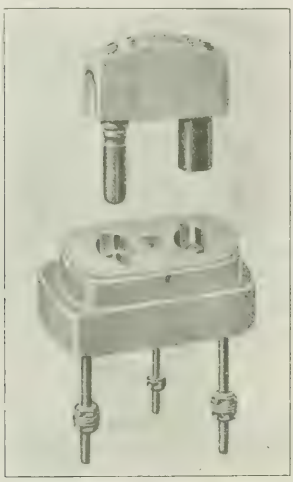
The retiring president, Mr. J. S. Highfield, has been fortunate in holding office during the most memorable year of the existence of the Institution, which he caused to be celebrated in a manner befitting the occasion—the completion of half a century of wholly admirable scientific activity and commendable solicitude for the welfare of the industry. The only regrettable circumstance connected with the function was the unfortunate indisposition which robbed him of the privilege of presiding over the commemoration ceremonies, except at the closing meeting. No such interesting event awaits the new president, whose term of office commenced with the current month, but Mr. Frank Gill will find abundance of useful work ready to his hand—and once more we venture to suggest that the burden imposed upon the president is far too heavy; the vice-presidents, we are certain, would gladly relieve him of a material portion of his labours, were they called upon to do so, and only with their aid will it be possible for a busy engineer to accept the constantly growing duties and responsibilities of the presidential chair without grave detriment to his private interests.

The programme announced for the first part of the session is of excellent promise; the subject of the presidential address remains as usual wrapped in mystery for the moment, but such subjects as the improvement of power factor (a posthumous paper by the late Dr. Kapp), domestic load building, transmission by underground cables at very high pressures, and arc welding, will whet the appetities of technical students of all ages. A useful list of subjects is also forecast for the informal meetings, and there is every reason to look forward to a very successful season.

THE "ELECTRICAL REVIEW" FRENCH TOUR.

(*Continued from page 547.*)

The Société Française Gardy, of Argenteuil, which owns six factories (three in France and the remainder in Switzerland, Spain and Belgium respectively) has for a number of years specialised in high- and low-pressure accessories. The principal work carried on at the Argenteuil factory, which was inspected by a section of the party on October 7th after the visit to Gennevilliers, is the manufacture of low-pressure accessories, and not merely is the metal work machined, but the porcelain and black composition insulating parts are made there also, the company thus having facilities



Fuse Cartridge, Plug and Socket.

which are almost unique. The porcelain is baked in a continuous kiln with 24 chambers, of which at one time six are being emptied and filled, six being warmed up with the waste gases from the baking ovens, and six carrying on the baking, while the remaining six are being cooled down by the incoming air on its way to the

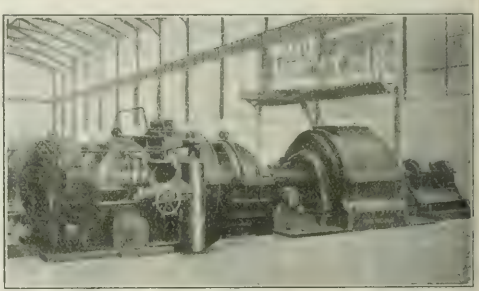


Producer Gas Coaling, Gantry and Railway.

burning chamber. The system is thus regenerative, producer gas being used for heating.

The company has for a number of years been well known for its system of low-pressure fuse bases of the socket type, with non-changeable two-pin fuse plugs. The fuse wire is embedded in a special sand and then sealed; the fused plugs are exchanged for a nominal sum. As each rating of fuse has a special size and distance of pins, the danger of over-fusing is eliminated. This type of fuse can be replaced by any householder; it is also used in enormous quantities in the 3-ampere size by the French Post Office for the protection of telegraph and telephone lines. This fuse has in France for a number of years replaced the screw plug type of calibrated fuse; in the latest pattern it is practically impossible to fix a fuse wire and, further, the live parts are very well protected.

The company also manufactures at the Argenteuil works many types of snap and knife switches. A number of high-pressure aerial switches and pole line accessories are under construction at these works, a well fitted-up test room with a 200,000-volt transformer being provided for the purpose of testing the assembled parts. A feature of the works is a well-arranged laboratory for the chemical examination of raw materials, from the brass and copper to the sand used in the fuses. About 600 hands are employed at present at the Argenteuil works, and one must say that one has rarely seen a series of "shops" kept in such apple-pie order. On looking at the nicely finished material, one can realise that neatness and order in manufacturing have their influence on the products turned out.



Turbine Room at St. Ouen.

On Sunday morning, October 8th, a section of the party, numbering about 20, eschewed the delights of Versailles, preferring to visit the power station of St. Ouen, an excursion which was not included in the official programme, but which well repaid those who took part



St. Ouen: End of Coal Railway.

in it. The arrangements for the visit were made by Mr. Charles Erith, who afterwards entertained this party at lunch at Prunier's. The visitors were received by M. Pécheur, chief engineer, and other directors of the company. This station belongs to the Compagnie Parisienne de Distribution d'Electricité, whose field of operations is the City of Paris, the company being the concessionaire of the Municipality; for this reason it is not at present a member of the Union d'Electricité. The station is situated outside the fortifications to the north of Paris, close to Gennevilliers, and

contains eight 10,000-kW turbo-generators, two of which were built by the Compagnie de Fives Lille, and the remainder by the Atelier de Constructions Electriques du Nord et de l'Est, and the Société Alsacienne de Constructions Mécaniques. The plant works at 12,300 volts, 41⅔ cycles per second, 1,255 r.p.m., and the alternators are of the two-phase type; the latter were designed to carry 12,500 kW continuously for four hours, but during the war years they were still more heavily loaded, without giving rise to trouble. The turbines are of the Zoelly and Rateau types. One of the Fives-Lille sets ran for 45,000 hours without a hitch. The boilers are Belleville and Babcock & Wilcox, with chain grate stokers. Two 50-ton cranes serve the engine room.

More interesting, however, was the new plant which was being installed. This comprised two generating sets of 40,000 kW each, constructed by the Société Alsacienne, of Belfort, and three more are on order, making a total of 200,000 kW of new plant, which will operate at 12,300 volts, 50 cycles. Additional boiler plant has also been installed, comprising four big Stirling boilers built by the Compagnie Fives-Lille, and equipped with Riley stokers. Six similar boilers are on order. Each of these five-drum boilers covers an area 29 ft. square, and the height from the grate to the top of the combustion chamber—which would make a fair-sized barn—is 30 ft.; the boiler is of the twin type, having two Riley stokers sloping towards the middle, and contains 1,940 3¼-in. tubes in banks 60 tubes wide and about 14 deep, the heating surface being 2,100 m.² (22,600 sq. ft.). The 4-ft. boiler drums are made of single plates, 30 ft. long and 1¾ in. thick where the tubes enter. The boilers are equipped with internal superheaters, and work at a pressure of 20 kg. per cm.² (280 lb. per sq. in.), each evaporating 132,000 lb. of water per hour at normal full load and 176,000 lb. when required. The superheater header is made in two parts, welded together; the heating surface of the superheater is 1,000 m.² (10,764 sq. ft.), and the Green economisers, situated above the boilers, have a surface of 1,706 m.² (18,363 sq. ft.), the tubes being of cast iron. The boiler casing is of steel, lined with brick, the lining at the ends, where it is not protected by tubes, being thicker than at the sides. The boiler-house, like most of the station buildings seen in France, is largely of reinforced concrete construction, with concrete hoppers over the firing floor; there are no overhead bunkers, and consequently the boiler house is exceptionally light. It is interesting to note that the Riley stokers, which feed from both sides of the boiler were made to gauge and were not assembled until they arrived on the site.

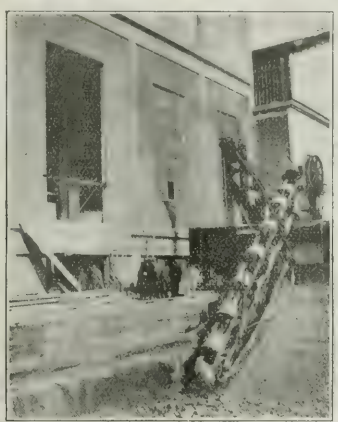
Coal is received in barges on the Seine, holding 1,350 tons each, from which it is grabbed by two cranes and dropped into hoppers, electrically driven. These are filled from the hoppers and run along an elevated railway the full length of the works, distributing the coal through hoppers. Storage [illegible] of the railway have a capacity of 30,000 tons, [illegible] needs of the undertaking for one month, and provision is made for submerging the coal in storage, thereby saving a few per cent. of the calorific value and reducing the cost of fire insurance. The chutes are so arranged that the coal sliding down into the storage tanks is distributed over a wide area. From the tanks it is raised by an electrically-driven crane and grab, and dropped into hoppers, whence duplicate B. & W. bucket chain conveyors carry it up to the stoker hoppers.

Water is derived from the River Seine through duplicate wire screens, which can be raised singly and cleaned with water jets; this arrangement has worked well during the past eight years. Settling ponds are provided, the water being charged with sand. The pumping plant is situated in an open basement running alongside of the engine-room.

Rateau fans are provided below the boilers for forced draught, and the Prat draught system is used for the waste gases, with the usual short steel stacks; the latter are being erected with the aid of steel gantries, which can be moved along from one to another. The Prat draught equipment is also installed at Gennevilliers, on the largest scale as yet attained.



Side View of Coal Railway.



Excavator Digging Foundations for Extensions.



Erecting the Prat Chimneys on Top of Boiler-house.

The newest feature of the plant is the system adopted for the removal of ashes. Ash grinders are not used; the ashes are dropped through hoppers into a trough 2 ft. wide, along which they are carried by a stream of water to a sump, whence they are lifted with a grab and dropped into hoppers for removal by trucks. The same water is continuously circulated through the ash channel. The coal derived from Northern France has a calorific value of about 13,300 B.th.u. and contains 12 per cent. of ash. British and German coal is also used. The ash is used for making bricks in an adjoining brickyard.

The annual output of this station is 300 million kWh; the plant connected to the mains is rated at 430,000 kW, of which about 100,000 is normally in use, the maximum demand being 120,000 kW. There are 300,000 consumers; many small industries derive their power supply from St. Ouen. No price concession is made to consumers of electricity for heating purposes in Paris, owing to the terms of the concession from the City.

Lea recorders are used in the engine room, and a variety of instruments are installed in the boiler-house, with a view to maintaining high efficiency in operation. The lay out of the station is very convenient; special attention has been devoted by M. Pecheux (chief engineer) and his colleagues to securing reliability of

supply and low maintenance costs, and the visiting engineers were greatly interested in the means adopted to this end.

In order to arrive at a uniform frequency of supply, the older portion of the plant, designed for 41⅔ cycles, is being gradually speeded up and will eventually supply at 50 cycles, like the new generating plant. It will then be possible to interconnect the St. Ouen and Gennevilliers power stations, with the intermediary of Scott-connected transformers—for the cost of converting the existing two-phase system to three-phase would be prohibitive.

On Monday morning, October 9th, an early start was made by train for Arras, where the party boarded a fleet of motor-cars for the next stage of the tour. From the railway many traces of warfare were visible, and those who had the good fortune to travel with members intimately acquainted with the route and the events that occurred in that region found the journey exceedingly interesting. The 60,000-volt overhead transmission line from Gennevilliers to Creil was seen alongside of the railway, and the well-wooded rolling country, adorned with autumn tints, presented a charming appearance on the way to Amiens. After passing Albert, the scenery changed, the route crossing and recrossing the line where the trenches had been; the most noticeable signs of battle were the innumerable dead tree trunks, shell-holes, and ruined buildings, and saddest sight of all, the cemeteries. Over all the waste Nature had flung her green mantle, the trenches had been filled up, and the wire had been gathered into huge piles of rusting steel.

Soon after leaving Arras a halt was made at St. Nicholas to visit a high-pressure sub-station on the system of the Société Electrique du Nord-Ouest, a company somewhat analogous to our Power Companies, which distributes electrical energy in bulk over a large area.

(To be continued.)

SINGLE-PHASE COMMUTATOR MOTORS.

There was a very large attendance at the meeting of the National Association of Supervising Electricians on October 10th, to hear a lecture by Mr. F. Creedy on "Single-phase Commutator Motors, their Progress and Reasons why they Demand the Attention of Power Engineers." Mr. W. E. Highfield presided.

The lecture may be said to have brought into a true perspective the real position which the single-phase motor will occupy in the general scheme of electricity supply, at any rate in the near future. It is possible to produce these machines at a price very little higher than that of the direct-current motor and quite as low as that of the old-fashioned type of single-phase machine. The Creedy motor has been redesigned and Mr. Creedy claims that the single-phase commutator motor can now take its rightful place as the correct machine for the supply of power to lightly-loaded districts or areas where the motor load is not the predominating feature.

The advantages of single-phase distribution are well recognised, but, said the lecturer, these advantages have hitherto not been available owing to the importance of the motor load to every supply authority and the very low average power factor—frequently not greater than 0.5—produced by the old-fashioned type of motor. Mr. Creedy did not place the claims of single-phase distribution too highly, but restricted them to small towns or self-contained districts where no great density of motor applications was to be expected or where the chief load did not consist of motors. Such a single-phase system should preferably receive a bulk supply from a large polyphase system, the district supplied with single-phase energy being subdivided so that the total power supplied was fairly well balanced among the three phases, bulk three-phase supply being given to a local sub-station and sub-divided at a local switchboard. Within this sphere, the system was to be regarded as superior to all others, and in support of this, it was pointed out how the small independent direct-current systems of a large number of towns were being changed to single phase so as to permit of bulk supply without the installation of rotating apparatus in the sub-station. This was facilitated by the facts that single-phase mains were identical with direct-current mains and that with single-phase supply, cable faults were fewer than with direct current, a figure of 1 to 5 having been mentioned to Mr. Creedy.

Curves and diagrams were shown illustrating the single-phase commutator motors manufactured under the Creedy patents, and comparisons were made between them and the squirrel-cage and direct-current types. It was pointed out that a particularly noticeable feature of the compensated single-phase motor was that it retained its high power factor down to a quarter full load. A comparison of the current taken by a split-phase type of motor showed this to be 36 per cent. greater at full load and 82 per cent. greater at half load than that of the Creedy type.

A curve was exhibited which showed that the price of the modern single-phase motor was only from 4 to 10 per cent. above that of the direct-current motor, and almost exactly the same as that of the single-phase slip-ring induction motor throughout the range shown. The weights of single-phase motors were only about two-thirds of those of the corresponding direct-current motors and efficiencies were only slightly lower, being superior in most instances to those of the split-phase motor.

The lecturer then recapitulated the description given in his previous paper before the Association of the principal properties of the compensated type of motor. Emphasising the need for high power factor apparatus, it was pointed out that once low power factor apparatus was on the mains it cannot easily be got rid of, and would continue to load them up with non-revenue-producing current when a revenue-producing load was immediately available. If it were possible to change all the split-phase motors on the mains to unity power factor apparatus, it was estimated that the existing mains throughout the country would still be from 15 to 20 per cent. in excess of requirements, but, of course, some thousands of h.p. of motors of the old type now on the mains could not be got rid of without very large capital expense.

Discussion.

The discussion on the lecture was to a considerable extent an expression of satisfactory service with the type of motor advocated by Mr. Creedy, but there were several useful criticisms based on experience with their use which should be valuable to those responsible for the design.

Mr. Pooley (Messrs. Pooley & Austin) said that being associated with Mr. Creedy as he was, he felt that the points of the motor had been put very clearly and preferred to leave it to others to criticise.

Mr. Wreford related criticisms of the motor that had been made to him by other people. It had been queried, he said, whether unity power factor could really be got, but he believed the lecturer must have convinced everyone that this was an every-day result. The difficulty appeared to be that many people did not sufficiently understand its characteristics and were sometimes almost frightened of it. As an example of the manner in which these motors were being used, he mentioned one supply undertaking with more than 3,000 h.p. connected of which more than one-third was of the compensated commutator type. There was a tremendous saving in switchgear and transformers as compared with the use of direct current, and some supply authorities were welcoming the change over to single phase even where there was a fairly large amount of power.

Mr. Smith said that in printing works they converted from single phase to direct current with a consequent loss of about 20 per cent. If the machine compared favourably with a d.c. one with regard to speed variation, and unity power factor could be obtained, its use would be a great advantage.

Mr. Harmer said the most important point in connection with this motor was the power factor. His own experience with the compensated commutator type of motor had been very satisfactory, although he believed there were about 40 brushes on a 40-h.p. machine and, as these cost about 2s. 6d. each to replace, the cost of maintenance might be serious. His fear on this score, however, had not been borne out in practice. As to variable speed, in London the requirement was not so much for a variable speed as for one or two speeds, and a Creedy motor with three speeds would fill the bill entirely.

Mr. A. L. Johnson gathered that the lecturer claimed only about 25 per cent. of what his salesmen claimed. If unity power factor was really obtainable, he could not understand why all station engineers did not insist upon Creedy motors being used. He was not quite certain whether it was claimed that this motor was so good as to be comparable with the direct-current motor.

Mr. Creedy: It is.

Mr. Johnson pointed out that in the comparison of weights that had been given in the curves, no particulars were stated as to the type of d.c. motor with which the comparison was made.

Mr. Creedy explained that the d.c. motor in that case was one of the best known modern machines made by one of the largest makers of the day.

Mr. Johnson said he had come to the conclusion that although the Creedy machine was a really practical proposition for single-phase circuits, it had limitations. The starting torque was about the same as that of the direct-current motor, but it did not compare so far as variable speed was concerned.

Mr. McGillivray asked why it was that the transformers

supplied with the machines often burned out. He had had one of these machines at work for about four years and the speed decreased by some 20 per cent. On turning the commutator up, however, the speed rose again almost up to the original. In his case, the system was single phase, 90 periods, which was rather a difficult one for the motors, but apart from the trouble he had mentioned, the motors had given good service.

Mr. Giffard asked whether Mr. Creedy had considered the possibility of getting a continuous change of speed by using an induction regulator instead of a transformer, and so injecting into the windings a gradually increasing e.m.f.

Mr. Bates said that so far as price was concerned, the motor itself was reasonably cheap, but the cost of starting gear seemed to put it out of court. The cost of maintenance would be higher than that of either the d.c., or squirrel-cage machine. Especially would this be so with regard to re-winding, because the ordinary repair shop would not be prepared to take the job on, or if it did, the price would be very much higher than in the case of the other two types of motor. He had never been able to get any definite information as regarded power factor.

Mr. Wreford agreed that contractors and repair people should know more about this motor than they did, but he added that a company with which Mr. Bates was concerned had recently taken on the repair of Creedy motors.

Several other speakers took part in the discussion, and among the points raised was the importance of correcting power factor in view of the fact that when bulk supply becomes more general, charging will be on the kVA and not the kW basis. The necessity for single-phase motors to conform to the conditions at present attaching to d.c. machines was also commented upon.

Mr. Creedy, replying to the discussion, said that the best results were obtained as regarded speed variation, with a range of 2 to 1, but they had built motors with a speed range of 3 to 1. The motors could be built for any voltage desired and constant-speed, single-phase, motors had been built for 2,000 volts, but there was not a great demand for h.p. motors of this type. At present they had not been standardised above 440 volts and the lowest was 100 volts. Owing to the low voltage and the easy duty on the brushes the renewals were very light. On the point raised as to transformers burning out, a new type of machine had been placed on the market and the old starting gear had been done away with; the starting gear was now essentially the same as in the case of the d.c. motor. The only reason why induction regulators were not used was cost; moreover, they had never actually been used because these motors were never built for several hundred horse-power, and in the case of the small motors, the cost of the induction regulator would put them entirely out of court.

People were quite familiar with the d.c. machine, whereas that was not so with the single-phase motor. All new apparatus had to fight against this.

THE NORTH WALES AND CHESTER ELECTRICITY DISTRICT.

Draft Constitution of Joint Electricity Authority.

The provisional delimitation of this area by the Electricity Commission was announced in July, 1920. In January, 1921, the Chester Corporation submitted a scheme for the improvement of the existing supply of electricity in the district, and in the following month the North Wales Power & Traction Co. did likewise. During the same month the Commissioners held their first local inquiry in connection therewith, and the decision they reached in consequence thereof was published in April, 1921.

The Commission has now issued the draft North Wales and Chester District Electricity Order, 1922, in the first schedule to which the scheme constituting the area and establishing the Joint Electricity Authority is set out.

The first annex to the Order deals with the qualifications and appointment or election of members; tenure of office, casual vacancies, &c.; provision as to the election of elected members; and meetings and proceedings of the Joint Authority. The second annex outlines the technical scheme, while the third annex sets out the agreement that has been come to between the North Wales Power Co., Ltd., and the Aluminium Corporation, Ltd.

The second schedule specifies the powers, rights, and obligations conferred or imposed upon the Joint Electricity Authority by the Electricity (Supply) Act, 1919, and the present draft order, which are to be transferred from the Joint Authority to the North Wales Power Co., Ltd.

The draft order will come into operation on the date on which the above-mentioned deed of transfer is approved by the Electricity Commissioners, and as soon as it has been approved by a resolution passed by each House of Parliament.

As already announced, the Electricity Commissioners are to hold a second inquiry at Llandudno, on November 14th, with reference to the aforesaid scheme, and in order finally to determine the area of the proposed district.

LEGAL.

Mr. " or " Miss."

In the Shoreditch County Court, on Friday last, before Judge Cluer, Alfred Evans, of 35, Great Eastern Street, E.C., dealer in electrical motor accessories, sued Miss Mary Flanaghan, of 86, Copenhagen Street, E.C., also alleged to be a dealer in electrical goods, to recover £11 17s. 3d., balance of an account for goods supplied. The defence was that she had never ordered any goods, and that the business was not hers, but that of "Mr M. Flanaghan." Judge Cluer (to the defendant): In your country that " M." might stand for Michael, but in this district it would be Moses or Morris. (Laughter.) The plaintiff proceeded to prove his case, and a number of dispatch notes were produced, most of them being in the name of " M. Flanaghan," but some of them " Mr." The plaintiff said he had always considered himself to be trading with the defendant. He had sent applications for the money and invoices to the defendant, which had not been returned.

Wm. Cranbon, in the employ of the plaintiff, admitted that Mr. Flanaghan or the boy always came for the goods, and that he had not seen the defendant, and practically the same was said by Chas. Wright, another employé.

Judge Cluer said the plaintiff had failed to prove that the business belonged to the defendant. He seemed to have been under the impression he was serving " Mr.," according to the salesmen, but when he made inquiries he sued " Miss." He advised the plaintiff to collect better evidence for a future hearing. All the same, he told the defendant that she was doing a foolish thing to defend the action on such lines, if she were really the owner of the business, as it would cost her a lot of money in the long run.

Robinson v. Dannatt.

In the King's Bench Division, before Mr. Justice McCardie and a common jury, on November 18th, Mr. Isaac Vincent Robinson, of Walton-on-Thames, who holds the position of assistant secretary of the British Electrical and Allied Manufacturers' Association, claimed damages against Mr. A. Keith Dannatt, of Thames Ditton, for personal injuries and damage to his motor scooter resulting from a collision with defendant's motor-car on the Portsmouth Road between Cobham and Ripley on March 25th last year.

Plaintiff's case was that defendant, who was driving in the opposite direction, negligently and improperly swerved to the offside, so as to pass in front of him, and knocked him down. He was seriously hurt, his injuries including a fractured leg, and he still had to use a crutch. He was unable to perform his secretarial duties for five months, though his employers continued to pay his salary of £1,150 a year.

Defendant denied all plaintiff's allegations of negligence, and asserted that the accident was due to plaintiff's fault. Defendant counterclaimed for damage to his motor-car.

The jury found that defendant was not to blame, and his Lordship directed judgment to be entered for defendant for the amount of his counterclaim, £23.

Marconi's Wireless Telegraph Co. v. Mullard Radio Valve Co.—Judgment.

Mr. Justice P. O. Lawrence, in the Chancery Division on Thursday last week, delivered judgment in this action, which was brought by the plaintiffs for an injunction to restrain the defendants from infringing their Letters Patent Nos. 28,412 of 1913 and 126,658, and for the delivery up of the articles made in alleged infringement of the Letters Patent, and also for damages.

Plaintiffs are owners of the patent granted to the company, and Mr. H. J. Joseph Round for an invention of alleged improvements in receivers for use in wireless telegraphy and also of a patent granted to Michel Peri and Jacques Biquet of an alleged invention of " improvements in or relating to vacuum tubes." Plaintiffs complained in particular of the sale by the defendants on or about July 8th, 1921, of " L. R. Valves," constructed, it was alleged, in accordance with the inventions described in the specification of the patent of 1913 and in all the claiming clauses of the other patent, No. 126,658.

Defendants denied the alleged infringement. They admitted that they sold and manufactured considerable numbers of thermionic valves, but they alleged that in fact such manufacture and sale was by them as agents or contractors of H.M. Government, and in particular the Admiralty, on written authorisation in that behalf, and they denied that such valves constituted an infringement of either of the patents, and they further relied on the provisions of Section 29 of the Patents and Designs Act, 1907, as a defence to the action. Defendants also pleaded that the plaintiffs' Letters Patent had been at all material times invalid.

The trial of the action took place in July last, and after hearing a great deal of contradictory and highly technical evidence the learned Judge reserved his judgment. The case was reported in the Electrical Review of July 28th and August 11th, 1922.

In giving judgment on October 19th, his Lordship said the plaintiffs alleged that the defendants had infringed both the

Letters Patent belonging to them, and which he would describe as Round's patent and Peri's patent, and the plaintiffs claimed an injunction to restrain the alleged infringement. Defendants disputed the validity of both Letters Patent and also denied the alleged infringement. Although both inventions related to three-electrode valves, they were, in his judgment, essentially distinct, and must be dealt with separately. His Lordship first referred to Round's patent, and having read the claiming clauses of that specification, said that in 1904 Fleming invented a two-electrode valve, consisting of an evacuated glass bulb which contained a filament and a metal cylinder, and this valve operated to rectify or transform an alternating current into a continuous current capable of actuating a galvanometer by which signals could be read. In 1908 De Forest discovered that by introducing into a valve of the type invented by Fleming a third electrode in the shape of a grid interposed between the hot filament and the anode, the sensitiveness of the oscillation detector was increased. He did not think, from a perusal of the complete specification, that De Forest appreciated the great advantages of the introduction of the third electrode. Indeed, it seemed to his Lordship that it was doubtful, whether he even appreciated that his valve would act as an amplifier. His Lordship then referred in great detail to the invention of Von Lieben in 1911, and said that in his judgment the particular form of grid described in the claim of Round's patent was one of the essential elements of that claim, and that unless a valve contained a grid in that particular form it did not infringe, even although it contained the other two elements, *viz.*, a hot filament and a cylindrical anode. The Mullard valve was a "hard" valve, which contained a grid in the form of a loose open-ended cylinder placed round the hottest part of the filament. Hard valves first came into use some time after the date of Round's patent. Nothing was said in Round's patent as to the shape which the filament was to take, and therefore the difference in the construction of the modern three-electrode valves which were not in practical use at the date of Round's patent, would not of itself prevent a three-electrode valve containing Round's grid and anode from being an infringement. The main object of Round's invention, as stated in the specification, was to shape the two electrodes in such a manner as to shield the glass from the cathode stream and thus prevent it becoming electrified.

Having referred at great length to the expert evidence given at the trial and the documents put in evidence, his Lordship said he came to the conclusion that none of the documents relied upon by the defendants disclosed either Round's invention or Peri's, and that in both of those the inventions were both novel and useful, and that in both there was good subject-matter. He thought that the attack that the defendants had made on the question of validity failed. He thought that Peri's patent was a combination patent claiming a novel and ingenious method of shaping and arranging the various parts of the valve. Upon the evidence, however, he came to the conclusion that what the defendants had done did not infringe either of the plaintiffs' letters patent, and the action would be dismissed.

It was decided that the question of the costs of the action should be argued and decided at a later date.

British Electric Vehicles, Ltd.

The petition for winding up this company, which came before Mr. Justice P. O. Lawrence on October 17th, was withdrawn and dismissed without costs. We understand that four-fifths of the unsecured creditors had agreed to oppose the petition.

British Thomson-Houston Patents.

In the Chancery Division on Tuesday, the British Thomson-Houston Co., Ltd., were plaintiffs on two motions against the Incandescent Syndicate, of Castle Arcade, Cardiff, and Collinson Bros., Millgate Street, Bradford, for injunctions restraining them from infringing the plaintiff company's letters patent for improvements relating to evacuated vitreous containers having sealed-in conductors.

Mr. Trevor Watson appeared for the plaintiff company, and Mr. Courtenay Terrell for the two defendants.

There was no defence in either case, and orders were made as asked for, the parties having agreed to the form to be sanctioned by the Court.

Associated Electric Traders, Ltd.

The petition of Superlamp, Ltd., on October 24th came before Mr. Justice P. O. Lawrence in the Companies' Winding-up Court, the petitioner asking for the compulsory liquidation of the above company. Mr. Turner, for the petitioners, asked that the petition should be dismissed. Mr. Gavin Simmonds, on behalf of Cox & Co., creditors for £500, asked to be substituted as petitioner and proceed for a winding-up order.

Counsel for the company said he could not oppose the order being made.

In the result his Lordship substituted Cox & Co. as petitioners, and made the usual compulsory order.

SALESMANSHIP IN RELATION TO SMALL ELECTRIC FIRES AND COOKERS.

Mr. R. Smith, of "Tricity," gave the second of the E.D.A. salesmanship lectures this session at Caxton Hall on October 20th.

Mr. L. L. Robinson, borough electrical engineer, Hackney, who presided, pointed out that these salesmanship conferences should not be used for discussing trade squabbles, such as trade discounts and similar matters, but should be devoted solely to the matter of salesmanship. The object of them was to awaken general interest in the goods they had to sell, to endeavour to find means to keep that interest awake, how to convince the customer and secure his order, and how to make him a friend of the salesman. A salesman should have personal enthusiasm and confidence in what he was selling and, above all, he should study the psychology of the customer. As to dealing with technical matters at these conferences, here again the industry had become standardised to a very great extent, and the great need was for the commercial man to develop the industry. Salesmanship had been neglected to a very large extent in the past, but it was salesmanship which was the potent factor in reducing costs, inasmuch as it would help to bring more apparatus into use, and so bring down the cost of the apparatus and also of electricity.

Mr. Smith, who dealt exclusively with small electric fires and cookers, said that probably the first question which a salesman had to deal with was: "How does it compare with gas?" In this matter of comparison he could not do better than take the case of Hackney, where Mr. Robinson was conducting a very vigorous heating and cooking campaign. At Hackney electricity was available for these purposes at 1d. per kWh, whilst gas cost 10d. per therm. The class of user at Hackney probably used the boiling ring section of the cooker far more in comparison with the oven than was the case in most places, yet the following unsolicited testimonial had been sent to Mr. Robinson: "I believe that the cost, apart from the saving from waste, amounts to little more than half the cost of cooking by gas. I have kept a regular weekly record of the consumption figures and I have found that the electric cooker can be relied upon to do its work within a given time, which experience will tabulate." Again, running costs of a small cooker compared very favourably with gas. Taking an average-sized gas fire using 30 cu. ft. of gas per hour and a 2-kW electric fire, it was pointed out that 30 cu. ft. of gas per hour at a standard of 500 B.th.u. meant 15,000 B.th.u. per hour. As 100,000 B.th.u. constituted a therm, it followed that one therm would be used in 6⅔ hours, which, at a cost of 1s. per therm, would be approximately 2d. per hour. At 1d. per kWh the electric fire would cost the same amount per hour, but in this case the whole of the heat was, of course, given off into the room.

After a brief reference to the rateable value system of charging, which Mr. Smith believed would encourage a person wiring a house, as it involved only one set of wiring circuits and one meter, the paper pointed out that whatever the advantages of the radiator on the peak load during a cold snap, the central station had an almost ideal field before it in electric cooking, but some engineers had allowed cooking to be looked upon by the gas companies as their very own field. Fortunately this was not the case throughout the country generally, and there was no doubt that the public only required hiring facilities and a reasonable rate of charge to enable the central station engineer to secure this valuable load.

It was urged that an electric kettle with a self-contained element should always be supplied with an electric cooker owing to the greater rapidity with which water could be boiled compared with the boiling ring of the stove. Another factor of importance to the salesman was that he should be able to tell the prospective customer that he was himself using the apparatus which he was trying to sell. Advisory service should be given at the time of installation and at intervals subsequently. Hints should be offered on the advantages of using the residual heat of the hot-plates and oven for water heating for washing-up purposes, how one boiling plate might be used for boiling and simmering, and exactly what the possible economies to be effected really were. There were simple rules whereby the salesman or demonstrator might give the time required for boiling a given quantity of water because nothing was so liable to shake the interest of a client as the feeling was that a guess was being made to provide an answer. One of the most important questions was the reliability and length of useful life of the apparatus. All leading makers now gave one year's guarantee with their apparatus, and maintenance scheme could usually be arranged. Oven elements could be

made to give an indefinitely long life, and present-day boiling-plates were capable of giving very long service without attention.

The paper concluded by stating that electrical men should think and talk of electric cooking, heating, and general domestic applications of electricity as something which was very much of the present, to be used by themselves alike with the public.

In the ensuing discussion Mr. A. C. Cramb (Borough Electrical Engineer, Croydon) said that very carefully thought-out schemes were necessary, and personal attention should be given to every cooker sent out. At Croydon a lady demonstrator was sent along to the customer to give advice, and kept in touch with the customer afterwards. The results had been very satisfactory.

Mr. Joyce urged the necessity for doing everything to avoid having discontented customers, who would most certainly spread their discontent. Care should be taken that apparatus was not run on the lighting circuit, as that would make the cost too high and would militate against the use of irons, kettles, &c. Another drawback was that not enough instructions were issued with the apparatus.

Mr. Young suggested that more demonstrations should be given by persons who understood the apparatus. He deprecated the policy of selling small radiant heat fires as electric heaters; they would not warm a room, and were not intended to.

Mr. Berry said that many small electric fires could be sold if their uses were made known. As regarded cookers, he had proved that there was a tremendous saving in the shrinkage of the meat. The money in this business was colossal, and it was up to them to believe in this proposition and get on with it.

Mr. W. A. Gillott advocated that women should be used more than they were for selling electric cooking and heating apparatus; one of the first essentials was that the seller should use the apparatus that was being sold.

Mr. Roberts asked how often they heard a salesman tell a customer that an electric toaster would make 60 pieces of toast per kWh of electricity; that a small griller would grill four large pieces of steak per kWh, or that a two-pint kettle would boil 17½ times per kWh? He urged those who had to deal with this matter to abandon scientific salesmanship and talk facts in plain English.

Mr. Shears strongly supported the suggestion that there should be demonstrations, and expressed the opinion that the cooking load was the load of the future.

Mr. F. W. Leevers pointed out the necessity for putting in as many power points as possible when wiring houses, and thought the first thing to do, in attempting to sell cooking apparatus, was to convince the customer that it was cheaper than gas.

Mr. R. W. Hughman (*Electrical Times*) spoke of the crusade in America by the electrical industry for having plenty of convenient points in every residence. Once they were in, their use could always be advocated by the contractors and supply authorities.

Mr. G. Leevers disagreed with the suggestion that there should be saleswomen, but thought there should be women demonstrators.

Lieut.-Col. W. A. Vignoles (Chief Electrical Engineer, Grimsby) said that too much was being said about cost, but what they wanted to impress upon the customer was what he would get out of the apparatus. If the proposition was not a good one, then the salesman should be honest enough to tell the customer so.

Mr. Howell impressed upon salesmen the necessity for obtaining knowledge of the right kind about their goods.

Mr. A. Gowans Whyte (*Electrical Industries*) said that not enough instances of actual transactions were given. In his own electric home the consumption was only about 70 units per week, with six in family and an exceptional amount of cooking owing to delicate health. With a well-trained cook the consumption could be reduced considerably.

Mr. Beaver advocated the need for service as well as selling apparatus.

Mr. F. M. Long (Chief Electrical Engineer, Norwich) suggested that the limitations of an article should be studied as well as its possibilities.

Mr. Mann also urged that it was a bad policy to sell an article merely for the sake of selling it.

Mr. Clay said the public should be impressed with the fact that electrical apparatus was "foolproof" at present. At one time this was not so.

Mr. Smith, replying to the discussion, said that he stood for everything that was straightforward with the customer. He would not advise a customer to install a cooking apparatus when electricity was 4½d. per kWh for instance. As to maintenance, that was most important; customers undoubtedly appreciated personal attention.

A Large Rotor Forging.—Messrs. Somers, Ltd., of Haywood Forge, Halesowen, have made one of the heaviest steel forgings ever produced in the Black Country—a rotor of 40 tons weight—for a generating set ordered by the Birmingham Corporation Electricity Supply Department.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday until the following week. Correspondents should keep their communications at the earliest possible date, as no letter can be published unless we have the writer's name and address in our possession.

The Art of Getting a Job.

Could you or any of your readers offer any solution to the following? I have [illegible] answered countless advertisements for a storekeeper and assistant counter sales clerk, &c.

I have had some ten years' experience in the various branches of the business, [illegible] technical knowledge and a good [illegible] references, an abstainer, and am good at figures.

During the past six months I haven't had one reply to any letter. The salary asked for in most cases is from £2 10s. to £3, according to what the advertisement is for. Am I asking too much or too little?

"?"

October 22nd, 1922.

"How NOT To Buy."

The last paragraph of Mr. Shandy's letter in the current issue of the Electrical Review explains fully why this correspondence commenced.

I am not "resting," therefore I will conclude my contribution to this discussion in my usual "practical fashion":—

If factors are not required, manufacturers can refuse to supply and contractors can refuse to purchase from them.

W. C. Jeary,
Managing Director.
The Jeary Electrical Co., Ltd.

London,
October 21st, 1922.

[This correspondence is now closed.—Eds. Elec. Rev.]

Wages Variation in the Electricity Supply Industry.

Notice has been given from the employers' side to terminate an agreement which hitherto has worked with a minimum of friction, notwithstanding that all the advantage has not been with the employés.

If the employers' side of the National Council is sincere in its desire for improved relations between employer and employé, would it not be tactful to "leave well alone?" as it must be obvious that this endeavour to smash an agreement which has existed little over twelve months is hardly making for confidence, and only tends to establish an unhealthy precedent.

One wonders how much publicity would have been given to the position if the initiative for the termination of an honourable agreement had been in the reverse direction.

It is admitted that workers in some industries are lower paid, but (I feel sure my Hibernian friends will excuse me) is it a fair policy to adopt the Irish method of raising the roof by digging a hole in the floor? for due consideration should be taken of the fact that supply station men have not been amongst the most highly paid in the past.

In conclusion, it must be frankly stated that electrical workers expect some tangible evidence that the war-time promise of a better standard of living for the workers shall be realised, and this notice to terminate the agreement hardly points to a move with that desirable end in view.

A. Burton.

London, *October 16th*, 1922.

Installations by Unauthorised Persons.

I quite agree with "Contractor's Foreman" *re* his remarks about plumbers doing electrical work; also many steam, gas, and water fitters are styling themselves electrical engineers, &c. These sixpenny-book learned jobbies may have a little too much on their shoulders. Here is one example:—"So and So & Co., Ltd.," Plumbers, Gasfitters, Hot and Cold Water and Steam Engineers," and in larger letters, "Electrical Engineers." These are not proper firms with individual section representatives, but small budding firms. If the matter is left too late I am afraid the electrical contractor will have to buy a sixpenny book on plumbing, &c.—if they can get books printed with simplified diagrams and connections, &c., similar to books on electricity. I suggest that these cheap books should be reviewed by some body similar to the I.E.E. and all matter detrimental to the electrical contractor of recognised repute should be omitted. This, I believe, would put a stop to Mr. Gas and Mr. Plumbob Joe, &c. What's done can not be very well undone, but I blame the electrician for being too fond of parting with his hard-earned knowledge. I don't see that it would retard apprentice electricians and those of a genuine nature, but it would relieve us from an overcrowded profession, and instead of plumbers looking up their diagrams of connections *re* electrical work they would be [illegible] to send for an electrician who was an *electrician*.

High-Tension Paste.

October 21st, 1922.

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BUSINESS NOTES.

Bankruptcy Proceedings.—Wm Henry Roslington, 240, High Holborn, London.—This bankrupt who had carried on business as the "Greenling Electric Supplies" failed last April, and on October 17th, he applied to Mr Registrar Mercer at the London Bankruptcy Court, for an order of discharge. Mr. Walter Boyce, Official Receiver, reported that the liabilities amounted to £1,375; no assets were disclosed and nothing was likely to be received from the estate. Between December, 1919, and May, 1920, the bankrupt carried on business in partnership as "Greenling Electric Supplies." That business was financed as to £600 with borrowed moneys, and was insolvent in May, 1920, when the partner retired and the bankrupt took over the assets and liabilities. In June, 1920, he formed and became managing director of the Greenling Electric Supplies, Ltd., to which two persons subscribed £1,100 for shares, and in September, 1921, he transferred his own 1,000 vendor's shares (estimated to be of no value), to one of the said subscribers without consideration. The bankrupt attributed his insolvency to his household, personal and medical expenses having exceeded his income; to law costs, and to loss over the purchase and sale of some steel. The only offence alleged by the Official Receiver was the insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities, and the discharge was granted subject to a suspension of eighteen months.

George William Humphry, trading as the Humphry Electrical Co., 24, Broad Quay, Bristol, electrical engineer.—The first meeting of the creditors of the above was held on October 18th at the Official Receiver's Offices, 26, Baldwin Street, Bristol. The statement of affairs showed liabilities to unsecured creditors £285, while there were partly secured creditors for £182, and the assets were estimated to realise £339. Debtor attributed his failure to bad trade, loss of capital (£68) in Farrow's Bank, and depreciation of shares in a company. It appeared that in 1917 he started business with £30 in cash, and was the owner of two houses of the value of £600. The matter was left in the hands of the Official Receiver as trustee. The following are creditors:

	£		£
Callender's Cable & Construction Co., Ltd.	16	Notro-Vickers Elect. Co., Ltd. Salvage & White	49 17
Electrical Components, Ltd	18	English Electric & Siemens Supplies, Ltd.	10
Gooding, M. C., & Co.	15	Maggs, H.	20
		Western Trading Co.	18

Frederick William Williams, Gradus Works, Portheawl Road, Sydenham, engineer.—The adjourned public examination of this debtor was held recently at the Court House, Greenwich. Debtor stated that in December, 1919, he had about £4,000, including £800 in a business at Finchley, and started an electrical engineering business at Sydenham. In June, 1920, he agreed to buy the Gradus Works for £4,750, another business at Willesden for about £300, and also to pay £1,000 to the patentee of an electrical switch, and £200 to two people interested in the patent. He also incurred liability for £357 in connection with premises at Queen's Gate Place Mews. When he took the Gradus Works he paid £750 in cash, and undertook to pay the remainder by instalments of £1,000 every six months. Six months after taking the works he was first able to put the switch on the market, and meanwhile he had incurred considerable expense in machinery, wages, &c. He had borrowed over £10,000 from a certain gentleman, none of which had been repaid. In March this year he had had recourse to moneylenders. His profit and loss account to September, 1921, showed a loss of over £2,000. In July, 1921, he entered into a contract with a firm to sell his switches, but they failed to take anything like the number agreed upon. The statement of affairs showed ranking liabilities of £19,012, against assets of £35,965, so that a surplus was shown. In October, 1921, he agreed to purchase the "Retreat," at Crawley, for £3,750, paying a certain amount down, and obtaining £3,000 on mortgage. He [illegible] about £500. After further questions the examination was again adjourned.

J. Barwell, electric light and power engineer, 43, Waterside Road, Barton-on-Humber.—Receiving order made October 17th on debtor's own petition. First meeting, November 1st, at the Official Receiver's Office, Grimsby. Public examination, November 9th, at the Town Hall, Grimsby.

H. Sutcliffe, electrical engineer (deceased since filing of petition), late of 1, Lower Downs Road, Wimbledon.—Receiving order made October 16th on creditors' petition. First meeting October 30th at 29, Russell Square, W.C.

J. H. Rigby, electrician, 22, Higher Hillgate, Stockport.—First meeting, October 30th at the Official Receiver's offices, Byrom Street, Manchester. Public examination, November 28th, at the Court House, Stockport.

W. A. Davis, electrical engineer, 14, Basinghall Street, Leeds.—Trustee, Mr. H. C. Bourne, Official Receiver, 24, Bond Street, Leeds, released October 6th.

E. G. Davis (Davis & Rowe), electrical engineer, 119, Dunraven Street, Tonypandy.—Final dividend of 16s. 8d. in the £, payable October 30th at the Official Receiver's offices, 34, Park Street, Cardiff.

Company Liquidations.—Swift Electrical, Ltd., 6, Cork Street, Old Bond Street, W.—The statutory first meetings of the creditors and shareholders of this company were held on October 20th at the Board of Trade Office, Carey Street, W.C. Mr. J. Barwick Thompson, Official Receiver, reported that the order to wind up the company was made last April upon a creditors' petition. The company was registered as a private company on October 10th, 1919, with a nominal capital of £3,000 in £1 shares, of which 800 were issued for cash to the directors, who were also the promoters. They were John Henry Butler, Henry Edward Leigh, and Leonard John Evans; Leigh resigned on January 2nd, 1922, and Evans on November 20th, 1921. No remuneration was paid to directors, *qua* directors, but Leigh was appointed manager and secretary at a salary of £250 per annum, subsequently reduced to £4 a week, and was now a creditor for £44 in respect of those services, whilst Evans was appointed sales manager at a salary of £4 a week and commission. Butler received no remuneration until August, 1921, but was then voted a salary of £50 per month, to include travelling expenses, and he was returned as a creditor for £126 11s. The company was formed to carry on business as electrical engineers and manufacturers of, and dealers in electrical accessories; it took over no business of any description, but Butler had stated that both Leigh and Evans were experienced in the trade and hoped to be in a position to introduce business. Towards the end of 1920 the company found itself in need of funds, and thereupon obtained advances from Butler. In October, 1921, that gentleman had advanced £800 to the company, and on October 8th a debenture for £800 was created and issued to him; it bore interest at 8 per cent., and charged the whole of the assets of the company. Then on January 21st, 1922, Mr. Butler appointed his wife, Mrs. Louisa Butler, as receiver on his behalf; the bond had then been redeemed to the extent of £80, and stood as a charge for £720, plus interest. According to accounts furnished by the receiver, she had sold nearly all the assets and had realised £778, sufficient to pay off the bond and interest and to defray the costs of the receivership. The unrealised assets consisted of book debts, the chief of which was disputed on various grounds, and it was difficult to say whether anything substantial would be realised. The unsecured liabilities were returned at £1,883, and there was a preferential claim of £126 due to Butler as before stated. The failure of the company was attributed by Butler to the fall in the demand for electrical accessories, as the result of which the company's stock had to be sold at a loss, but he (the Official Receiver) thought it was quite obvious that was not the only reason. The company began with inadequate capital, and had had recourse throughout to its bankers or directors for the funds with which to carry on the business. Several creditors complained that goods had been ordered when the directors obviously knew that the company was insolvent, seeing that the debenture was given in October, and that they had supplied goods up to the following January. The chairman suggested that the creditors could have obtained at Somerset House the knowledge that the company was started with a nominal capital of £3,000, of which only £800 was issued, and that a debenture for £800 was created in October, 1921. Mr. Borrodaile, on behalf of Messrs. Watshams, electrical engineers, King Street, Covent Garden, the petitioning creditors, asked whether the Official Receiver was satisfied that the debenture was issued in consideration for cash. The chairman replied that that was the fact, and Mr. Butler pointed out that he was the biggest loser by the company's failure, as, in addition to being a creditor for £126, he was the largest shareholder.—A creditor: At any rate the goods we supplied to the company on credit were sold, and the proceeds were used to pay off your debenture.—In the absence of any resolution, the liquidation was left in the hands of the Official Receiver.

Rickard, Wright & Dyas, Ltd.—Winding up voluntarily. Liquidator, Mr. R. S. Dawson, Tanfield Buildings, Hustlergate, Bradford.

Blakeborough & Rhodes, Ltd.—Winding up voluntarily. Liquidator, Mr. T. R. G. Rowland, 5 and 6, Victoria Buildings, Stockton-on-Tees. Meeting of creditors, November 2nd.

Dissolutions of Partnership.—Tyne & Tees Electrical Co., electrical engineers, 23, Grange Road, Darlington.—Mr. R. Stewart and Mr. J. Drummond have dissolved partnership. Debts will be attended to by Mr. Drummond, who will continue the business under the same style.

Leng & Garrett, electrical engineers, Wheathill Terrace, Rotherham.—Mr. F. Leng and Mr. W. Garrett have dissolved partnership. Debts will be attended to by Mr. Leng, who will continue the business at 12, Godstone Road, Rotherham, under the style of F. Leng & Co.

Stockport Electrical and Mechanical Engineering Co., electrical and mechanical engineers, 276a, Buxton Road, Stockport.—Messrs. W. Sadler, J. Wager and L. Seddon have dissolved partnership. Debts will be attended to by Messrs. Sadler and Wager.

Laird & Jury, electrical engineers, Hill Cross, Coventry.—Messrs. G. A. Laird, S. S. Jury, D. Hyde, and T. H. Hyam have dissolved partnership. Debts will be attended to by Messrs. G. A. Laird, D. Hyde and T. H. Hyam, who will continue the business as Laird, Hyde & Hyam.

Trade Announcements.—Mr. T. T. D. Geesin, of 4, Clevedon Road, Penge, London, S.E.20, has recently been re-appointed London representative for Messrs. Princeps & Co., who have removed their head office to 14 and 17, Wentworth Chambers, Pinstone Street, Sheffield.

Messrs. Henry Joseph & Co. have appointed Mr. R. E. Higgin, of 265, Deansgate, Manchester, to be their agent for Lancashire, Cheshire, and the West Riding of Yorkshire, and Mr. C. E. Ridley, of 35-7, Dundas Mews, Middlesbrough, as their North-East Coast representative.

Messrs. M. J. Green, B.Sc. (Eng.) and V. Foster have entered into partnership as the General Electrical Supply Co., 144a, The Portway, West Ham, merchants and contracting engineers (with Continental goods as specialities).

The Electrical Alloy Co. has removed from 4, Regent Square, W.C., to 281, Grays Inn Road, W.C. Telephone No. and telegraphic address are unchanged.

The Reader Electrical Co., of Wakefield, has removed its business to 14, Stamp Office Road.

Messrs. Hogan Bros. & Co., 44, William Street (South), Dublin, have been appointed agents for the Irish Free State for the Holland Insulated Wire & Cable Works, of Amsterdam.

Messrs. L. P. R. Bean & Co., Ltd., of Sydney, N.S.W., desire to form trading connections with British manufacturers of domestic and general electric light and power appliances, hydro-electric and power station equipment, electric elevators, farm lighting sets, and general electrical machinery. Mr. Bean is at present making a business tour of America, England, and Europe.

Messrs. W. J. Knox & Sons, lighting and heating engineers, Railway Street, Lisburn, desire to receive manufacturers' price lists of gas and oil direct-coupled sets up to 12 kW.

Catalogues and Lists.—Messrs. Leslie McMichael, Ltd., Providence Place, West End Lane, Kilburn, N.W.6.—A profusely-illustrated catalogue giving details and prices of all kinds of wireless apparatus.

The Cambridge & Paul Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—List No. 157, illustrating and describing electrical CO_2 recording apparatus. Also a mailing card illustrating the "Omega" insulation and conductivity tester.

Mr. Charles Kratt, Ashley Street, Nottingham.—An illustrated leaflet describing the "Hastie" colour-changing electric sign.

The Tangent Tool Engineering Co., Ltd., 40-41, Great Marlborough Street, W.1.—A circular letter announcing the reduction of prices of "Tangent" tools.

Mr. Thomas T. D. Geesin, 4, Clevedon Road, Penge, S.E.20.—Publicity matter dealing with metallic packings, packing nuts, air and gas drainers, air filters, oil extractors, and steam dryers, manufactured by Messrs. Princeps & Co., Sheffield, of which firm Mr. Geeson is London representative.

British Insulated & Helsby Cables, Ltd., Helsby, near Warrington.—Pamphlet H.99, containing numerous illustrations and details of wireless aerials and accessories. Fully priced.

Messrs. Henry Joseph & Co., 96, Victoria Street, S.W.1.—A binder containing several illustrated and priced leaflets dealing with cut-outs, ceiling roses, lamp shades, vibro-massage apparatus, switches, lampholders, &c. Also a pamphlet advertising "Langham" motors.

The Wandsworth Electrical Manufacturing Co., Ltd., Ludgate Hill, Birmingham.—A list of reduced prices of switches, and revised discounts.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Folder OS.2732, giving illustrations and prices of "Osram" automobile-type lamps of various patterns.

Messrs. Frederick Thomas & Co., 189, Drummond Street, N.W.1.—A comprehensive catalogue of lighting fittings—plain and ornate—including brackets, lanterns, standards, pendants, bowls, switch-plates, &c.

Messrs. Cleworth, Wheal & Co., Ltd., Grange Engineering Works, Snows Lane, Castleton, near Manchester.—An illustrated pamphlet describing fully the "Natural" humidifier for employment in textile factories, &c.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Two well-illustrated folders advertising "Simplex Triple-Purpose" signs.

Messrs. Charles Erith & Co., Palace Chambers, Bridge Street, S.W.1.—A well-illustrated brochure describing the construction and operation of "Riley" stokers for water-tube boilers.

The Falkirk Iron Co., Ltd., Falkirk.—An illustrated leaflet (No. 304), giving reduced prices of "No. 5,280" electric cookers.

The Midland Electric Power Installation Co., Old Mill Street, Wolverhampton.—An illustrated and priced pamphlet advertising the "Mepic" shop-window heater.

The Avamore Engineering Co., Ltd., Haslemere, Surrey.—An illustrated folder dealing with the "Squeegee" positive rotary high-speed pump and methods of driving.

The Steam Fittings Co., Ltd., West Drayton, Middlesex.—A leaflet illustrating and describing the "Union" portable gas calorimeter.

British Empire Exhibition.—The Duke of Devonshire has accepted the position of chairman of the Executive Council, and Lord Morris has been appointed a vice-president of the exhibition. Lord Morris was chairman of the provisional committee formed in 1909 to consider the question of an overseas exhibition, which, however, was eventually replaced by the present larger scheme.

For Sale.—By order of the B. D. H. Wholesale Electrical Supply Co., Bournemouth on voluntary liquidation, Messrs. Topus & Harding will sell by auction, on October 31st, at 157, Cheapside, E.C., the stock of electrical fittings, accessories, &c. Leicester Corporation Electricity Department has for disposal three 250-kW generating sets. (See our advertisement pages to-day.)

New Canadian Company to Sell British Electrical Goods.—During the past few months there has been formed in Canada Menzies-Smart, Ltd., which aims in part at introducing British electrical manufactures in the Western Canadian market. Mr. J. S. Menzies, head of the company (which is described as a Winnipeg firm of agricultural machinery merchants) is in this country at present. Mr. A. E. Ralph is acting as his advisory engineer. Mr. Menzies has fixed up agreements with a number of British firms for the sale of certain lines of electrical goods and the manufacture of others in Canada, particulars of which are given below. We understand that the company has been formed under the above title by a group of influential Canadian business men. The foremost object of the company is to develop a concession from the water-power branch of the Dominion Government, to provide a hydro-electric power supply at White Mud Falls, situated on the Nelson River, in the Province of Manitoba, an area of timber plantation for the supply of pulp for paper, the establishment of a pulp and paper mills, and a smelting plant for the copper mines. We give below a list of the agencies that the company has secured from manufacturers in Great Britain for the importation and sale of electrical and mechanical appliances in Canada. We are informed that arrangements have been made for the manufacture in Winnipeg of those that will call for a constant demand, and that eventually a branch works will be set up in each province:—

Berry's Electric, Ltd., for the sale of ironclad switchgear, lifebuoy saving devices, the "Mulparco" washing machine, and the "Orbosil" electric iron.

The New Rotoplunge Pump Co., Ltd., for the sale of the patent "Rotoplunge," "Suddo," and "Broadway" pumps.

Erskine, Heap & Co., Ltd., for the sale of switchgear.

Johnson & Phillips, Ltd., for the sale of cables and wires, patent wiring system, connecting boxes, and transformers.

Benham & Sons, Ltd., for the manufacture and sale of their patent electric vapour heater.

The Browning Electrical Co., for the sale of its patent electric soldering irons.

The Falkirk Iron Co., Ltd., for the sale of its "Falco" cooking apparatus.

The New Compression Starter & Switchgear Co., Ltd., for the sale of lampholders and starting switches and resistances.

The Zenith Manufacturing Co., for the sale of its adjustable resistanfers and rheostats and vitreous enamelled resistance units.

"Welco" Patents, for the sale of their "Welconstruct" slotted steel bars and accessories and electric heating and cooking apparatus.

Unemployment.—The Secretary to the Ministry of Labour announces that the number of persons on October 16th recorded on the Live Registers of the Employment Exchanges in Great Britain as wholly unemployed was 1,332,500. This was 2,400 more than in the preceding week, and 491,233 less than the figure recorded at the beginning of last January. The number working short time and drawing benefit for intervals of unemployment was 49,700 on October 16th, as compared with 50,748 on October 9th, and 934,786 on July 1st, 1921.—*The Times.*

Wages in the Lead Industry.—The Industrial Court, in a recent award on wages in the lead manufacturing industry, has decided that the present minimum rates paid to general labourers shall be reduced by 1½d. per hour in three instalments, the first to operate in November, the second in December, and the third in January next.

The New E.C.A. Offices.—As from Wednesday last, October 25th, the offices of the following Associations (of which Mr. L. G. Tate is secretary) have removed to the Institution of Electrical Engineers' Building, Savoy Street, Victoria Embankment, W.C.2. Telephone number changed to "Regent 488"; telegraphic address unaltered, "Nafecta Phone, London":—The Electrical Contractors' Association (Inc.); the N.E.C.T.A., Ltd.; the National Federated Electrical Association; the London Electrical Masters' Association; the Joint Committee of Specialists' Association; and the National Joint Industrial Council for the Electrical Contracting Industry.

Works Costing.—The Sessional Examinations of the Institute of Cost and Works Accountants will take place on December 4th, 5th and 6th, in London, Manchester, Birmingham, Sheffield, Glasgow, and Bristol. Forms can be obtained from the Secretary, 38, Grosvenor Gardens, London, S.W., 21 days in advance of the examination.

Copper and Lead Prices.—Messrs. F. Smith & Co. report October 25th:—Copper (electrolytic) bars, £70 15s., 20s. decrease; do. do. sheets, no change; do. do. wire rods, £80 15s., 20s. decrease; do. do. h.c. wire, 10 1/16d., ¼d. decrease; silicium bronze wire, 1s. 0¼d., ¼d. decrease.

Messrs. James & Shakespeare report October 26th:—Copper bars (best selected), sheet and rods, no change; English pig lead, £28 5s., 35s. increase.

Turbo Generating Plant Contracts.—The contracts for turbo-generating plant recently secured by Messrs. James Howden & Co., Ltd., Glasgow, include: Two 3,000-kW sets for large cotton mills abroad; ordered by the British Engineers and Textile Syndicate, Ltd., London; two 1,000-kW high-pressure sets for [illegible]; a 1,000-kW and a 750-kW geared sets for the Corporation; a 1,000-kW geared set for Fleetwood; two [illegible] sets for the Co-operative Wholesale Society, [illegible]; a 1,000-kW geared set for a colliery in Scotland; and [illegible] for Saskatchewan, Canada. A number of orders have also been booked for high-speed engine generating sets for Chinese and Persia.

Federation of British Industries.—At a meeting of the Grand Council of the Federation of British Industries, on [illegible], Sir Eric Geddes was unanimously nominated for the [illegible] presidency of the Federation during the coming year.

The Grand Council also recommended the addition to the list of vice-presidents of the Federation of the following (among others):—Col. R. K. Morcom, C.B.E., and Sir George Sutton, Bart.

These nominations will be considered next month by the annual general meeting of members of the Federation, with whom the actual election of officers rests.

New West Ham Showroom.—A conveniently-situated electrical showroom has recently been opened in Romford Road, Stratford, by the West Ham Electricity Department (engineer and manager: Mr. F. W. Purse). This is in the nature of a temporary structure owing to the uncertainty prevailing with regard to road widening in the district, but at the same time it is a handsome building, as will be seen from the accompanying view of the exterior. The builders were Messrs. [illegible] Coates, of Stratford. An attractive feature of



The New West Ham Showroom.

the front of the building is a coloured glass "pediment," which provides a striking night display. The show consists of a large range of lighting fittings, electric fires, and a multiplicity of domestic appliances, each of which is controlled by a separate pressel switch. The showroom is immediately adjacent to the head offices and storerooms of the department.

British Trade Mark Applications.—Below we give a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Motolite. No. 426,850. Class 6.—Dynamos. Motolite Dynamos, Ltd., Lardor Road Works, Askew Road, Shepherd's Bush, London, W. October 18th, 1922.

Kathanode. No. 425,910. Class 8.—Electric storage batteries (not for medical purposes). The "D. P." Battery Co., Ltd., Bakewell, Derbyshire. October 18th, 1922.

Oracle. No. 427,915. Class 8.—Wireless telegraphic and telephonic instruments. Winteringham, Ltd., St. Andrews Street, Northampton. October 18th, 1922.

Electric Vehicle Price Reductions.—Recent quotations show a substantial reduction in the price of electric vehicles. As this reduction has followed nearly a year behind the reduction in the price of steel and other components of the vehicle, it has been held in some quarters that manufacturers have been making undue profits, but, says the *Electric Vehicle*, those familiar with the manufacturing side of the business know that this is not true. Prices have been reduced rather to make a reasonable profit possible, by increasing the turnover. Now that the first cost has been brought to a level competitive with that of petrol vehicles of equal capacity, there should be no hesitation on the part of the buyer as to which type he will select for point-to-point transport work in urban areas. The superior economy of electric vehicles for this kind of work has been abundantly proved. How much stronger, therefore, becomes the argument for their use when the obstacle of initial cost (always appearing so formidable to the buyer) is entirely removed, or reduced to insignificant proportions.

Australian Tariff Decisions.—The following tariff decisions have been approved of by the Customs Department: *Electrical Appliances and Material.*—Telephones (wireless) and appliances therefor. Item 180 (a), British preferential tariff, free, intermediate tariff, 5 per cent., general tariff 10 per cent. Batteries, primary and parts thereof, for use in the operation of electrical relays in power stations. Item 174, free, 5 per cent., 10 per cent. Lightning arresters, 22,000V, oxide film, 3-phase, outdoor type, complete with cut-out fuses, hook and testing stick. Item 174, free, 5 per cent., 10 per cent. *Machines, Machinery, &c.*—Rotary converters, synchronous motors, to be incorporated in X-ray apparatus manufactured within the Commonwealth. Item 404, free, free, 10 per cent. Bogie trucks, for use in the manufacture of electric tramcars. Item 174, free, 5 per cent., 10 per cent. *Stokers, mechanical.*—For burning coke breeze. Item 178 (c), 27½ per cent., 35 per cent., 40 per cent.

The Minister for Customs has decided, as a number of industries are not in a position to meet the requirements of Australia, to defer the duties on paper-insulated and lead-covered telegraph and telephone cables until January 1st.—*Reuter's Trade Service* (Melbourne).

Local Exhibitions.—It is proposed to hold an "ideal homes exhibition in Dundee early next year.

The recent fire at the Cirencester power station necessitated the closing two days before the intended date of an electrical exhibition organised by Messrs. Edwards & Armstrong, Ltd., who have a branch in the town. The exhibition, which opened on October 2nd, contained numerous examples of domestic electrical appliances, lighting fittings, and industrial apparatus, one feature being a "Lister-Bruston" lighting set in operation. The show was held in a large garage, part of which was rented for the purpose.

The Worksop electrical exhibition, which concluded on October 23rd, was a pronounced success. Mr. J. Percival Crowther, A.M.I.E.E., said, at the opening ceremony, that the exhibition was due to the progressiveness of the Worksop electrical contractors and several well-known manufacturers. The exhibition included a large variety of electrical appliances, including wireless sets, cigar lighters, electric washers, motor horns, cookers, and advertising devices. The receipt of wireless messages attracted a good deal of attention. Among the novelties was a bedroom light which reflected a clock's face on to the ceiling. Pedestal electric heaters, gasfilled lamps, "Dimalite" adapters, and "Doriclite" fittings were also on view, and many visitors were particularly interested in the "Klaxonet" horn. The large consumption of current has prevented many motorists from having a "Klaxon" fitted to their cars, but the Klaxonet consumes little current, and the note has been improved

Trade and Wages.—The inaugural address delivered yesterday by Mr. Atholl Blair, the chairman of the Belfast Association of Engineers, was on the subject of "Trade and Wages."

Book Notices.—"Direction and Position Finding by Wireless," by R. Keen. Pp. xvi+376; figs. 254. Price 9s. "The Wireless Telephone—What it is and how it works," by P. R. Coursey. Pp. vi+112; 49 figs. Price 2s. 6d. "Masts and Aerial Construction for Amateurs," by F. J. Ainsley. Pp. viii+82; figs. 65. Price 1s. 6d. net. "Crystal Receivers for Broadcast Reception," by P. W. Harriss. Pp. viii+74; figs. 75. Price 1s. 6d. "The Perry Auto-Time Morse System," by F. W. Perry. Pp. xvi. Price 6d. London: The Wireless Press, Ltd.

"Wireless Telephony for All," by L. M. Cockaday. Pp. xii+211; 65 figs. London: H. Jenkins, Ltd. Price 5s. net.

"Engineering Abstracts," new series, No. 13, October, 1922. London: The Institution of Civil Engineers.

"M. & C. Machine Mining," October. Glasgow: Mavor and Coulson, Ltd.—This issue contains several useful articles upon coal-cutting and transporting machinery, including "Face Conveyors and Gate-end Loaders," and an interesting comparison of old and new mining methods.

"Moving Picture Projection," by J. Slater. Pp. xxviii+165; 34 figs. London: Bioscope Publishing Co., Ltd. Price 5s. 4d., post free.

Journal of the American Institute of Electrical Engineers. Vol. XLI, No. 10. October, 1922. New York: The Institute. Price $1.

Ilford Super Kinema.—When describing the above-named kinema last week it was stated that "Two Kershaw projectors by the Sun-Light Arc Corporation are installed." We understand that Messrs. Duncan Watson & Co. are the sole European concessionaires for the "Sun Light" arc high-intensity projection lamps used with this apparatus.

New French Company. La Société Hydro-Electrique de la Cère is the name of a new undertaking which has lately been formed in Paris (79, Rue de Monceau), with a capital of 20,000,000 fr.

Textile Mill Electrification.—The first meeting of the session of the Paisley Association of Engineers was held on October 10th, when Mr. R. W. Dodson delivered his presidential address, taking as his subject "The Electric Driving of Textile Mills." Mr. Dodson pointed to the many advantages to be gained by textile-mill electrification, and instanced cases where the production had been considerably increased by this means. Motors specially designed for this work had shown remarkable efficiency, and an example was quoted of a machine which had given an overall efficiency of 88 per cent. on a load varying from 50 to 200 per cent. of its rating.

Electricity in Advertising.—In a lecture bearing the above title delivered at the Publicity Club of London, Mr. Ernest Morison, manager, Outdoor Publicity, Ltd., gave an interesting review of the history of advertising by electrical methods. He incidentally provided proof of the adage "There is nothing new under the sun," and showed that many present-day developments which were claimed to be innovations had their forerunners as far back as thirty or forty years ago, although in many instances these had been forgotten. He recalled that football matches were played by electric light in Hull in 1883, and two years later Mr. J. Morley brought out a form of flood-lighting. The forming of various combinations of electric lamps by means of a "typewriter" switching apparatus dated back to 1891, the system having been introduced by a Mr. Champion. The years 1896-1900 saw many developments in electrically-operated signs, including the two-colour sign which was now so frequently seen. Mr. Seabrook brought out the first thermal sign flasher in 1904, and about that time Mr. Poulton, of the Electric Sign Co., invented the "wiping" method of switching on signs, so surmounting the police objection to the amount of light to be shown at once. Mr. Morison concluded by a reference to the scintillating sign in Shaftesbury Avenue, which he considered to be the most up-to-date example of this form of publicity.

LIGHTING AND POWER NOTES.

Accrington.—Extension of Supply.—The Electricity Commissioners have empowered the Corporation to proceed with the laying of a cable to supply electricity to the area of the Oswaldtwistle District Council without waiting for the sanction of Parliament.

Ambleside.—Electricity Charges.—The Windermere and District Electricity Supply Co. has applied to the Ministry of Transport for an order to charge 1s. per kWh, with minimum payments of 15s. for the winter quarters and 10s. for the summer quarters.

Ashford.—Electricity Supply Scheme.—The Council has retained Messrs. May & Hawes as consulting engineers to prepare a scheme for an electricity supply undertaking for the district.

Australia.—Tasmania.—The Treasurer, Sir Neil Lewis, said in his Budget statement that the hydro-electric department was rapidly expanding, there being an increase in the revenue of £36,364, with a net surplus for the year of £23,872. With the new enterprises that had been established in active operation, and with the healthy outlook in most of the primary industries of the State, there was every prospect of prosperous times ahead.—*Reuter* (Hobart).

Brisbane.—A project has been formulated for an electric lighting scheme in the suburbs of Windsor and Toowong, to cost £45,000. The Minister for Works is urging the municipalities concerned to endeavour to finance the scheme themselves. The Government has also suggested that a larger project, embracing several contiguous areas, should be entered upon, the new scheme to cost £100,000. The whole matter is as yet in abeyance.—*Reuter's Trade Service* (Melbourne).

Bolton.—Price Reduction.—The Electricity Committee has decided to reduce the charges for electricity by 0.1d. per kWh for both lighting and power purposes, the reduction to come into effect as from the beginning of the March quarter, 1923.

Bury.—Revision of Charges.—The Electricity Committee has decided that as from October 1st the following charges shall be made for electricity in lieu of those previously in force, viz.:—Lighting: offices, &c., 6d. per kWh; shops, 5½d.; hotels and private houses, 4½d. Power: for first 4,000 kWh, 3d. per kWh.; next 1,000, 1.5d. per kWh; next 190,000, 1d.; all above, .8d.; tramways, 1.5d.

Canada.—Winnipeg.—The Winnipeg branch of the Canadian Manufacturers' Association has proposed to the City Council that instead of proceeding with the projected steam standby plant of 15,000-h.p. capacity, costing $1,500,000, it should endeavour to come to terms [illegible] the Electric Development Co. [illegible] a connection could also arrange the sale.

Exports of Electric [illegible]. The total amount of [illegible] exported from Canada [illegible] the United States during the year ended March 31st, 1922, was $61,567,161, a decrease of 157,966,842 [illegible] as compared with the previous year.—*Electrical News.*

Toronto.—The recently-published report of the Hydro-Electric Commissioners for the year 1921 records a total income of $3,622,405, an increase of 15 per cent. [illegible] management costs amounted to $1,101,555 and [illegible] chased energy $1,111,019, as against $[illegible] and $[illegible] respectively in the preceding year. The gross surplus was thus $1,410,231. Interest, taxes, and other capital charges absorbed $266,915, leaving a net profit of $[illegible]. The amount of energy sold rose from 214,[illegible]45 to [illegible] kWh and the connected load from 194,800 to 227,600 h.p.

Cannock.—Tariffs.—In connection with the electricity supply scheme that was inaugurated on the 12th inst., for the time being the Council intends to charge at the rate of 7d. per kWh for lighting and 2d. for heating on a flat-rate system, but it also offers an alternative system, under which consumers would be charged upon the basis of 15 per cent. per annum, payable quarterly, upon the rateable value of the property supplied, plus a charge of 2d. for each and every kWh consumed. For hotels, shops, offices, &c., requiring supplies for lighting, heating, cooking, and other purposes, the Council, in addition to the flat rate referred to above, offers as an alternative the maximum demand system under which consumers would be charged at the rate of £2 10s per quarter per kW of maximum demand, plus 2d. per kWh. For ordinary power purposes the charge will be at the rate of £2 per quarter per kW of maximum demand, plus 1d. per kWh, subject to discounts varying from 5 per cent. up to 20 per cent., according to the demand made. Special terms are granted to large consumers, such as collieries, engineering works, &c., which are the subject of special agreements.

Cardiff.—Extension of Supply.—The Electricity Committee has decided to extend its area of supply to include Mynachdav, at a cost of £1,035. The city engineer and the electrical engineer have been requested to submit a report as to the advisability of extending the mains to the Ely housing site.

Corea.—Seoul.—H.M. Consul-General at Seoul has informed the Department of Overseas Trade that the Kongosan (Diamond Mountains) Electric Railway Co. has obtained official permission to supply electricity to Seoul, and it is hoped to commence the supply in September of next year. The generating station of the company, in which 32,000 kW of plant is to be installed, is nearing completion. The station is situated at Chudairi, Kogen Province, a distance of 62 miles from Tetsugen (Corean, Cholwon), a station on the Seoul-Gensan railway, which is to be the terminus of the line; from Tetsugen to Seoul the distance is about 61 miles, so that electricity will have to be transmitted a distance of over 120 miles in all. The total cost of the transmission line is estimated at nearly 4,000,000 yen.

Crompton.—Special Order.—The Urban District Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity within the district, and to obtain a bulk supply from Oldham Corporation.

Dolgelly.—Water-power Scheme.—The Urban Council has under consideration three schemes submitted for the utilisation of the cataracts in the district for generating electricity.

Edinburgh.—Year's Working.—The accounts of the City electricity undertaking (engineer: Mr. F. A. Newington) for the year ended May 15th, 1922, show a total income from all sources of £395,091, as compared with £311,699 in the previous year. Working expenses remained at about the same level, being £242,512, as against £241,054. The gross profit was thus £152,579, as compared with £[illegible]. Although there was a considerable increase in capital charges, the result was a net profit of £30,711, contrasting favourably with a deficit of £963 in 1920-21. A total of £500,416 was spent on capital account during the year, the largest items being: Portobello station (land, buildings, and machinery), £292,312; mains and transformers, £126,192; and sub-station land, buildings and plant, £49,376. Energy sales showed the appreciable increase of 4,308,196 kWh., with a total of 33,935,455 kWh.

Electricity District.—South-East Lancashire.—The Board, at its meeting on October 17th, approved of the installation of a further 150-kW set by the Audenshaw and Wilmslow Electric Supply Co., Ltd. A proposed contract between the Manchester Corporation and the Stretford Urban District Council was approved, whereby the Corporation will furnish, for a period of seven years, bulk supplies to the Council, the maximum demand to be 10,000 kW., the supply to be given [illegible]. The Board has issued to the constituent authorities [illegible] tive *questionnaire* requesting information [illegible] with the question of running hours.

Emley (Yorks.).—Electricity Supply.—A [illegible] meeting has decided in favour of electricity [illegible] in the village.

Faversham.—Electricity Charges.—The Town Council has applied to the Electricity Commissioners for an Order fixing the maximum charge for electricity for lighting at 1s. per kWh.

Loan Sanctioned.—The Council has received sanction to a loan of £801 for mains.

Huddersfield.—Loan Sanctioned.—The Corporation has received sanction to borrow £16,000 for electricity purposes.

India.—Upper India.—*Indian Engineering* states that considerable developments are reported in connection with the utilisation of electric power in Upper India. The Indian Electric Supply & Traction Co., Ltd., Cawnpore, whose fine new power house on the banks of the Ganges at Cawnpore is being set to work, has found it necessary to extend already. In addition to the two 4,500-h.p. steam turbo-generators now being started, this company is ordering two 9,000-h.p. generating sets, together with the necessary boiler and electrical equipment. This power house is the largest and most up-to-date in Upper India. It is understood that Rai Bahadur Sir Ganga Ram, Kt., C.I.E., M.V.O., of Lahore, has placed orders in England for a large power house at Renala, Punjab, for the utilisation of hydro-electric power from the Lower Bari Doab canal for irrigation purposes. The Punjab Government Irrigation Department has recently ordered a large number of electric pumps in connection with the Sutlej weir works. It is interesting to note that the orders for the whole of the Cawnpore plant, for the power house electrical plant at Renala, and for the electric pumps for the Sutlej, have been placed with the English Electric Co., Ltd.

Jersey.—Proposed Electricity Supply.—The Jersey Gas Light Co., Ltd., has lodged a Bill with the States for powers to supply electricity for private and public purposes in Jersey. The memorial for the Bill embodies the scheme and plans which the company's consulting engineers (Messrs. May and Hawes, Westminster), have prepared, and undertakes to give a supply of electricity within 18 months. The scheme is practically the same as that which the company's engineers got out just prior to the war, the system of supply being the d.c. three-wire system at pressures of 240 and 480 volts. The power station will be erected on a site already in possession of the company, almost centrally situated in the supply area, and a comprehensive list of underground mains has been drawn up for the initial scheme.

Keighley.—Bulk Supply.—A special meeting of the Town Council is to be held to consider a recommendation of the Electricity Committee with regard to the supply of electricity to Skipton. The committee has recommended that, subject to powers being obtained, an agreement be entered into with the Yorkshire Electric Power Co. for an e.h.p. supply of electricity in bulk.

Luton.—Loan.—The Town Council has applied for a loan of £5,209 for a 1,000-kW rotary converter, with transformer, switchgear, &c.

Lees (Lancs.).—Electricity Scheme.—The Urban District Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity within the district.

Northwood.—Price Reduction.—The Northwood Electric Light & Power Co., Ltd., has reduced the charge for electricity for heating and cooking from 3d. to 2d. per kWh.

Radcliffe.—Loan Sanctioned.—The District Council has received sanction from the Electricity Commissioners to the borrowing of £22,769 for electricity purposes.

Bulk Supply.—The chairman of the Electricity Committee reports that the agreement between the Council and the Lancashire Electric Power Co. for a bulk supply of electricity has been sealed, and that electricity will be supplied from January 1st.

Royton.—Electricity Scheme.—The Urban District Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity within the district.

Southend-on-Sea.—Loan Sanctioned.—The Town Council has received sanction to a loan of £15,000 for house services.

Skegness.—Electricity Supply.—The Urban Council has received an application by a firm for permission to supply electricity to the town for public purposes, and the matter has been referred for consideration to the General Purposes Committee.

Spalding.—Plant at the Gasworks.—The Urban District Council has decided to obtain the report of an expert on the question of installing an electrical plant at the gasworks, the two systems to be worked in conjunction with each other.

Weston-super-Mare.—Street Lighting.—After a spirited debate upon the respective merits of gas and electricity for street lighting, the Urban District Council agreed on October 11th to accept the tender of the Weston-super-Mare and District Electric Supply Co., Ltd., for a contract to light electrically a number of the principal streets for a period of five years. It had been agreed by a committee that the remainder of the district should be lighted by the local gas company, but an amendment proposing the referring back to Committee of this question was carried and embodied in the main resolution.

Willesden.—Year's Working.—The report and accounts of the Council's electricity undertaking (engineer: Mr. A. W. Blake) for the year ended March 31st last, show a total income of £101,967, comparing with £100,231 in the preceding year. Working expenses amounted to £74,112, as against £72,927, leaving a gross profit of £27,855 (£27,304). After crediting bank interest, &c., and deducting capital and other charges, a net profit of £3,153 remained. In the previous year the net profit was £4,503. The energy purchased from the North Metropolitan Electric Power Supply Co. amounted to 9,725,020 kWh, as against 9,537,290 kWh in 1920-21. The sales, however, fell from 8,362,787 to 8,160,940 kWh. During the year a 500-kW rotary converter was installed at Salusbury Road, and eventually removed to the Acton Lane sub-station. Twenty-five miles of cable was laid and 588 new services provided.

Windsor.—Electricity Charges.—The Electrical Installation Co., Ltd., has applied to the Ministry of Transport for an Order authorising the continued charge of a maximum of 1s. per kWh, with minimum payments during the winter quarters of 15s. per quarter, and during the summer quarters of 10s.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Tramcar Improvements.—The Corporation has decided that 23 tramcars specially designed on the "pay-as-you-enter" system be altered and remodelled to the newer standard type at a cost of £3,450.

Argentina.—Railway Electrification.—The electrification of the suburban section of the Buenos Aires Western Railway between Plaza Once and Moreno is now well advanced. The company has recently been running trial trains over the section with the object of giving preliminary practice to the drivers, guards, and other *personnel*, and also to test the track and rolling stock. The results so far have been satisfactory. It is hoped that the electrified section will be opened to public service before the end of the year.—*Review of the River Plate.*

Bolton.—New Routes.—With a view to the relief of unemployment during the winter, the Tramways Committee has decided to apply to the Government Unemployment Grants Committee for assistance in the scheme, estimated to cost £43,000, for making five extensions to the tramways, as follows:—Chorley Old Road, from the terminus to Midge Hole Lane. Brownlow Fold, from the terminus, Eskrick Street, along Elgin Street and Church Road to Harpers Lane; Great Lever, from Bridgman Street to Higher Swan Lane; Salisbury Street and Shiffnall Street, for convenience of working at the tram sheds.

Reduced Fares.—The Tramways Committee has decided to restore the pre-war fares throughout the day until 6.30 in the evening, the higher fares being charged after that time, after 1.30 on Saturday afternoon, and on Sundays.

Bradford.—Track Renewals.—The Ministry of Transport has sanctioned the borrowing of £90,593 in respect of part of the cost of reconstructing the following sections of the tramways, *viz.*:—Barkerend Road (Byron Street to Rushton Road); Forster Square, Lidget Green (Tyrrel Street to Listerhills Road); Little Horton (Holm Top Lane to Southfield Lane); Manchester Road (Bentley Fold to Pearson Road); and Thornton (Godfrey Street to Allerton Road).

New Railless Car.—The municipal tramway authorities have recently constructed in their own works at Thornbury a special six-wheel railless car, with which experiments are at present being conducted.

Edinburgh.—Electrification of System.—Cable cars ceased to run along Princes Street last Saturday, and on Sunday morning electric cars were running on the ordinary service.

Extension of Route.—The Corporation Sub-Committee has recommended an extension of the Liberton route at a cost of £15,320.

London. "Underground" Developments.—In addition to the new works which are under construction at Golders Green in connection with the Hendon and Edgware extension, the reconstruction of the City and South London Railway, and the linking-up of that line with the Hampstead tube, the Underground railways have large development schemes pending for continuing the Piccadilly tube beyond Hammersmith and linking up this line with Richmond and Hounslow, thus providing a through service of trains between these districts and the West End. Many improvements for facilitating heavy

traffic at some of the more important traffic centres are under consideration. Westminster station is to be practically rebuilt, escalators are to be installed at Tottenham Court Road, Bank, Shepherd's Bush, and Bond Street, and the escalator equipment at Oxford Circus is to be improved. At all these stations the booking office arrangements are to be reorganised and new equipment provided in the shape of electric changegiving machines with a view of relieving congestion by speeding up the traffic between the street and the platform.

L.C.C. Tramway Department.—The Highways Committee of the London County Council reports that, owing to adjustments of wages in the tramway department, the following savings will be effected:—Transport workers, present financial year, £62,000, and in subsequent years about £124,000; engineering (mechanical), present year, £84, subsequent years £152; coach trades, present year £2,970, each subsequent year £5,150. —*Financial Times.*

Oldham.—Year's Working.—The annual report of the general manager of the Corporation tramways (Mr. W. Chamberlain) for the year ended March 25th last, shows that the total income was £253,883, as compared with £250,742 in the preceding year. The total working expenditure was £200,503, as against £202,235, leaving a gross balance of £53,380 (£48,507). After crediting interest, &c., and deducting capital charges, a balance of £16,723 was carried to the appropriation account, a result which compared favourably with the 1920-21 net profit of £5,065. The whole of the profit was transferred to the reserve for renewals, which, at the end of the year, stood at £35,632. The capital expenditure during the year amounted to only £15. The Parcels Department showed a profit of £322, as compared with a deficit of £260 in 1920-21. The car-mileage increased from 2,202,868 to 2,460,699. The percentage of working expenses to receipts fell from 80.65 to 78.97, and the average traffic revenue from 26.760d. to 24.273d. per car-mile.

United States.—New Railway.—An application was filed with the Interstate Commerce Commission recently by the Staley system of electrified railroads for permission to build a 950-mile line in Colorado, New Mexico, and Arizona, with 225 miles of branch lines. The projected road is to start at the Mexican border in Prima County, Arizona, and run northward through the San Juan basin.—*Reuter's Trade Service* (Washington).

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—Telephone Tariff.—Telegraphic advice has been received by the United River Plate Telephone Co. that the increase in its tariff, applied for in 1919, has been granted by the President.—*Financial Times.*

Australia.—Automatic Telephones.—The Federal Public Works Committee has recommended the erection of a six-storeyed automatic telephone exchange at Sydney with a capacity of 16,000 lines, at an estimated cost of £404,000.—*Reuter's Trade Service* (Melbourne).

Canada.—New Wireless Station.—The Canadian Marconi Co., in co-operation with the English company, has applied to the Government for a licence to erect at Vancouver a powerful wireless station, at a cost of $2,000,000, to give direct communication between Australia and the east coast. —*Financial Times.*

Germany.—Valve Thefts.—A Berlin engineer, two physicists, and a mechanic have been arrested on the charge of having obtained patented wireless transmission valves belonging to the Telefunken Co., and sold them abroad. The company is stated to have found its valves in use in stations situated in the United States, Holland, and the Russian border States. The persons arrested are said to have confessed, and have been released on bail pending prosecution.—*The Times.*

Japan.—Wireless Developments.—In order to develop the radio art on a large scale in Japan, a plan has been submitted to Premier Kato and is said to have received his approval. The co-operation of the Minister of Communications is also to be secured. The plan is supported by leading financiers of Japan, and contemplates the formation of a company capitalised at 200,000,000 yen, along the lines of the large radio enterprises in other countries. It is understood that the Japanese Government favours in principle the retention of all kinds of communication in the hands of the Government. The first step will be the formulation of plans for a high-power radio station consisting of several units, designed for direct communication with the United States and with various Asiatic countries. The company will manufacture its own apparatus and will eventually enter the export field. It has already secured the consent of Marconi's Wireless Telegraph Co., Ltd., the Radio Corporation of America, the Compagnie Française de Télégraphie sans Fil, and the Gesellschaft für Drahtlose Telegraphie to its inclusion in the working agreements made among these four radio companies. *Commerce Reports.*

Poland.—New Radio Station.—Preliminary test [illegible] carried out this month between New York and [illegible] connection with the new radio telegraph station that [illegible] erected at Warsaw by the Radio Corporation of America for the Polish Government.—*T. & T. Age.*

The Telephone Service.—New Exchanges.—The following new Liverpool and district telephone exchanges are to be opened to replace existing exchanges:—Birkenhead, Bebington, Port Sunlight, Formby, Frodsham, Garston, Hoylake, Lark Lane, Newton-le-Willows, Old Swan, Photograph, Exchange, Rock Ferry, Royal (new exchange in same building), St. Helens, Walton, Warrington, Waterloo, and Widnes. Exchanges in the following districts, at present undeveloped, will be undertaken provided sufficient support is obtained:—Thornton Hough, Halewood, Kirkby, Union Mills (I. of M.), Crosby (I. of M.), Kirk Michael (I. of M.), Ballaugh (I. of M.), and Sulby (I. of M.). Extension to present equipment is in hand at Anfield, Bootle, Central Grappenhall, Helsby, and Warrington. The exchange equipment at the Bank Exchange has been increased by 280 lines. The new exchange at Fleetwood, which was opened on July 15th last, is the first public exchange to be installed on the "Relay" automatic system. We hope to publish details of the equipment next week.

United States.—Wireless Telegraphy.—The Associated Press has been giving prominent notices in its [illegible] to traffic arrangements recently concluded between the Postal Telegraph and Cable Co. and the Radio Corporation of America, both United States corporations, whereby the former agrees to accept for transmission at all its offices messages to Europe, Asia, &c., marked "*Via* R. C. A.," this route indication meaning that the messages are to be transmitted by the trans-Atlantic wireless routes operated by the Radio Corporation at New York to Great Britain, Germany, France, Norway, and also other countries with which direct wireless services may in the future exist. Mr. Clarence H. Mackay, president of the Postal Telegraph and Cable Co., in his announcements, refers to arrangements his company has with the Telefunken Co. of Germany, securing the right to purchase all the high-powered radio apparatus necessary to establish additional radio stations in the United States. This, he added, also carries with it the right to a proportion of the wireless traffic out of Germany and for the exchange of radio messages with Telefunken stations in all parts of the world. This is a remarkable change of front, for, in the Mackay Co.'s reports "Wireless" was generally regarded lightly and referred to as suitable only for ship-and-shore work.

It is interesting to watch the re-grouping of telegraph interests, for, since the opening for traffic of the Miami Barbados cable, the Western Telegraph Co., an associate company of the Eastern Telegraph Co., has been running in joint effort with the Western Union Co., and this has undoubtedly made more mutual the interests of the All-America Cables, Radio Corporation of America, Postal Telegraph & Cable Co., and the Commercial Cable Co., as well as European wireless undertakings. It remains to be seen how far the French cable interests and the interests of the Imperial cables will be benefited by a closer association with one or the other interests. It will be interesting to watch progress and developments.

Wireless Telephony.—The "Phono-Phane." The Hon. Edward Fallows, a member of the United States Congress and president of the Hutchinson Radio Co., of America and Canada, arrived at Southampton from the U.S.A. to-day. He was to bring with him the "Phono-Phane," an instrument that is regarded as being "one of the greatest discoveries in radio detection of the day." The chairman of the Hutchinson Co. is Dr. Miller Hutchinson, the inventor of the Klaxon horn, the Acousticon, the Dictograph, and the Speedmeter. Mr. Fallows was also to bring a new radio set, which is remarkable for its small size. He has come to this country in order to negotiate with electrical companies in England.

Air Ministry Regulation.—The Air Ministry has decided that all civil aircraft making journeys of over 100 miles must be fitted with wireless apparatus. All British machines on the regular air routes have for some time past been fitted with wireless. The new ruling means that all machines used for special flights of over 100 miles will be similarly equipped. The order is another of the series made in the interests of safety as a result of frequent conferences between Air Ministry officials and pilots and officials of the air lines.—*Evening News.*

Yap.—New Wireless Station.—In the next budget of the Governor-General of the South Sea Islands there will be an item of 1,200,000 yen to cover the construction of a high-power radio station in the island of Yap, included in the South Sea Islands group over which Japan was given a mandate by the League of Nations. Under the provisions of the treaty concluded at Washington, the United States was granted equal rights with Japan as regards the [illegible] of radio and cable stations on the island, which during the war was a landing point for the German-Dutch cables. These cables are now operated jointly for the benefit of the five principal Allied and Associated powers, and form a direct connection with the commercial Pacific cable for business between the United States and the Dutch East Indies. —*Commerce Reports.*

CONTRACTS OPEN AND CLOSED.

The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen.—November 10th. Electricity Department. One [illegible] turbo-alternator, with surface condenser and accessories. (October 20th.)

Australia. Melbourne.—Postmaster-General's Department. November 16th. Insulated signal cable (Sched. 958).
November 21st. Switchboard parts (Sched. 67).
December 12th. 1,416 switchboards (Sched. V68). (See this issue.)
January 10th, 1923. Telegraph power plant (Sched. W.A. [illegible]). (October 20th.)
Victorian Railways. November 29th. One industrial electric storage battery truck (4,000 lb. carrying capacity).*
January 24th, 1923. Fifty miles insulated copper wire.—*Reuter's Trade Service* (Melbourne).
January 19th, 1923. Electricity Commissioners. Steam turbine-driven boiler-feed pumps (Spec. 23/4) for the Morwell power scheme. (October 20th.)

Belgium.—November 8th. Belgian Telegraph and Telephone authorities, La Salle Madeleine, Brussels. Telegraph cable and wire, insulators, and other material.

Birmingham.—November 27th. Electric Supply Department. E.h.p. switch panels, &c. (October 20th.)

Bristol.—November 14th. Electricity Department. One 4,000-kVA single-phase turbo-alternator with condensing plant. (October 20th.)

Dublin.—November 6th. Irish Postmaster-General's Department. 14,000 Leclanché cells, 3,500 dry cells, 8 tons chloride of ammonia, 40,000 Leclanché zinc rods, 3,500 Leclanché glass cells. (October 13th.)
November 14th. 90 tons h.d. copper wire, 25 tons bronze wire, 70 tons g.i. wire. (See this issue.)
November 13th. Great Northern Railway (Ireland). Stores for six months, including electrical fittings and lamps, electric cable and wire, &c. (See this issue.)

Edinburgh.—November 1st. Tramways Department. Supply, &c., of one 20/25 h.p. motor tower wagon.
November 14th. Eight automatic point controllers and 56 top-covered car bodies.

India.—November 3rd. High Commissioner for India. Electric jib crane and overhead electric crane. Director-General, Stores Department, 11, Belvedere Road, S.E.
November 17th. D.c., l.p. two and three-core cables. (See this issue.)

Leeds.—November 10th. Electricity Department. Iron castings for 6 or 12 months. (October 20th.)

London.—London County Council.—November 6th. Control panel and switchgear connections for No. 4 generator at Greenwich power station. (October 13th.)

Madagascar.—December 20th. Posts and Telegraphs Department. Copper and bronze wire; insulators, brackets, bolts, &c.; cable, covered wire, &c. Agence Economique de Madagascar, 40, Rue du Général-Foy, Paris.

Neath.—Rural District Council Electricity Department. One 1,000-kW turbo-alternator, with condensing plant, foundations, switchgear, &c. (October 13th.)

New Zealand.—Wellington.—December 5th. Telephone system for the Mangahao power house and sub-stations, &c.*
Dunedin.—December 8th. City Council. One 150-h.p. 3-phase motor and reduction gear for the Mornington cable tram-[illegible]

Rochdale.—November 1st. Board of Guardians. Electric lift, &c., at Birch Hill, Dearnley. (October 13th.)

South Africa. — Pretoria.—November 23rd. Municipal Council. H.p. and l.p. switchgear, transformers, and cables in connection with the extension of the electric light and power supply.*

South Shields.—November 15th. Electricity Department. Two water-tube boilers with mechanical stokers, economisers, induced draught plant, and steel chimney, also ash-handling [illegible] (October 20th.)

Stoke-on-Trent.—November 15th. Electricity Department. Mains and cables for 12 months. (See this issue.)

Torquay. — November 4th. Electricity Department. E.h.p. switchgear for Newton Abbot power station and main sub-station at Torquay. (October 20th.)

Warrington.—November 13th. Electricity Department. H. and l.p. paper and lead-covered cable. (October 20th.)

*A copy of the plans, specifications and conditions of tender, [illegible] be inspected at the Department of Overseas Trade [illegible], 35, Old Queen Street, S.W.1.

Wicklow.—November 4th. Urban District Council. Semi-Diesel engines and dynamos, booster, switchboard battery, overhead mains, house services. Messrs. J. P. Tierney and Co., consulting engineers, 44, Kildare Street, Dublin.

York.—November 21st. North-Eastern Railway Co. Telegraph apparatus and telegraph wire and line stores for six months. (See this issue.)

CLOSED.

Douglas.—Corporation. Accepted:—
Erection of power station (£7,500).—Greer Bros. The tender was the lowest of the six sent in.

Dover.—Mr. E. A. Pinto, of Dover, has obtained the contract for electric lighting installation at the Customs and Excise Department, Dover.

Glasgow.—Tramways Committee. Recommended:—
Copper trolley wire.—R. Johnson & Nephew, Ltd.
Copper rail bonds.—British Insulated & Helsby Cables, Ltd.
Bell pushes.—W. C. Vuille & Co., Ltd.
Fluted brass rollers.—C. Henderson & Co., Ltd.
Bond plugs.—J. Stewart & Co., Ltd.
Ratchet braces.—Dempster, Moore & Co., Ltd.

London.—London County Council. Highways Committee. H.p. switchgear for the Central Repair Depôt.

Johnson & Phillips, Ltd. (accepted)	**£1,071**
Ferguson, Pailin, Ltd.	1,125
A. Reyrolle & Co., Ltd.	1,530
General Electric Co., Ltd.	1,570
Park Royal Eng. Works, Ltd.	1,619
British Thomson-Houston Co., Ltd.	1,742
Metro.-Vickers Electl. Co., Ltd., Trafford Park, Manchester	2,008
Switchgear & Cowans, Ltd.	2,146
Bertram Thomas	2,146

Marine-type boilers, with mechanical stokers, for Central Repair Depôt.

S. Hodge & Sons, Ltd.	£2,550
Davy Bros., Ltd. (accepted)	**2,585**
Clayton, Son & Co., Ltd.	2,942

Four electric lifts for Central Repair Depôt.

*British Steel & Iron Exporters, Ltd.	£1,694
Holt & Willetts (accepted)	**1,838**
Knights Electl. Eng. Co., Ltd.	1,970
S. H. Heywood & Co., Ltd.	2,109
R. A. Evans, Ltd.	2,305
Etchells, Congdon & Muir, Ltd.	2,217
Pickerings, Ltd.	2,347
Wm. Wadsworth & Sons, Ltd.	2,350
Medways' Safety Lift Co., Ltd.	2,360
Hoisting Appliance Co.	2,399
Aldous & Campbell, Ltd.	2,560
Hill & Sons	2,695
Reliance Lift & Eng. Co., Ltd.	2,795
Ditto ditto (alternative)	2,076
Express Lift Co., Ltd.	2,817
Waygood-Otis, Ltd.	2,866
Marryat & Scott, Ltd.	2,899
A. & P. Steven	2,990
John Bennie, Ltd.	3,110
Higginbottom & Mannock, Ltd.	3,250
London Hoist & Machinery Co.	4,565

* Not to specification.

Metropolitan Asylums Board. Accepted:—
Installation of generating set, switchboard, &c., at Highwood Institution.

Peter Brotherhood, Ltd.	£224
J. H. Holmes & Co., Ltd. (accepted)	**240**
J. Crompton & Co., Ltd.	342
Aster Eng. Co., Ltd.	251
J. H. Holmes & Co., Ltd. (alternative)	251
Aster Eng. Co., Ltd. (alternative)	260
Elec. Construction Co., Ltd.	275
Petter Oil Engine Co., Ltd.	285
Austin Motor Co., Ltd.	294
Sunderland Forge Co., Ltd.	325

Hackney.—Electricity Committee. Recommended:—
Electric lorry, with hand-tipping body (£800).—Garrett & Sons, Ltd.

Hammersmith.—Electricity Committee. Recommended:—
Stairways, platforms, &c., to the two additional boilers under the extension scheme (£256).—Foster Construction Co., Ltd.
1,000 yd. .05 l.p. cable (£159).—Hackbridge Cable Co., Ltd.

Richmond-on-Thames.—Town Council. Accepted:—
Electrically-driven booster pump (£130).—Worthington-Simpson, Ltd.

Rishton.—Urban District Council. Accepted:—
Electricity distributing station, subject to the approval of the Blackburn Electricity Committee.—Messrs. J. Highton & Sons, Blackburn.

Salford.—Tramways Committee. Accepted:—
Stores for six months.
Lamps.—English Electric & Siemens Supplies, Ltd.; British Insulated and Helsby Cables, Ltd.
Gear wheels.—Met.-Vickers Electrical Co., Ltd.; British Hele-Shaw Patent Clutch Co., Ltd.
Steel tires.—Brown Bayley's Steel Works, Ltd.

Wolverhampton.—Town Council. Accepted:—
Reconstruction of the tramway between Bilston Crescent and the Wergs (£14,617).—M. A. Bassett.

New Swedish Electric Welding System.—A demonstration of the system of electric welding by alternating current invented by the engineer, M. Toernbloem, which has been called the Wex system, was recently given in the presence of representatives of the Press. Foreign countries are said to be displaying great interest in the invention. *Reuter's Trade Service* (Stockholm).

FRANK GILL, O.B.E., M.I.E.E., M.Inst.C.E.

President of the Institution of Electrical Engineers, Session 1922-23.

The Institution of Electrical Engineers, which has just celebrated the jubilee of its foundation as the Society of Telegraph Engineers, has, either from appropriate choice or more likely by happy coincidence, selected as its president for the ensuing year a member who has been prominently connected with what is generally known as the "light-current" side of the industry. Telephone men the world over will recognise the wisdom of the Council's choice.

Frank Gill was born on October 4th, 1866, the son of an Advocate in the Isle of Man. He entered the service of the United Telephone Co. in 1882, and subsequently joined the Telephone Co. of Ireland at Dublin, where he took advantage of the lectures and laboratory work of the Royal College of Science under that pioneer in scientific telephony, Prof. (now Sir William) Barrett. In 1890 he was appointed electrician to the Liverpool district of the National Telephone Co., and three years later became district manager of a large Lancashire area, a position which he held only for a few months, as in the same year he became district manager for Dublin and the South of Ireland. In 1896 he was promoted to the position of superintendent for Ireland.

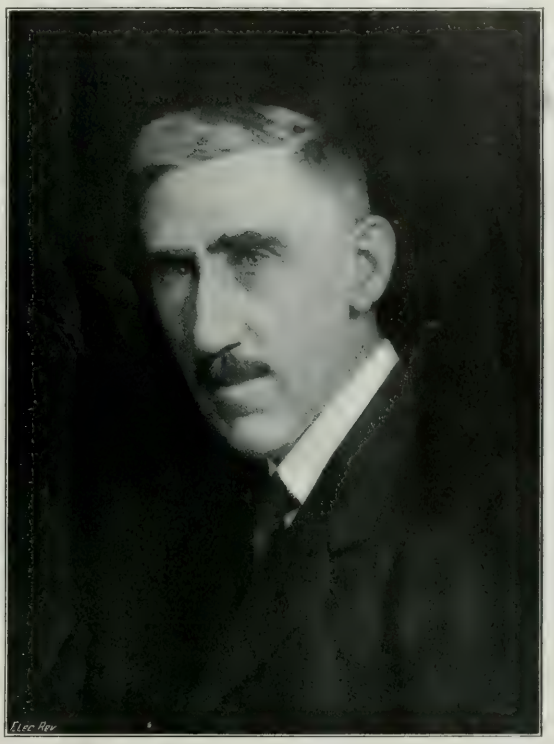


Photo by] [*Elliott & Fry.*

Mr. Frank Gill,
President of the Institution of Electrical Engineers.

In 1903 the position of engineer-in-chief for the National Telephone Company became vacant. The period was a critical one, for it is not too much to say that upon the engineering depended the successful working and the satisfactory conclusion of the company's affairs at the end of their licence in 1911. The general manager, the late Mr. Gaine, selected Mr. Gill as the man who should be his technical adviser and control the engineering side of the company's work. It was during the lifetime of the company that a writer in the *National Telephone Journal* said of Mr. Gill that from the date of his appointment as engineer-in-chief "his individuality and energy began to impress themselves not only on the undertaking of the company, but to an equal degree on the company's staff. He insisted on a more exact method of considering telephone problems than the older generation of telephone men had been wont to make use of, and this exactness has permeated the company's staff to the advantage of company and subscriber alike." Though he has made many useful inventions and novel applications in the art of telephony, he has never approached his problems from the standpoint of the inventor. To this fact his success has been largely due. Individual predilections have been subordinated and an unbiased mind applied to the selection of the best available material for the purpose in view.

Up to the time of the transfer of the service to the Post Office, Mr. Gill remained engineer-in-chief, and was retained by the company to advise in that capacity in the subsequent arbitration and settlement. Only insiders know just how much of the work fell upon Mr. Gill, but it is generally known that his share was large and of the first importance. In the prolonged examination and cross-examination of the arbitration his comprehension of main principles, his grasp of detail, and his fair and clear exposition impressed both friend and foe alike.

When the company's affairs were finally disposed of Mr. Gill founded with Mr. Cook the firm of Gill & Cook, practising as consulting engineers, and in this capacity planned some new systems and investigated many existing systems in various parts of the world. Throughout his career Mr. Gill has made a study of telephone conditions in other countries, and is familiar with those of probably every country in Europe and the principal ones of North and South America, together with the arrangements prevailing for international communications. During the war his energy and organising powers found ample scope in the Ministry of Munitions, his services being recognised by his being made an O.B.E. After the Armistice he took up the important appointment which he now holds of engineer-in-chief to the International Western Electric Co.

Mr. Gill was an Associate of the Institution in 1891, member 1898, and hon. secretary to the Dublin Local Section from 1899 to 1902. He was elected to the Council in 1903, and in 1906 he was elected as vice-president. He was again elected to the Council in 1912 and 1913. He is also a member of the Institution of Civil Engineers, a Fellow of the American Institute of Electrical Engineers, and a member of the Electrical Section of the British Engineering Standards Committee. His contributions to the *Proceedings* of the Institution have been numerous and important, and he has rendered many valuable services, executive and otherwise, to the Institution. Though a telephone man, he is no sectionalist; his interests are wide and his experience of heavy engineering considerable, so that members of the heavier branches of the industry need have no fear that the session under his presidency will be unduly "light." Ernest in his aims, direct in his methods, Mr. Gill may be relied upon to uphold the best traditions of his high office, and to promote the interests of the Institution, the status of the engineer and the progress of the industry in all its branches.

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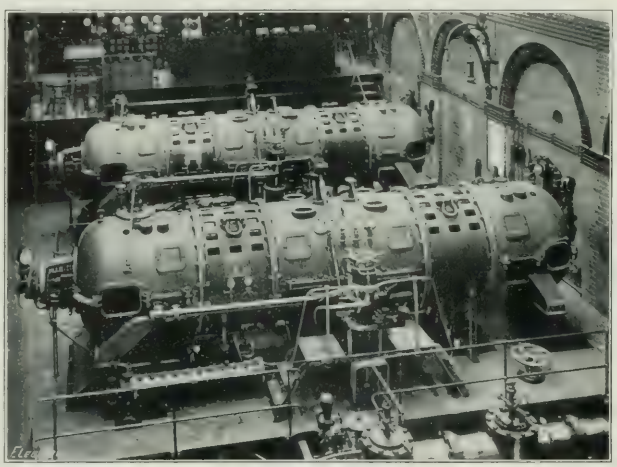
ELECTRICITY SUPPLY AT NELSON.

Inauguration of New Plant.

The Nelson municipal authorities were amongst the first to undertake the provision and supply of electricity. By the Nelson Electric Lighting Order, 1883, the local board secured the necessary powers, but it was not until about 1889 that it was in a position to commence the supply. The initial plant was installed at the gas works, and consisted of a Willans & Robinson (Rugby) G. G. type engine coupled to a 100-kW Holmes (Newcastle) dynamo, electricity being supplied at 110 volts and distributed on a two-wire system. Steam was provided by the gas works boilers, and the supplies of both gas and electricity were combined in one department.

In 1900 a site adjacent to the destructor works was selected in order that the steam generated by the destruction of refuse might be utilised, and also to obtain the necessary space for the provision of a car shed in connection with the tramway undertaking then about to be electrified. On March 12th, 1902, the new plant was inaugurated. It comprised three Willans-Bruce Peebles 200 kW sets, generating at 460-550 volts d.c. In 1903 another 400-kW Willans - Bruce Peebles set was added, raising the total capacity to 1,000 kW. Since that year until the recent extensions no addition had been made to the plant.

The Corporation electricity undertaking supplies the borough of Nelson and the urban district of Barrowford, and affords a supply in bulk to the urban district of Brierfield. During the year ended March 31st, 1922, the total number of kWh sold was 1,521,199 (the traction supply was furnished by Burnley and Colne), the h.p. of the motors connected to the mains being 1,560, and the number of lamps connected 75,841. The generating station is situated on a site adjoining the Leeds and Liverpool Canal, from which water is obtained for condensing purposes.



Brush-Ljungström 3,000-kW Turbo-generators at Nelson.

At a meeting of engineers before the Chief Electricity Commissioner, Sir John Snell, in London, at which Mr. R. Blackmore, of Stalybridge, together with Mr. G. F. Nayler, engineer and general manager, represented Nelson, sanction was obtained for the Corporation to install additional plant in its existing buildings. The scheme approved by the Council included two 3,000-kW, 6,600-volt, 3-phase, 50-period standard Brush-Ljungström sets, each of which is designed to work at a steam pressure of 200 lb. per sq. in. at the turbine stop valve (the steam being superheated 262 deg. F.), exhausting into a vacuum of 28½ in. of mercury [illegible]. Each turbine is coupled direct to [illegible] alternators having a combined output of 3,000 kW at a power factor of 0.8, and wound for 6,600 volts, 50 cycles. The exciter is coupled direct to one of the alternators, and the regulation of the set is affected solely by regulation of the exciter field, for which purpose a finely graded regulator is fixed on the switchboard. The combined set runs at 3,000 r.p.m., and is capable of carrying an overload of 25 per cent. for two hours.

Each turbo-alternator set is mounted on a Brush surface condenser, which is the standard method adopted for this plant. The whole of the weight of the turbo-alternator is thus carried by the condenser, resulting in a great saving of foundation work. Each condenser has a cooling surface of 5,200 sq. ft., and is capable of dealing with 32,420 lb. of exhaust steam per hour, with circulating water at a temperature of 70 deg. F. The condenser tubes are 12 ft. 9 in. in length and ¾ in. in diameter. Each condenser has 2,115 tubes, and is provided with a three-throw Edwards air pump, 17 in. by 12 in., running at 120 r.p.m. and driven by a Brush standard d.c. 18-h.p. motor through gearing.

A hotwell pump is provided, driven off the air-pump crankshaft, for lifting the condensate to the hotwell, whence it returns to the boilers. The circulating pump is by Messrs. Drysdale & Co., and is capable of delivering 4,800 gallons per minute against a total head of 25 ft. when running at 720 r.p.m. The pump is driven by a 55-h.p. standard Brush motor, to which it is coupled direct. The motor is controlled by an Ellison oil - immersed rotor starter and stator circuit-breaker of the floor mounting type.

For filtering the air to the alternators, a Davidson wet air filter is provided of the spray type.

The rotary converting plant for the supply of the direct current through the present supply mains, together with h.p. and direct switches for the generators, rotary converters, &c., is the work of the Metropolitan-Vickers Electrical Co., Ltd. It comprises a control desk in the generating room, e.h.p. switch cubicles in a room some 40 yards away, which contain 6,600-volt oil switches, and three rotary converters of 500 kW each for use in connection with both lighting and traction supplies.

In the boiler house, three water-tube boilers with chain grate stokers have been provided. Each boiler has an evaporative capacity of 25,000 lb. of water per hour, and is complete with superheater; economisers by Messrs. E. Green & Sons are fitted to all the boilers. A steel chimney 100 ft. high by 8 ft. 6 in. in diameter, induced draught fan and electric motor, with galleries, dampers, valves and ash hoppers complete the boiler-house installation, all of which has been carried out by Messrs. Babcock & Wilcox, Ltd. The circulating water and steam piping has been installed by the Superheating Units, Ltd. The boiler feed pumps of 75,000 lb. hourly capacity each have been supplied by Messrs. J. & G. Weir, Ltd., and installed by the Nelson Corporation staff, who have also been responsible for the whole of the wiring.

The supply and laying of the h.p. and l.p. cable and ducts have been carried out by W. T. Henley's Telegraph Works Co., Ltd.

On October 12th the plant was inaugurated by Ald. W. F. Cooke, chairman of the Electricity Committee, in the presence of a large gathering of members of the Town Council, Corporation officials, and representatives from neighbouring authorities.

The Mayor (Councillor R. W. Gibson) presided, and explained that Nelson would now be able to provide electricity not only for the town's use, but for neighbouring authorities in addition. He acknowledged the debt they owed to Colne and Burnley for their assistance during the trouble they had had with their old electrical plant.

Ald. Cooke reminded the visitors that in the weaving establishment of Messrs. J. Nelson & Sons they had the largest weaving shed in the world, which, he added, was driven by electricity.

Major Coulson (Brush Electrical Engineering Co., Ltd.), on behalf of the contractors, presented to Ald. Cooke a silver salver to mark their pleasant association during the extension of the electrical undertaking.

THE CANNOCK U.D.C. ELECTRICITY UNDERTAKING.

An Interesting Bulk Supply Scheme.

The inauguration of electricity supply within the Cannock Urban District Council's area, the official ceremony in connection with which took place on the 18th inst., will have an important influence on the future progress and development of the district generally. The Cannock Council secured the necessary powers as far back as 1901, but not until two or three years ago did it appoint Messrs. Arthur Ellis & Partners, of Cardiff, as its consulting engineers to advise generally with regard to the scheme.

The total estimated cost of the scheme was £82,572, and in connection with the first section of it the Council made application to the Electricity Commissioners for a loan sanction of £36,753. Of this amount the Commissioners sanctioned the borrowing of £27,000 on account, subject to further loans that may be required.

The Cannock area of supply is situated in the North-West Midlands Electricity District, and it represents a very important part of the larger district. The Electricity Commissioners have accordingly sanctioned an agreement under which Wolverhampton Corporation supplies Cannock in bulk upon terms which will permit it to distribute from the sub-station at Queen Street at rates which are considered to be most reasonable.

The power transmitted will be the usual 3-phase, a.c. at 30,000/33,000 volts. This will be controlled from the Queen Street sub-station, at which the voltage is reduced to 6,600 volts for distribution by means of high-pressure cables laid within the district to meet the requirements of collieries and industrial works, whilst arrangements are also being made whereby (by means of transformers) the pressure is reduced to 400 and 230 volts for purposes of distribution upon a 4-wire, 3-phase system for private consumers.

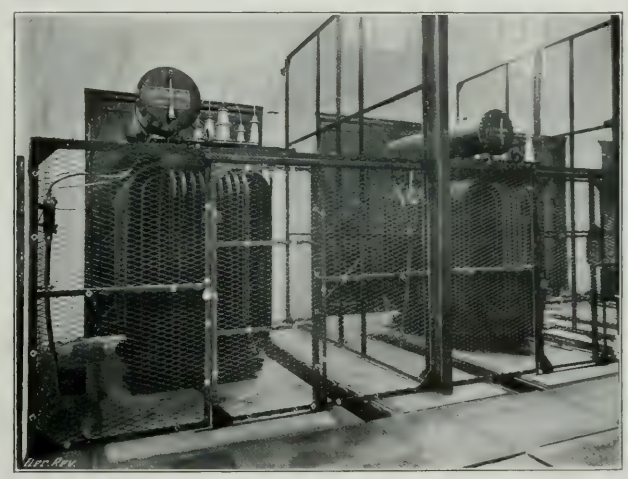


Fig. 1.—Ferranti 1,250-kVA 33,000/6,600-V Transformers.

Whilst it is anticipated that in the very near future there will be a demand of something like 5,000 kVA, it is interesting to note that it has been computed that there is a potential load within the Cannock area of something like 15,000 kVA. Already the Council has secured two important consumers in the West Cannock Colliery Co., Ltd., and the Cannock and Rugeley Colliery Co., Ltd. Supply to the first-named was given on September 22nd last, whilst the Council intends proceeding with the work necessary to afford a similar supply to the Cannock and Rugeley Colliery.

The provision of supply in bulk from the Wolverhampton Corporation has necessitated the laying of about 9½ miles of e.h.p. cable from the electricity works at Wolverhampton to the sub-station at Queen Street. The cable is looped in and out of the Holly Bank Co.'s new Hilton Pit, which is to be totally electrically driven, and is about 4½ miles from Wolverhampton. (A 6-mile, 33,000-volt, 0.2 sq. in. cable, with Merz-Beard pilot protection also delivers a bulk supply at the Ocker Hill station of the Midland Electric Corporation for Power Distribution, Ltd.)

The main transmission cable is a 0.2 sq. in. 3-core cable paper-insulated, lead-covered, and steel-armoured, laid direct in the ground. It is protected by means of a pilot cable designed to work on the Merz-Beard compensated system, the pilot cable comprising also conductors for use in connection with a telephone system which will ensure direct communication between the Wolverhampton Corporation's generating station and the various sub-stations.

The scheme provides for a 6,600-volt ring main right round the district. This ring will ultimately be supplied direct from the sub-station by feeders running radially from the main sub-station to various sub-stations along the ring, so that ultimately certain local sub-stations may be supplied from three directions and the remainder from two directions, and in such a way as to secure continuity of supply.

At present the equipment of the main sub-station comprises four 33,000-volt cubicles and operating panels, one of which is the incoming feeder panel belonging to the Wolverhampton Corporation, controlling the main bulk supply, a metering panel of joint ownership, and two transformer panels for controlling the supplies to the two transformers, which are protected on the G.E.C. biased system (McColl patents).

The 6,600-volt supply is obtained by means of two

1,250-kVA transformers connected in "mesh" on the 33,000-volt side and "star" on the 6,600-volt side, the neutral point being earthed. Two transformers, each of 125-kVA capacity, are used for the purpose of further reducing the pressure to 400 and 230 volts for distribution within Cannock town itself.

The whole of the main sub-station equipment has

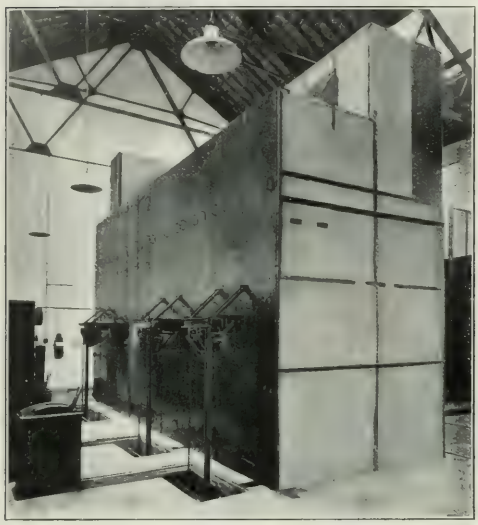


Fig. 2.—Stonework 33,000-V Switchgear Cubicles.

been supplied and erected by the General Electric Co., Ltd., the transformers (fig. 1) having been manufactured by Messrs. Ferranti, Ltd., as sub-contractors. The 33,000-volt, 6,600-volt, and 400-volt mains have

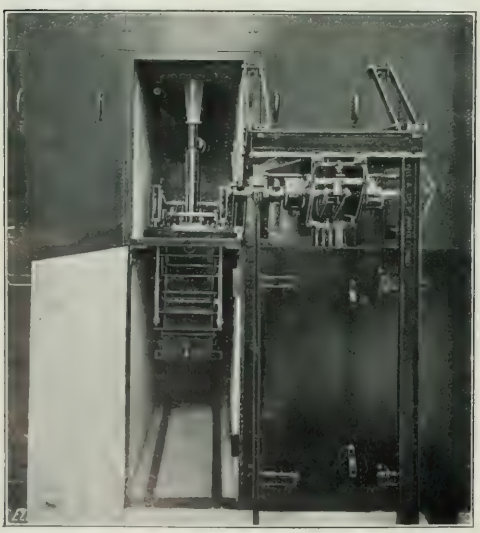


Fig. 3.—G.E.C. Oil Switch.

been supplied and laid by the British Insulated and Helsby Cables, Ltd.

The switchgear was manufactured at the G.E.C. works at Witton; the 33,000-volt stonework cubicles (fig. 2) are built upon iron framework, each unit being separated from the next by moulded stonework slabs, with sheet-steel doors at the back and front. Each cubicle is sub-divided by stonework slabs into separate cells in order to secure safety. The bus-bars each occupy a separate cell, while isolating links are in another division, and each oil-switch tank has an independent compartment. The porcelain insulators between the compartments are so designed as to prevent any fumes generated in the oil-switch compartment passing to any other compartment. Each phase of the oil switch is in a separate tank.

The oil switches (fig. 3) have a maximum breaking capacity of 350,000 kVA, the total break per phase is 12 in.; the head of oil above the contacts is 11 in.; the

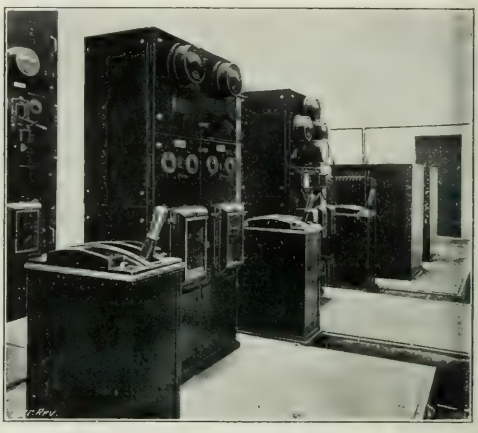


Fig. 4.—G.E.C. Oil-Switch Control Gear.

volume of oil, 66 gallons. The control of the switches is by signal levers and suitable bell-crank mechanism which, together with the instrument panels, are shown in fig. 4. The tanks are of welded steel and lined with 3-ply birch—a non-resinous wood, which is absolutely essential, as otherwise the resin collects upon the contacts and may prevent their opening. A speed of break of the contacts of 5 ft. per second has been obtained. When opening under conditions of short circuit the magnetic blow-out effect of

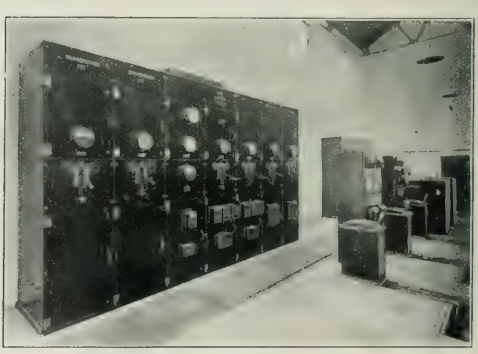


Fig. 5.—The 6,600-V Switchboard.

the current increases the speed above this figure. The moving parts of the switch are naturally rather heavy, and an air dash-pot is provided so that no damage can be caused by the switch mechanism being suddenly closed.

Some details of the G.E.C. biased system of protection, as applied to transformers, should be mentioned. Protection against faults of any kind, including leaks to earth, between phases, and even between turns of the same phase, is said to be provided by this system. The main underlying principle is based on a comparison

of the currents that enter and leave the various windings; but by the special refinement introduced in accordance with the McColl patent, it is possible to employ, it is claimed, unusually sensitive settings for the relays to avoid the danger of instability upon overloads and to remove the necessity for very exact, and therefore delicate and expensive, apparatus.

If all is in order in the transformer, the entering and leaving currents are in constant proportion, the current ratio obviously being modified by a leak. Current transformers at either end of the windings supply proportionate currents to the relays, which open the circuit breakers when a derangement occurs.

The special feature of this system consists of restraining the action of the relays by a coil excited in proportion to the load current. Thus, the fault setting increases with the load, and can be safely made sufficiently sensitive to act in response to a small leak without introducing the likelihood of improper tripping when a heavy overload increases all the currents in the circuits, and may easily swamp a moderate, but constant, setting. The importance of this is due to the fact that the great majority of transformer faults originate as small leaks between adjacent turns, which

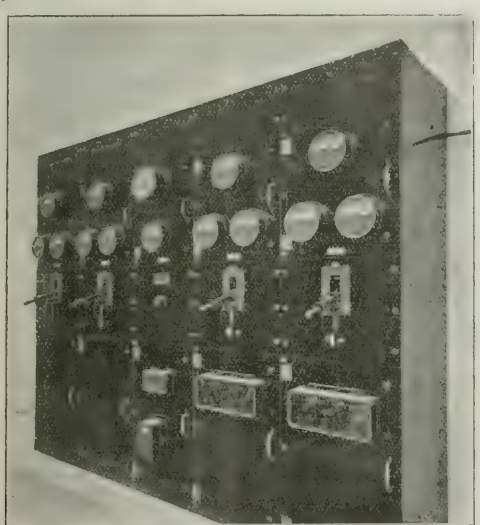


Fig. 6.—The 400-V Switchboard.

ordinarily have to continue burning the insulation until the damage is sufficient to trip the less sensitive relays.

Overload protection may also be afforded by the McColl relays, this practice being adopted in the case of the gear at Cannock. The relays are shown on the front of the operating board in fig. 4.

The 6,600-volt and 400-volt switchgear is enclosed in sheet-steel cubicles, and the respective boards are illustrated in figs. 5 and 6. Interlocking arrangements render it impossible for the isolating links to be opened until the oil switch is in the "off" position.

In addition to the sub-station at Queen Street, Cannock, an important sub-station has been provided by the West Cannock Colliery Co. at its premises at Hednesford, to which the Council has already laid the main. This sub-station will control the distribution of the supply throughout the colliery premises for different purposes. The Cannock Council has installed in this sub-station switchgear supplied and erected by Messrs. Reyrolle & Co. to the specifications of the Council's consulting engineers, whilst the Colliery Co. has, in turn, provided somewhat similar switchgear as well as transformers for reducing the 6,600-volt supply to the pressure necessary for its own purposes, all of which has been carried out to the designs and specifications of the company's consulting engineers (Messrs. Walter Dixon & Co., of Glasgow).

The main 6,600-volt cable between the Council's sub-station at Queen Street and the sub-station at the colliery premises consists of three split-conductors each of 0.10 sq. in. sectional area. This, again, is a paper-insulated cable, lead-covered, wire-armoured, and laid direct in the ground with suitable protection.

It is estimated that in the immediate future at the West Cannock Colliery alone there will be a demand of something like 800 kVA, whilst the requirements of the Cannock and Rugeley Colliery Co. will very substantially add to this demand, so that almost from its inception the undertaking attains considerable importance, apart from the supplies to other consumers at Cannock, including public lighting.

The demand for electricity for private lighting purposes has already been such as to justify the Council's decision to carry out an extension of mains along the New Penkridge Road.

Further powers from the Electricity Commissioners are being applied for, and, if granted, they will enable the Council to extend the use of electricity over a much larger area, the proposed additional area of supply embracing such districts as Cheslyn Hay, Great Wyrley, Huntington, Penkridge, Hatherton, Brereton, Rugeley, and a small part of Brownhills. The area of supply administered by the Cannock Council as at present defined has a length from east to west of about six miles and a breadth from north to south of about three miles, but this, if the extension order is granted, will be increased in length to approximately 10 miles.

FORTHCOMING EVENTS.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 28th. At the Hotel Cecil, Strand, W.C. At 5.30 p.m. for 6 p.m. Fourth annual dinner.

Paisley Association of Electrical Engineers.—Tuesday, October 31st. At the Palace Tea Rooms. At 7.30 p.m. Paper on "Practical Dynamic and Static Balancing of Machinery," by Mr. F. G. O'Hagan.

Institution of Railway Signal Engineers.—Wednesday, November 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5 p.m. Resumed discussion on Mr. Lascelles' paper on "Weissenbruch's Signal System on the Belgian State Railways."

Institution of Electrical Engineers.—Thursday, November 2nd. At the Institution of Electrical Engineers, Victoria Embankment. At 6 p.m. Inaugural address by the president (Mr. F. Gill).

(South-Midland Centre).—Students' Section.—Monday, October 30th. At Birmingham. Paper on "Energy Meters Used on a.c. Systems," by Mr. L. B. Francis.

(East Midland Sub-Centre). Tuesday, October 31st. At the Derby Technical College. At 7 p.m. Paper on "Electricity in Small Houses," by Mr. J. W. Beauchamp.

Chelmsford Engineering Society.—Thursday, November 2nd. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Effect of Heat Treatment on the Macrostructure of Steel," by Mr. J. G. Widdowson.

Chemical Society. Thursday, November 2nd. At Burlington House. At 8 p.m. Ordinary scientific meeting.

Warrington Electrical Exhibition.—November 2nd to November 11th. At the Empire Hall.

International Motor Exhibition. At Olympia, W., and White City, Shepherd's Bush, W. November 2nd to November 11th.

British Electrical Development Association.—Salesmanship Conference. Friday, November 3rd. At Caxton Hall, S.W. At 7.30 p.m. Paper on "Fires and Cookers (Design)," by F. H. Howell.

Junior Institution of Engineers.—Friday, November 3rd. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Laminated Springs," by Mr. T. H. Saunders.

Finsbury Technical College Old Students' Association. Saturday, November 4th. At the Engineers' Club, London. Annual dinner.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:—

Wade's electrically-driven saw.
Robson lamplocks.

NOTES.

Ljungström's Steam Turbine Locomotive.—*Svenska Dagbladet* states that the Ljungström steam locomotive has now been equipped with a new device for increasing the capacity of the condensers, &c., so that the locomotive is capable of taking steeper gradients than hitherto and is able even to develop greater power than any corresponding express locomotive driven by a piston engine.—*Reuter's Trade Service* (Stockholm).

Service Notes.—It is officially stated that officers and other ranks of the Regular Army, Militia, Territorial Army, or Officers' Training Corps who wish to install private wireless sets for sending or receiving messages, are subject in all respects to the Postmaster-General's regulations governing the installation and working of such sets. They should apply in their private capacities for transmitting or receiving licences to the General Post Office, which will treat their applications on the same lines as those received from members of the public generally. The War Office accepts no responsibility for wireless sets other than those held on the authorised establishment of units.—*The Times.*

Italian State Services Condemned.—A correspondent of *The Times* says that representatives of the most important industrial concerns of Italy held a meeting on October 17th, at which a large number of Senators and Deputies were present. After a lively discussion the meeting passed a resolution to the effect that all the public services, such as the railways, posts and telegraphs, &c., now in the hands of the State should be handed over to private enterprise. This, it was said, would greatly improve the various services, and at the same time relieve the State of the burden of the losses which were being incurred.

Lecture.—On October 19th, at the Hackney Town Hall, Mr. L. L. Robinson, the borough electrical engineer, delivered a lecture on "Hackney Electricity" to a female audience. The lecture was followed by a demonstration of electric cooking.

Electric Steering Gear.—At a meeting of the Council of the Yacht Racing Association, the opinion was expressed that Mr. R. H. Lee's action in fitting electric steering gear to his large cutter *Terpsichore* was contrary to the spirit of the Association's rules.

Wave Transmission.—On Monday last the claim of Messrs. Walter Haddon and G. Constantinesco for the use during the war of the C.C. interrupter gear for firing bullets between the revolving propeller blades of aeroplanes was brought before the Royal Commission on Awards to Inventors. Over 30,000 of these gears were made by Messrs. Dormans, of Stafford, during the war. The system affords a convenient means of utilising electrical motive power for actuating rock drills.

The Statistical Man.—(There is an opinion prevailing among technical staffs that the function of accountancy departments is to involve the former in as much arithmetical complication with regard to emoluments as is humanly possible.)

From an age quite embryonic,
I've developed quite a chronic
Inclination for statistics
With regard to £ s d.
And I don't mind the admission
That my present high position
Is due to my ambition
To promote economy
So I warble each day,
In my whimsical way,
As I whittle and wangle and plan;
Oh, I'm a statistical,
Really tight-fistical,
Mystical, twistical man.
I've a way of calculating,
That's extremely complicating,
To the unsophisticated,
Ever-trusting employé.
I'm a sphinx who stands alone as
The man who bear the onus
Of jumbling up the bonus
With the basic salaree.
So I chuckle and say,
In my humorous way,
When I give them my statements to scan,
Oh, I'm a statistical,
[illegible]
Mystical, twistical man.

ANON.

Miners' Lamps.—In the "Safety Lamps Order" of September 21st, 1922 (H.M. Stationery Office, 9d. net), a number of miners' electric lamps are approved for general use, including the "E.K.," "Lemaire," "[illegible]," "Cowl," and "Davis-Derby" types. Several patterns are approved for special purposes, and amendments to previous orders appear. An appendix contains lists of lamps approved to date, with amendments.

Educational.—Wireless in London Schools.—The London Elementary Education Sub-Committee recommends the inclusion of wireless telegraphy in the curriculum of an approved number of elementary schools. The Sub-Committee reports that applications have been received from certain schools for sanction to include the principles of wireless telegraphy in the curricula and to obtain a licence from the Postmaster-General for the installation of the equipment. The equipment, it is stated, is made by the boys in their handicraft lessons. So far permission has been given by the Sub-Committee to thirteen schools, and it has made a limit of twenty-five schools. *The Times.*

R.N.D. Engineers' Dinner.—The fourth annual dinner of the Royal Naval Division, Engineers, Signal Company, will be held at the Engineers' Club on November 18th at 6.30 for 7 o'clock. Mr. G. W. Hilditch will occupy the chair. Morning dress will be worn. Tickets, 10s. 6d. each, may be had from Mr. J. N. Robertson, 20, Manor Court Road, Hanwell, W.

The Jeffrey Battery Locomotive.—An interesting design of "arc-proof" battery locomotive that has been approved by the U.S. Bureau of Mines for operation in gaseous mines is described in the *Electric Vehicle*. A distinctive feature of the Jeffrey locomotive is the swinging or pivoted battery box, which can be swung through 90 deg. When the battery is swung round to this position the motors, which are overhung outside of the wheel base, are accessible for inspection. Another advantage of this construction is that it makes it necessary to disconnect the battery from the locomotive wiring in order to swing it. When such a locomotive is put on charge after the battery box is swung round, the electrical equipment in the locomotive has no connection with the battery; in other words, the battery can be put on charge without risk of any connection being made with the locomotive wiring. This permits the locomotive and its electrical parts to be inspected and repaired while the battery is being charged, and is a valuable safety device. The switch box compartment, containing an ampere-hour meter and charging plug (in normal operation there is no arc formed in this compartment), is constructed just to give mechanical protection to the electrical parts. This cover is locked with a padlock when the locomotive is sent out on the road. On the side of the switch box is a compartment in which renewable fuses are mounted. The main switch handle, which projects through the middle compartment, must be moved down and out of the way before the fuse box compartment can be opened. When this locomotive is out on the road and blows a fuse, the motorman can renew the fuse only after he has opened the main-line switch, disconnecting the battery completely from all of the electrical equipment, not only in the switch box, but from the locomotive proper. All electrical parts inside the switch box are dead when the main-line switch is open. It is not possible for a man to touch any live part, or in any way cause an arc to be formed while the fuse box lid is open. The British agents for this locomotive are Messrs. Hugh Wood and Co., Ltd.

New French Electric Vehicles.—At the annual Paris motor show, which opened on October 5th in the Grand Palais, Champs-Elysées, and in the annexe on the Esplanade des Invalides, a new 5-ton electric motor lorry was displayed by Messrs. Laporte, Fils & Cie., of Toulouse. A battery of Tudor accumulators supplies two 7½-h.p. electric motors which drive the rear road wheels through reduction and internal gearing. It is stated that the municipal authorities of Toulouse have half a dozen Laporte machines in operation for dust collection purposes.

A feature of the commercial vehicle section of the show was a railless trolley motor 'bus, constructed by the firm of Henri Crochat; it forms one of a number which has been built for service between the town of Modane and the village of Lanslebourg, near the summit of the Mont Cenis Pass, a distance of about twenty miles. The vehicles are of the single-deck type and have seating accommodation for twenty-five passengers.

The Electrical Trades Benevolent Institution.—The annual festival of this Institution, which had been fixed for November 15th, has had to be postponed owing to the choice of that day for the General Election; it will therefore be held on Wednesday, November 29th, at the Trocadero Restaurant, London, W., at 7.30 p.m. Sir James Kemnal will preside, and ladies will be present.

The objects of this admirable Institution, of which the president is Sir David Salomons, Bart., M.I.E.E., and the hon. secretary is Mr. F. B. O. Hawes, A.M.Inst.C.E., M.I.E.E., are: "To grant pensions and to dispense temporary relief to deserving and necessitous persons who are or have been engaged in the electrical trade in the United Kingdom, as employers, managers, teachers, or on the engineering, designing, drawing, sales, or office staff, or in any other similar capacities, or to their dependents."

The purpose of the Festival is to make a special collection in aid of the funds, which remain far below the level that they should attain, in view of the importance of the industry and the needs of its necessitous members. The persons aided by the Institution are not entitled to assistance from other sources, and whilst it has been possible up to the present temporarily to relieve all urgent cases, mainly out of the small subscriptions of the enrolled members, the interest on invested

funds is far from sufficient to provide pensions for those who are incapacitated for further work, or for their dependents. It is hoped, therefore, that in spite of the hard times there will be a generous response to the appeal of Sir James and the committee in connection with the Festival.

Large Incandescent Lamps.—What are claimed to be the largest incandescent lamps ever made are produced in the U.S.A. and are intended for the illumination of motion picture studios. The lamps are over 2 ft. in height and of 30-kW power at a pressure of 220 volts; they are rated at 100,000 c.p.

Appointments Vacant.—Chief engineer (£1,852 + bonus), for the Sudan Government Posts and Telegraphs Department; combustion engineer (£600), for the Victorian Electricity Commission; charge engineer, for the Southend Corporation Electricity Department. (See our advertisement pages to-day.)

Ship's Electric Laundry.—A fully-equipped electric laundry is one of the outstanding features of the new Cunard liner *Franconia*, which was launched on October 21st from the yard of Messrs. John Brown & Co., Ltd., Clydebank, Glasgow.

Water Power and Austria's Recovery.—H.M. Commercial Secretary at Vienna (Mr. O. S. Phillpotts) takes a more hopeful view of the possibility of Austria's economic recovery than is generally accepted. In his report to July this year, which has been issued by the Department of Overseas Trade, he states that Vienna has made further progress during the past twelve months in maintaining her pre-eminence in the foreign trade and in the finance of that part of Europe, that the general trade of the country has improved and that on the whole Austrian industries have been working at 60 per cent. of their capacity.

Of German penetration the most notable instance is the purchase by Herr Stinnes of a large interest in the Alpine Montan Co. The loss on the Government munition works, which are now producing other goods, afforded an opportunity to the German A.E.G. to take over the largest, viz., the Woellersdorf works, on a fifty years' lease.

With regard to possible hydro-electric developments, the report points out that the exploitation of the ample unused water power in the Alpine districts and in the Danube has from the beginning been recognised as an obvious method of improving the economic condition of Austria, since the trade-balance is weighted by the necessity of importing so much coal and oil from abroad. The water-power actually harnessed by the end of 1920 amounted to 170,000 h.p., less than 10 per cent. of the total available, while Switzerland had over 22 per cent. in use.

At first, after the war, there was a tendency to delay work until foreign capital could be found, as it was expected that the crown would some day improve in value, and that the Austrian capital invested when the crown was low would then never be able to earn dividends. As, however, the crown has steadily fallen and all endeavours to attract foreign capital have hitherto proved unsuccessful (with the exception of a small participation of German and Swiss money in the Tyrol) the various provincial governments have now founded Austrian companies, part of the capital being raised by the authorities, part by the banks, and part by the public, and construction has been started on a number of important works. In view of the continued depreciation of the currency, it is doubtful whether enough funds can be raised in the country to complete the more ambitious schemes that have been commenced, and the exploitation of the Danube water-power has been postponed for the present.

According to published statistics, 24 large works which, when completed, would yield 99,400 h.p. were under construction in 1921, and some others, such as the Lower Austrian and Styrian provincial schemes have been commenced since the end of the year. The 99,400 h.p. includes the federal railway works for the electrification of the lines in Vorarlberg, the Tyrol and Salburg, the provinces furthest from coal supplies. It is hoped to complete these in five years, but the electric traffic on parts may be started in 1923 and 1924. The cost of construction for the railway electrification is proving very many times greater (in crowns) than the original estimates, and like most other government expenditure, is being paid for practically by the printing of banknotes. The electrical engineering and locomotive industries, which are well developed in Austria, have received large orders in connection with the various waterpower schemes.

The Professional Classes Aid Council.—The report of this body for 1921-22 shows that applications for help were made by 626 persons; 66 of these received financial assistance and 296 were advised. The accounts show an income of £7,749, and a sum of £5,443 expended in relief.

Spain's Hydro-electric Power.—Recent hydro-electric developments in Spain are detailed in a report which the United States Commercial Attaché in Madrid has made to Washington. The important new installations may be divided into two groups, one lying in the province of Lerida and Gerona and aggregating 146,500 horse-power, the other centreing at the falls of Dos Aguas and of the Cinca in the Aragonese Pyrenees.

An estimated total of 300,000 horse-power of hydro-electric installations was under way in Spain at the beginning of 1921, of which the plant of the Riegos y Fuerzas del Ebro at Camarasa Falls, Lerida was finished during the year. Power from both of these groups is transmitted to Barcelona at 110,000 volts. At the beginning of this year the available electric resources of Spain in actual exploitation were estimated at from 500,000 to 600,000 h.p. [illegible] the Commercial Attaché, is only about one-tenth of the potential energy possible of development.

As the consumption of electrical energy increases in the capital and other large cities in Spain through the extension of electric lighting and railway electrification, and the use of electricity in manufacturing [illegible] and more in evidence. At the same time the power is developing better traction facilities.

It cannot be said that the Spanish Government has adopted a favourable attitude towards the [illegible] which are urgently needed and would help the economic progress of the country. By a [illegible] year, concessions for the exploitation of hydro-electric power will be granted for 75 years, at the end of which time all the works, machinery, transportation lines, and the like, will revert to the State. Protests against this regulation have been made by the electrical enterprises, the chambers of commerce and industry, by foreign embassies, and by many other groups throughout the country, and it is hoped that the legislation will be modified.

Other legislation which has been contrary to the interests of the development of these national industries has been the raising of import tariffs on machinery, material, and accessories, which are necessary for these electrical enterprises and are not produced in Spain. All these factors will undoubtedly retard the exploitation of Spain's hydro-electric resources.

Manchester Electro-Harmonic Society.—The opening concert of the season was held at the Albion Hotel, Manchester, on Friday last, when, owing to the indisposition of the president, Mr. J. A. Robertson, M.I.E.E., the chair was taken by Major E. J. Hogan, a member of the Executive of the Electro-Harmonic Society of London, who opened the proceedings felicitously, and conveyed fraternal greetings and congratulations from London to the Manchester Society. The Society holds its concerts on the third Friday of each month, and extends a cordial invitation to visitors who may be in Manchester. The musical direction of the concerts is in the efficient hands of Mr. W. J. Smith, of Jackson's Row, Manchester.

United States Electric Vehicle Market.—The demand for electric trucks during September was reported to be fairly good. An order for 30 trucks was recently placed by a Brooklyn bakery. The recent increase in the number of inquiries received by manufacturers is regarded as an indication that the advantages of electric vehicles for local service are becoming more generally known. The Steinmetz Electric Motor Car Corporation, which only began business a few months ago, sold 60 electric cars in the New York district during August. This company is experimenting with a 5-passenger electric car of a new type, which will be sold for 1,000 dollars. The car is now being tested and, in this connection, one of the company's engineers is now in England investigating the merits of a new type of battery which is said to be far in advance of anything now on the market. The annual electric show was opened in New York on October 7th. Owners of 200 electric trucks announced their intention of being represented in the parade, which is regarded by the industry as an excellent opportunity to show the increasing popularity of electric vehicles in the various lines of industrial activity. Electric motor truck dealers are offering a prize of 1,000 dollars for an advertising slogan to be used in future electric vehicle publicity campaigns. Twenty-nine electric trucks and passenger cars, valued at 35,954 dollars, were exported from the United States in July.—*Reuter's Trade Service* (New York).

INSTITUTION NOTES.

Institution of Electrical Engineers.—Ordinary Meetings.—According to present arrangements, the following are the details of ordinary meetings for the new session:—November 2nd, Presidential Address, Mr. F. Gill; November 16th, "The Improvement of Power Factor," by the late Dr. G. Kapp (to be read by Prof. M. Walker); November 30th, "Domestic Load Building," by Mr. W. A. Gillett; December 7th, "The Possibilities of Transmission by Underground Cables at 100,000/150,000 Volts," by Mr. A. M. Taylor; December 14th, "Electric Arc Welding Apparatus and Equipment," by Mr. J. Caldwell; January 4th, 1923, "Variable-speed a.c. Motors without Commutators," by Mr. F. Creedy; January 18th, "Works Production," by Mr. G. H. Nesom; [illegible] 6th, Annual Dinner; the next six meetings [illegible] May 10th, Fourteenth Kelvin Lecture, by Dr. J. A. Fleming, F.R.S.; May 31st, Annual General Meeting.

Wireless Section.—The following meeeting has been arranged:—November 8th, "The Effect of Local Conditions on Radio Direction finding Installations," by Messrs. E. L. Smith-

Rose, M.Sc., and R. H. Barfield, B.Sc. There will be seven other meetings, details of which will be announced later.

Informal Meetings.—The informal discussions will be as follows:—November 6th, "The Importance of Commercial Knowledge to the Engineer," opened by the President; November 20th, "Electric Light Wiring" (Mr. E. J. Pearce). December 11th, "An Electrical Installation at a Model Farm" (Mr. F. A. Sparks). December 18th, "Time Switches" (Mr. E. C. Shute). January 8th, 1923, "The Protection of Inventions by Letters Patent" (Mr. E. W. Moss); "Insulators and Insulating Materials" (Mr. A. G. Warren); February 26th, Students' Concert. There are to be five other meetings, details of which will be announced later.

Institution of Production Engineers.—The first meeting of the session was held at the Royal Automobile Club on October 20th, when the president, Mr. Max R. Lawrence, M.I.Mech.E., delivered his address, which took the form of a review of the Institution's work and future aims. He made a number of suggestions for furthering the Institution's objects and increasing its membership, as, for instance, the establishment of provincial branches, the inclusion of costs and selling prices within its purview, and maintaining an atmosphere of informality at its meetings.

Institution of Rubber Industry.—At a meeting of the Manchester Section of the Institution on October 16th, a paper entitled "Symbolic Rubber" was read by Mr. D. F. L. Zorn, chairman of the Rubber Shareholders' Association. The paper was described as "Some Philosophic Questions Reviewed in the Light of Modern Knowledge."

Chelmsford Engineering Society.—On October 12th, at the East Anglian Institute of Agriculture, Mr. Borlase Matthews gave an illustrated lecture on "Electricity Applied to Agriculture." Various types of electrical ploughing machinery were explained, also methods of making hay from stacks of wet grass by electrically blowing air through them. The electroculture of crops by the "corona" effect from overhead wires was explained, and it was claimed that this method resulted in a 10 per cent. increase. It was shown that chaff cutting, sheep shearing, milking, butter making, and in fact any operation requiring a rotary motion, could very conveniently be carried out by means of electricity. Poultry rearing also provided opportunities for the use of electricity.

On October 18th a paper was read on "Payment by Results," by Mr. J. E. Powell, who said that no system of payment by results should be adopted unless it ensured industrial content as well as commercial success. Old piece-work systems failed generally through the cutting of rates. Usually this was necessary, because the piece-work rates were fixed on the old time basis. The time allowed for a job was vitally important. If an hour was allowed for a job which should take 54 minutes, an increase of 10 per cent. in the cost of labour was the result. A discussion followed, after which Mr. Powell answered the questions raised.

Edinburgh Electrical Society.—On October 21st the Society visited the works of Messrs. Brunton at Musselburgh. The members were received by Mr. Adam and other gentlemen of the staff and conducted through the various departments. After inspecting the wire-drawing, the steel rope works, and the galvanising rooms, the members assembled in the power-house, where Mr. J. Walker gave a short descriptive address. The extensive new laboratories were next visited, and demonstrations of tensile and fatigue testing were given.

Institute of Transport.—At a meeting held on September 13th, a number of railway and tramway officials, as well as others connected in various ways with transportation, were admitted to the various grades of membership.

South African Institute of Electrical Engineers.—The gold medal of the Institute for the year 1921 has been awarded to Mr. Bernard Sankey for his paper on "Reinforced Concrete Poles for Overhead Line and Traction Work."

OUR PERSONAL COLUMN.

For [illegible] Electrical engineers, whether connected with the [illegible] or the commercial side of the profession and [illegible] electric, tramway and railway officials, to [illegible] The Electrical Review posted as to their movements.

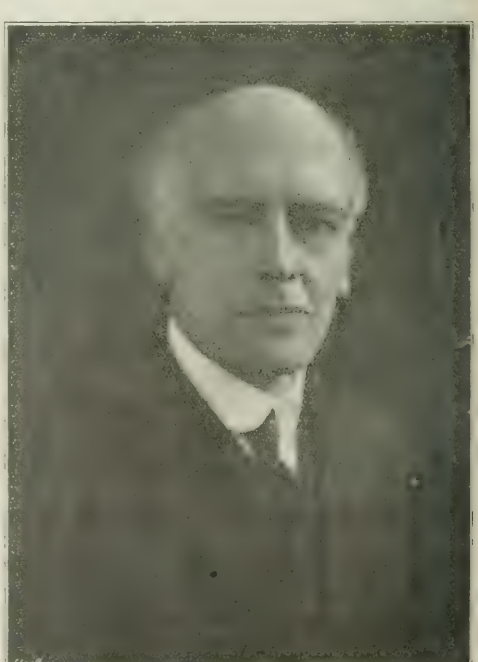
Mr. A. [illegible] has resigned the post of honorary secretary of the North-Western Centre of the Institution of Electrical Engineers, and Mr. A. B. Mallinson, of Worsley Street, Salford, has succeeded him.

Mr. A. H. Banks, late chief assistant to the town clerk of Manchester, has been appointed clerk to the South-East Lancashire Electricity [illegible] board at a salary of £800 rising by annual increments to £1,000 per annum. Mr. Banks has for some three years acted for the electricity employers in the North Western Area in all industrial negotiations, and upon the issue of the Commissioners' notice delimiting the South-East Lancashire Electricity District he was requested to act as honorary secretary to the conference which prepared the scheme. The conference some months ago elected the Advisory Board, which is operating voluntarily in all respects as though Parliament had confirmed the Order. That being so, the Board desired to appoint a clerk who would be entirely their officer and not connected with a constituent authority. The appointment was made unanimously, and the Board expressed the desire that Mr. Banks should continue to act for the electricity employers in relation to industrial negotiations, &c.

Mr. Barnes has been appointed chief assistant engineer to the Manx Electric Railway Co. He was trained under the chief engineer, Mr. Edmundson, and afterwards became general superintendent of the Calgary Power Co., Canada. Since 1916 he has been second electrical engineer of the White Star S.S. *Majestic*.

The Edinburgh Town Council has increased the salary of the deputy tramways manager, Mr. Fitzpayne, from £580 to £660, and that of Mr. M'Leod, of the traffic department, by £100 a year.

Professor William Cramp, D.Sc., who has been elected chairman of the South-Midland Centre of the Institution of Electrical Engineers (he delivered his address on Wednesday last), holds the Chair of Electrical Engineering at the University of Birmingham. Prof. Cramp commenced his career with Messrs. Ferranti, Ltd. He served a five-years' apprenticeship and was then engaged as a tool-maker, rising to be foreman. Subsequently he entered the firm's drawing office, eventually becoming assistant to the works manager and then outdoor erector. In 1901 he left Hollinwood to take up the position of lecturer in electrical design and demonstrator under Prof. Ayrton at the Central Technical College, South Kensington. He left this post to establish a consulting practice in 1906, first in London, eventually removing to Manchester. Mr. Frith joined him in 1914, and thus was established the firm of Cramp & Frith, which is still carried on under the same designation, although Prof. Cramp is no longer a partner. When the late Prof. Kapp resigned the Chair of Electrical Engineering at Birmingham University in 1919, Prof. Cramp was chosen to succeed him. While in Manchester Prof. Cramp lectured during a period of five years on electrical design at the College of Technology, and obtained the M.Sc. degree of that institution. For his research work Prof. Cramp was granted the degree of D.Sc. by the University of Manchester; it was his *penchant* for research which led him to abandon consulting work for the Birmingham chair, which affords him ample opportunities for exercising his recognised talents in this direction. Prof. Cramp also holds the degree



[Photo: C. W. Sons. [Birmingham

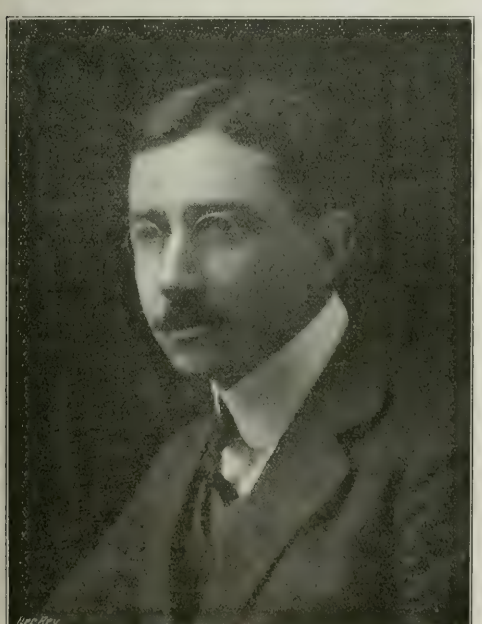
Professor W. Cramp, D.Sc.,
Chairman of the South Midland Centre of the I.E.E.

of M.Sc. (Birmingham); he was chairman of the North-Western Centre of the I.E.E. in 1911-12; in 1921 he delivered the James Watt anniversary lecture at Greenock; and in the same year he was awarded the silver medal of the Royal Society of Arts for research work in connection with pneumatic conveying. Prof. Cramp has made many contributions to the literature of technical science: mention may be made of a paper presented to the British Association in 1903 on single-phase repulsion motors; "Magnetic Leakage and its Effect in Electrical Design," which received a special I.E.E. premium; and the descriptions of the Cramp single-phase motor which appeared in the ELECTRICAL REVIEW in 1906 and 1907. The following books also stand to Prof. Cramp's credit:—"Continuous Current Armature Windings," "Continuous Current Machine Design," and, in collaboration with Dr. C. F. Smith, "Vectors and Vector Diagrams in the Alternate Current Circuit." The last was translated into German, in 1912, by Emil Waltz.

MR. B. WELBOURN, who is this year's chairman of the Liverpool Sub-Centre of the Institution of Electrical Engineers, and delivers his address on November 6th, received his early technical training at King's College, London, at a time when the late Dr. John Hopkinson was Professor of Electrical Engineering there. He became an Associate of the College, and was appointed student demonstrator in the Siemens laboratory. Subsequently he became a pupil at the works of Messrs. Willans & Robinson, Thames Ditton, later securing the post of electrical engineer to the Electro-Chemical Co., Ltd., St. Helens. In 1900, Mr. Welbourn joined the contract department of the British Insulated Wire Co., Prescot, and from that time to the present day he has remained with the firm which is now, of course, the British Insulated & Helsby Cables, Ltd.; he has been contract manager for the past 20 years.

During the European war, Mr. Welbourn was a member of the Lancashire Anti-Submarine Committee. He has been closely identified with the development of paper-insulated cables for high-pressure work, and serves on various committees of the B.E.S.A. and B.E.I.R.A. Mr. Welbourn was vice-chairman of the Lancashire & Cheshire Linking-up Committee of Engineers, which published two reports that attracted a great deal of attention.

Mr. Welbourn is also familiar to our readers as a prominent and active member of the Institution. He has been a member of the Council for three years, and is a past-chairman of the



Elliott & Fry [*London.*

MR. B. WELBOURN,
Chairman of the Liverpool Sub-Centre of the I.E.E.

Manchester Local Section. Among his contributions to electrical engineering literature are a paper on "British Practice in the Construction of Overhead Transmission Lines," and an address on "Electrolytic Copper as used for Electrical Work," delivered before the I.E.E., and a paper read before the Institution of Mining Engineers, on "Copper and Aluminium Overhead Lines and Insulated Cables." Mr. Welbourn is something of a "globe trotter" and has seen a great deal of Europe, Canada, and the United States.

At Eastwood Council, on October 19th, it was decided [illegible] subject to the electrical engineer and [illegible] for three years, the minimum scale of salaries [illegible] for chief electrical engineers by the National [illegible] adopted. Mr. W. Knowles moved the matter [illegible] that when they saw other public bodies cutting down [illegible] and economising, he felt it was not a time for them to be increasing salaries. This motion, however, was defeated.

MR. A. W. GARSIDE, who has been 15 years [illegible] salesman in the Sheffield area for the Metropolitan-Vickers Electrical Co., Ltd., has now been appointed supply leader for the Cardiff area of the company. Mr. Garside's duties in the Sheffield area have now been taken over by Mr. H. Girdlestone, lately with the British Thomson-Houston Co., Ltd.

It is stated by a Liverpool paper that Mr. FRANCIS H. POWELL has been appointed to the newly-created Chair of Electrical Engineering at the School of Engineering, Canterbury College, New Zealand. He was educated at the Liverpool College, and proceeded to Liverpool University, where he took the degree of B.Sc. with first-class honours in Engineering and afterwards obtained the degrees of M.Sc. and M.Eng. He was awarded a University Fellowship, a University Scholarship, and was the first holder of the "David Rew Memorial" Research Scholarship in Electrotechnics. He is a member of the Institution of Electrical Engineers and of the American Institute of Electrical Engineers.

MR. A. E. IZANT, having relinquished his position with the Metallic Electrical Engineering Co., Ltd., is shortly taking up the position of representative, on the South-East Coast, for the Cable Accessories Co., Ltd., Tipton, Staffs.

Mr. VICTOR DELEBECQUE terminated his agreement as general manager of the Walsall Electrical Co., Ltd., Walsall, last week, after 12½ years' engagement. Mr. Delebecque informs us that he is now making other arrangements for manufacturing his specialities, and, pending these arrangements, communications for him should be addressed to Ash Villa, Sandwell Street, Walsall.

The Council of the British Cast Iron Research Association has offered the important position of Director of Research to the Association to Dr. Percy Longmuir, of Sheffield. He has accepted, and will take up his duties on November 1st.

On and after November 1st, the address of Mr. W. M. SELVEY will be 66, Victoria Street, Westminster, S.W. 1. The new telephone number is "Victoria, 264."

MR. W. J. SALAMAN, late director of the Millwall Engineering Co. and other companies, has joined Messrs. Henry Joseph & Co. as an active partner, and will have charge of sales and agencies.

MR. G. TERRELL, M.P., has been re-elected president of the National Union of Manufacturers.

Amongst the members of the new Cabinet, whose appointment the King approved on Tuesday, is SIR PHILIP LLOYD-GREAME, president of the Board of Trade. Offices which remain to be filled are those of Postmaster-General, Minister of Transport, and director of the Overseas Trade Department.

Obituary.—MR. FERNAND ESPIR.—We regret to record the death, which occurred on October 18th at a nursing home, of Mr. Fernand Espir, of 3, East India Avenue, London, E.C. Mr. Espir, who was in his 59th year, was an importer of electrical wire and appliances, and was sole agent for the Tréfileries et Laminoirs du Havre and the Société Anonyme des Anciennes Usines de Fuisseux.

NEW COMPANIES REGISTERED.

Whiteside, Bloomfield & Co., Ltd. (185,016).—Private company. Registered October 13th. Capital, £500 in £1 shares. To carry on the business of manufacturers of, and dealers in motor accessories, wireless equipment, &c. The first directors are:—H. S. Whiteside, "Garrick Villa," Hampton-on-Thames; W. S. R. Bloomfield, 187, Oakwood Court, Kensington, W.14; R. Crook, 79, Manor Road, Richmond, Surrey. Registered office: 10, Lower John Street, Regent Street, W.

Auto-Bulbs, Ltd. (184,991).—Private company. Registered October 13th. Capital, £100 in £1 shares. To carry on the business of manufacturers, importers, and distributors of electric lamps, electric light fittings, and electrical appliances and apparatus, &c. The first directors are:—G. R. Boyle, 2, Chillingworth Gardens, Strawberry Hill, Middlesex (sales manager of Perm-a-Grip, Ltd.); Dorothy Montrose, 224, High Road, Leyton, S.E.13. No qualification necessary. Secretary: C. Lazarus. Registered office: 14-17, Holborn Viaduct, E.C.

Newcastle Carbide Co., Ltd. (185,006).—Private company. Registered October 13th. Capital, £500 in £1 shares. To carry on the business of manufacturers of, and dealers in carbide of calcium and similar products or products arising therefrom, electro-chemical products and apparatus, electric plant, &c. The first directors are:—Mrs. E. A. Bingham, C. H. Bingham, and C. H. Bingham, Junr., all of 2, Kingswood Road, Upper Norwood, S.E. Registered office: Room 223, Mansion House Chambers, 11, Queen Victoria Street, E.C.

Bristol Carbide Co., Ltd. (184,993).—Private company. Registered October 13th. Capital, £500 in £1 shares. To carry on the business of manufacturers of, and dealers in, carbide of calcium and similar products or products arising therefrom, electro-chemical products and apparatus, electric plant, &c. The first directors are:—Mrs. E. A. Bingham, C. H. Bingham, and C. H. Bingham, Junr., all of 2, Kingswood Road, Upper Norwood, S.E. Solicitors: Chas. Bingham & Co., 11, Queen Victoria Street, E.C.

P. Adair, Ltd. (185,085).—Private company. Registered October 17th. Capital, £500 in £1 shares. To carry on the business of import and export merchants, consulting, mechanical, and electrical engineers, &c. The first directors are:—G. E. R. Adair, "Wellesley House," Sloane Square, S.W. (director of Adair, Wighton & Co., Ltd.); P. Adair, 65, Upper Gloucester Place, N.W.1 (director of Acme Radio Valve Co., Ltd.). Secretary: R. E. Wynn. Registered office: St. Andrew's House, 82a, Holborn Viaduct, E.C.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Indian Electric Supply & Traction Co., Ltd.—Particulars [illegible] May 2nd, and covered by trust deed [illegible] charges on the company's property, present and future, including uncalled capital, but [illegible] Bower Trust, Ltd.

Elliott Brothers (London), Ltd.—Satisfaction to the extent [illegible] 1922, of mortgage dated July 19th, 1916, securing £30,000.

Acme Engineering Co. (London), Ltd.—Debenture dated October 10th, 1922, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: J. Lowe, 43, Bloomsbury Square, W.C.

Madras Electric Supply Corporation, Ltd.—Particulars [illegible] May 25th, and covered by [illegible] Sept. 2nd, 1922, charged on the undertaking, [illegible] the purchase of such undertakings by the local authorities, government or otherwise, under the statutory powers, and the company's undertaking and property, present and future, including [illegible] Trust, Ltd.

Kidderminster and District Electric Lighting and Traction Co., Ltd. (59,972).—Return dated July 6th, 1922. [illegible] £100,000 in 5,000 pref. and 5,000 ord. shares of £10 each. 5,000 pref. [illegible] £77,000 paid. Mortgages and charges, nil.

Barnsley and District Traction Co., Ltd. (72,962).—Return dated July 5th, 1922. Capital, £100,000 in 50,000 pref. and 50,000 ord. shares of £1 each; 22,000 pref. and 20,035 ord. shares taken up. £42,035 paid. Mortgages and charges: £20,578 debenture stock and £29,000 second debentures. (According to balance-sheet dated December 31st, 1921, the £29,000 second debentures were issued to bankers as collateral security for overdraft.)

Lancashire Electric Light and Power Co., Ltd. (77,202).—Return dated May 31st, 1922. Capital, £789,838 in 499,975 first pref., 137,500 7 per cent. pref., and 152,363 ord. shares of £1 each. 465,000 first. pref., 137,500 7 per cent. pref., and 152,363 ord. shares taken up. £1 per share called up on the first and 7 per cent. pref., and 149,963 ord. shares. £751,813 paid, leaving £650 in arrears. £240 considered as paid on 2,400 ord. shares. Mortgages and charges, £685,000.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

The annual meeting was held on October 19th, when the Marquess of Winchester presided. The Chairman, in moving the adoption of the report and accounts, said that the share capital still remained at £3,000,000. The actual amount of first mortgage debentures outstanding was £1,721,630, but, following the usual practice, they had added the amount of debentures drawn for redemption, but which, up to the date of the balance sheet, had not been presented for payment, making the total figure £1,926,879. The second mortgage debentures stood at £1,201,881, £78,260 having been paid off during the year. The creditors and credit balances stood at £1,681,360, those in London amounting to £1,555,775, being chiefly in respect of sums owing for interest on debenture coupons uncollected and the necessary reserve for taxation. They had not considered it necessary to increase the reserve fund, which still stood at £250,000. Referring to the other side of the balance sheet, the leases and concessions, and the company's power stations, buildings, equipment and land, and the cost of acquisition of power contracts, stood at £1,377,614 and £1,737,044 respectively, a reduction of £80,124, due chiefly to the amount written off for depreciation. The company's loan to the Rand Mines Power Supply Co. and the 500,000 shares in this company stood together at £2,638,310, being a reduction of £101,692. The debtors and debit balances amounted to £98,639. Cash and investments were set out in detail, and amounted altogether to £2,182,137. Turning to the profit and loss account, the receipts amounted to £784,425, as compared with £[illegible] Depreciation and amounts written off, including the provision made for British taxation, amounted to £[illegible]. The net result for the year was a profit of £172,926, which had been carried to the balance sheet and added to the amount brought forward from the previous year, making the total balance to the credit of the profit and loss account £265,408. In respect of this balance the preference shareholders had received three dividends, two each of 3 per cent. and one of 4 per cent., all less income tax, and the ordin[illegible] received a dividend of 5 per cent. less income tax in respect of the year 1921. These dividends absorbed £[illegible], leaving £90,408, which had been carried forward to the current year. By far the most important matter affecting the company and the gold mining industry generally during the period under review was the strike of the [illegible] which embraced the employés of the company and the staffs of the Johannesburg engineering shops. The prospects of the present year were good. The business of the company was being well maintained, and the demand for [illegible] exceeded those of the corresponding months last [illegible]. He hoped that there would not be any material [illegible] as compared with last year's figures. [illegible] Bill to which he referred at the last meeting, was passed during the recent session of the Union Parliament. It was satisfactory to note the increasing output of gold from the Witwatersrand Mines. The average working costs for August, 1921, were 25s. 4d. per ton milled, but for August, 1922, the average costs amounted to 20s. 5d., a reduction of 4s. 11d. per ton milled. The average of 20s. had, therefore, nearly been realised, as against the pre-war level average of 16s. 8d. per ton milled. The net result of the economies which had been effected was that low-grade mines were now again able to work at a profit in spite of the premium on gold having largely disappeared. The matter of plant capacity and notified demands to date would necessitate the immediate purchase of two additional large machines, together with boilers and all auxiliaries, and this important business was now being dealt with. Until a final decision had been arrived at it was impossible to forecast whether these additions could be made out of funds still in hand, but he was hopeful that they could install the plant required for extension without any addition to capital.

Mr. A. E. Hadley formally seconded the resolution, and it was carried unanimously. The retiring directors, Lord Brabourne and Mr. F. Astley Cooper, were re-elected.

Eastern Extension, Australasia & China Telegraph Co., Ltd.

The annual meeting was held on October 18th, when Sir John Denison-Pender, G.B.E., K.C.M.G., presided. The Chairman mentioned with regret the recent death of the general manager and secretary, Mr. F. E. Hesse, whose association with the company dated back to its birth. In presenting the report, which was abstracted in our issue of October 13th, the Chairman said that in comparison with 1920 it would be seen that the amount placed to the general reserve fund had been increased by £50,000. The directors considered it advisable to make that further provision in order to meet expenditure in connection with the laying of new cables. They also considered that, in view of the decrease in traffic receipts, as evidenced by the returns for the first six months of the current year (the working expenses still being very high), it was expedient to carry forward the sum of £307,880 to the account for 1922. Further capital expenditure had been incurred during 1921 to the amount of £409,740, of which amount £280,265 represented the balance of the cost of the Madras-Singapore Direct Cable, and £129,475 new offices and houses for the staff, &c. The delays in the transmission of Far East and other traffics had been very greatly reduced; in fact, but for temporary misfortunes, such as interruptions of important sections, it might be said that after taking into consideration the volume of traffic to be carried, transmission had been quite satisfactorily dealt with. The new cable between Madras and Singapore was successfully laid and opened for traffic on April 18th, 1921. A contract had since been entered into with the Telegraph Construction & Maintenance Co. for the manufacture of a cable to be laid between Colombo and Penang, which they hoped to have working in April next. When that had been effected it was confidently hoped that they would be in a position to give a good and fast service to the Far East by having a margin in cable capacity in the event of temporary interruptions. There were, perhaps, two or three important sections which it would be advantageous to strengthen at a future date, and that would not be lost sight of by the directors. The work of installing automatic apparatus was being pressed on as much as possible; this, it was hoped, would eventually lead to a reduction in working expenses. During the past year such apparatus had been installed and successfully worked at their Cocos Station, whereby a reduction of seven operators was effected. Owing to the increased number of cables now in operation at Singapore, and to the additional space required for new apparatus, they had been obliged to undertake the construction of a new office at that station, which it was hoped would be completed and occupied in about 18 months from date. It had also been found necessary to provide new offices at Melbourne and Sydney, and properties had been purchased and plans for the reconstruction of the buildings were under consideration.

Colonel the Hon. Arthur G. Brodrick, T.D., A.D.C., seconded the Chairman's motion, which was carried.

Sir John Denison-Pender and Mr. J. H. Wilson were re-elected directors of the company.

Amalgamated Wireless (Australasia), Ltd.

The net profit for the year ended June 30th was £9,251, which, with £2,180 brought forward, made an available total of £11,431, as compared with £11,839. A dividend of 6 per cent. absorbed £11,136, and £296 was carried forward. The gross profits showed an increase of £4,059, but working expenses rose in greater proportion. The agreement with the Commonwealth Government necessitated increasing the capital to £1,000,000 by the issue of 800,000 £1 shares. The Commonwealth took 500,001 of these, and 2s. has been paid upon each of the new shares. The Government undertakes to bear, for three years, any loss in the working of the stations taken over.

Marconi's Wireless Telegraph Co., Ltd.

An extraordinary general meeting was held on October 20th, to consider resolutions for increasing the capital to £4,000,000 by the creation of 1,000,000 new ordinary shares of £1 each, and for extending the borrowing powers of the directors from one-half up to the total nominal capital for the time being. Signor Marconi presided, and in proposing the resolutions said that the development of wireless telegraphy throughout the world was making very great progress, and a number of important stations were being, or had yet to be built. To ensure efficient working, avoidance of interference, and provide the highest degree of economy, both in the matter of construction, and subsequently in the conduct of the telegraph services, the Radio Corporation of America, the Compagnie de Télégraphie Sans Fil, of Paris, the Telefunken Co., of Berlin, and their company, had joined together to erect those stations in many foreign countries. At Buenos Aires, in the Argentine Republic, a station was in the course of erection, and it was hoped would be opened for service about May 1st next. In Brazil similar work had been commenced. At Bogota, Colombia, a service would be opened very shortly, the station having been recently completed. Other arrangements were in course of negotiation, and direct telegraph services would shortly be established between the several South American Republics and Central America, and also from the South American Republics and Central America to the United States of America, the principal capitals of Europe, and, by relays, from these to almost every part of the world. The capital of the company in Australia had been increased and the Australian Government was taking a considerable share interest. The company was to construct a station for direct service with this country. They were taking a substantial part in that company. They had also signed an agreement with the Government of the Union of South Africa to create a direct wireless telegraph service between South Africa and this country. Very big developments were taking place in Canada, in which they would be taking part with the Canadian company. They had also signed an agreement with the Austrian Government to take over the existing wireless telegraph stations in Austria and to construct additional stations for the purpose of conducting telegraph services with foreign countries. There were a number of very important arrangements which by now might be completed or on the eve of completion, particulars of which he regretted he could not give at the moment, but he had told them sufficient to satisfy them of the progress which the company was making and the considerable building programme which they had in front of them, both at home and abroad. In addition, however, to the construction of telegraph stations, they had the advent of broadcasting. That was an entirely new business, which they had every reason to believe would assume very big dimensions, and add very considerably indeed to the earning powers of the company. Not only was broadcasting proceeding at home, but likewise it was going ahead in most other important capitals of the world; thus they had to make provision for very considerable manufacture, both for home and for foreign requirements. That was a business which, according to their present estimates, would keep a sum of approximately seven or eight hundred thousand pounds more or less continuously and profitably employed for some time to come. In these circumstances they would no doubt all appreciate that additional capital must be found, and, therefore, it was that they were asking for the necessary authority to provide the moneys which were required. They intended to issue short-term debenture stock, giving to the holders a right to convert it into ordinary shares of the company at any time prior to April 1st, 1929, at the rate of £3 of stock for one ordinary share. Their view was that that was the most economical and the most satisfactory way of raising additional capital at the moment. A substantial part of the money raised would be employed for some time in construction work, and would, therefore, of course not be immediately productive of profit. The broadcasting business, however, should more than compensate. He wanted to make it perfectly clear that while they were increasing the capital of the company there would be no issue of these shares—they would be held for the purpose of giving to the debenture holders the right of conversion.

Mr. Godfrey Isaacs, in seconding the motion, said they had had questions from shareholders asking what had been done with the moneys subscribed in 1918. In that year the share capital and premiums received amounted to £1,457,599, and on December 31st in the same year the excess of assets over liabilities amounted to £3,548,346. At the end of 1921 the excess of assets over liabilities amounted to £7,961,946—a difference approximately of £4,400,000, or some £250,000 more than the amount which they had issued. During the period from 1918 to 1921 inclusive they had distributed dividends and bonuses amounting to £1,938,901. The present shareholders would have the right of preferential allotment up to one-half of the issue of debentures.

The resolutions were carried.

Electric Supply Co. of Victoria, Ltd.—The directors' report for the year ended March 31st, 1922, states that the lamps connected increased from 312,520 to 329,242, and that the tramway passengers carried fell from 6,096,269 to 6,035,062. The trading account [illegible] a gross profit of £[illegible] £69,389. The balance to the credit of profit [illegible] is £85,980, plus £14,536 brought forward [illegible] Debit debenture interest, [illegible] deducting [illegible] from [illegible] £[illegible] of [illegible] [illegible] vision for British corporation profits tax, £1,350; leaving a balance of £[illegible]. [illegible] proposed [illegible] preference dividend for the [illegible] ended March 31st [illegible] £24,000; and [illegible] £15,512. [illegible] direct the particular [illegible] of the [illegible] siderable sums payable [illegible] for the year [illegible] review. These in Australia, and this country, plus British Corporation profit tax, [illegible] £[illegible]. The directors, therefore, regret that they are unable to recommend a dividend upon the ordinary share capital.

Prospectuses. *London Underground Electric* [illegible] this was advertised to [illegible] the end of last week [illegible] for issue 4½ per cent. debenture stock in the London [illegible] Railway Co., the City & South London Railway [illegible] Central London Railway for the [illegible] respectively £2,250,000, £1,250,000 and £1,000,000. The [illegible] cations was to close by Tuesday last. The [illegible] was, however, over-subscribed within 24 hours.

The Mediterranean Asbestos Quarries, Ltd.—On Monday last the daily Press contained a prospectus statement concerning this company and its objects. The statement was not an invitation to apply for shares, but merely for Stock Exchange purposes. The company acquires certain concessions in the Island of Corsica for the purpose of quarrying, transporting, marketing, and dealing in asbestos. Among the directors is Mr. D. N. Dunlop, M.I.E.E., director of the British Electrical and Allied Manufacturers' Association.

Power Securities Corporation, Ltd.—This company's prospectus, which is to be issued next Monday, will offer 500,000 pref. shares (7 per cent. cum. participating) of £1 each and 100,000 ordinary shares at 22s. each. The company has acquired the whole of the ordinary capital in Balfour, Beatty and Co., Ltd., but the constitution of the latter will remain unaltered. 400,000 of the Corporation's ordinary shares have been subscribed for by Sir W. G. Armstrong, Whitworth and Co., Ltd., Babcock & Wilcox, Ltd., the British Thomson-Houston Co., Ltd., the directors of Balfour, Beatty & Co., Ltd., and the directors of the new corporation.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—Sir Glyn H. West, presiding at the annual meeting on October 19th, said that the past year had been the most trying one in the history of the company; the profit had been satisfactory in the circumstances. The company had probably the best organised hydro-electric department in the country, and was negotiating with considerable hope of success for more than one large contract, which would bring a considerable amount of work to both Elswick and Openshaw. Moreover, when hydro-electric energy was used for paper-making there was the additional advantage of supplying the paper-making machinery itself; for this purpose works had been acquired in Bury.

Fuller's United Electric Works, Ltd.—By order of the High Court, Chancery Division, separate meetings will be held at Winchester House, Old Broad Street, E.C., on November 9th, of the holders of the 7 per cent. short-term notes; unsecured creditors other than preferential creditors and other than creditors for under £10; the holders of preference shares; and the holders of ordinary shares, for the purpose of considering and if thought fit approving a scheme of arrangement.

Automatic Telephones (Australasia), Ltd.—The net profit for the year ended June 30th last was £8,463, and the balance brought forward gave an available total of £10,703. Of this £6,250 was absorbed by a 10 per cent. dividend and £4,452 was carried forward. In anticipation of large orders in the near future the company has decided to issue the balance of unsubscribed capital, £37,500.

Weymouths, Ltd. (Victoria).—The report for the year ended June 30th of this company, in which the English Electric Co., Ltd., holds an interest, shows a net profit of £6,593, as against £7,373, on a capital of £52,500. A dividend of 10 per cent., absorbing £5,250, was again distributed, £1,283 was transferred to reserve, and £60 carried forward. A bank overdraft of £11,536 was extinguished during the year.

Erinoid, Ltd.—The trading profits for the year ended August 31st last were £27,935. After allowing for depreciation, &c., the net profits were £13,222. Deducting debit of £9,719 brought forward, £3,503 remains to carry forward. During the last six months of the company's year there was a marked increase in sales, which still continues, and prospects for the ensuing year are stated to be most promising.

Montreal Power Companies.—The Montreal Light, Heat, and Power Co. is paying a quarterly dividend of 2 per cent. on the common shares, and the Montreal Light, Heat, and Power Consolidated Co. one of 1¾ per cent. Both are payable on November 15th.

The Swiss Oerlikon Works.—The accounts of the Maschinenfabrik Oerlikon, of Oerlikon, show net profits of 1,810,000 fr. for 1921-21 as compared with 1,860,000 fr. in the previous year, and the dividend is at the same rate of 8 per cent.

Reduction of Capital.—Southern Brazil Electric Co., Ltd., and Reduced. A petition for the confirmation of the reduction of the capital of the company from £750,000 to £425,000 has been presented to the High Court, Chancery Division, and will be heard by Mr. Justice Lawrence on November 7th.

Brampton Bros., Ltd.—Dividend of 10 per cent., free of tax, on the ordinary shares; to reserve, £10,000; carried forward, £8,236.

Callender's Cable & Construction Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum on the ordinary shares, less tax.

Montevideo Telephone Co., Ltd.—Final dividend of 5 per cent., free of tax, making 8 per cent. for the year.

Babcock & Wilcox, Ltd.—Interim dividend of 8 per cent., tax free, compared with 7 per cent last year.

STOCKS AND SHARES.

Tuesday Evening.

Dramatic developments in the political world have made little difference to Stock Exchange markets. Men engaged in business always regard a General Election as being something of a nuisance. If it has got to be, then the sooner it is over the better. The prospect of the campaign being short and intensive is therefore welcome, and the immediate result of the possibility of a change of Government was a rise in the price of the War Loan, reflected as usual in other investment securities round the Stock Exchange. Publication of the terms of the Southern railway grouping arrangements caused activity in the stocks affected; the Home Railway electric stocks are better. Last Friday's meeting of the Marconi company caused no particular changes in the prices of the company's shares. Electricity supply issues are all very steady. Another heavy drop in the value of the franc adversely affected anything connected with Continental interests.

The County of London Electric new ordinary shares hardened to 4s. 3d. premium, but reacted a trifle. Vague hints are current with regard to certain developments said to be pending in connection with the company's business, though what these may be diligent inquiry has failed to elicit. The existing ordinary shares are better at 29s.; the new preference drooped to 1s. 9d. premium. Another rise of 2s. 6d. lifted Charing Cross ordinary to 7⅞. City of London ordinary at 2 1/16 are better.

How a small electricity company may be handicapped by limited conditions, the experience of the Guildford Electricity Supply Company abundantly demonstrates. In 1920, the shareholders sold their undertaking to the municipality, and the final payment in respect of their shares has just been made. Preference and ordinary alike receive 8s. 6¾d. in the pound. The preference having no priority rights, they get the same as the ordinary. It had been pretty generally expected that 10s. a share would have been available for both classes. But the whole business is disappointing, and demonstrates the necessity that there is for the Electricity Commissioners to formulate some scheme whereby central stations can supply energy to a number of districts without the latter being called upon to provide their own facilities for supply.

The principal movements of this week in our lists are substantial rises in the stocks and shares of the Eastern cable group. Eastern Extensions, Westerns, and Globes are all about 12s. 6d. higher and a corresponding rise of 5½ points has put up Eastern Telegraph ordinary stock to 193. This makes forcible reply to the fear of those who saw in the extension of broadcasting the possibility of a blow to the cable companies. It is unnecessary to emphasise the continual recommendation of the stocks and shares in this column for several years past, the counsel being based upon the financial strength of the companies and the sound management which carried them so skilfully across the difficult war period. The fact of the dividends being paid free of tax renders the stocks worth holding even after the rises of the last three or four weeks, and, so far as can be seen at present, there is nothing to stop further improvements to £20 for the trio of shares and 200 for the Eastern Telegraph stock.

Marconis have been a dull market since the meeting last Friday, when the terms of the debenture issue were not announced. Evidently the shareholders do not like the idea of having this large slice of new capital placed in front of the existing shares. There has been very little selling, but at the same time further support was not rendered. Canadians however, are a good market at 11s. 3d. and Radio Common maintain their rise.

Ready subscriptions awaited the new issues of Tube debenture stocks made last week. The lists were closed in advance of the advertised time, and it was generally assumed that there would be a premium on the stocks when dealings started. However, some of the allottees apparently applied for more stock than they wanted, because, instead of the premium, a slight discount developed, though this quickly disappeared, and the quotations are all at par, *i.e.*, the issue price of 93. Underground income bonds are better at 87½. Metropolitan ordinary rose 2⅝ and Districts 1½, the former keeping time with a sharp rise in Great Western ordinary. Prior-charge stocks hold their rises of last week.

United River Plate Telephone shares show a rise of 10s. at 7⅜, in consequence of the announcement that the company has now authority to revise its rates. Orientals at 2 5/16, are nominally 1/16 down, most of which is accounted for by the dividend deduction. Chile Telephones at 6½ are a fraction up.

Amongst manufacturing shares, rises to 14s. 6d. in India Rubbers and to 44s. 6d. in British Insulated ordinary stand out prominently. Callenders and Henleys keep their prices, and the market as a whole is a good one. In the electricity manufacturing group, few changes of any consequence have occurred. Babcock and Wilcox advanced substantially, on the increase in the dividend. At 3¼ xd the price exhibits a gain of practically 5s. on the week. There has been an eager demand for the shares from the North.

Brazilian Tractions soon lost the couple of points which they annexed on declaration of the quarterly dividend of 1 per cent. Owing to the slump in the franc, orders to sell Brazilian Tractions came from the Continent, and the price has reacted to 47. Although there is nothing going on in Mexicans and other foreign descriptions, the tendency is dull, by reason of the drop in the French Exchange.

Rubber shares took on a new lease of life, and prices went ahead very considerably—too sharply, as it afterwards turned out, because a good deal of profit-taking ensued, which failed to encounter the expected support from fresh buyers. Therefore the market is quieter, although speculation looks for a fresh advance in the shares owing to the price of the raw produce having risen to a shade over 1s. per lb. There is nothing new to report in connection with the market in armament shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Oct 24, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	8⅜	—	£7 1 2
Charing Cross Ordinary	8	9	7⅞	+ ⅛	5 18 0
do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½		4 12 4
City of London	14	14	2	+ ⅛	6 15 7
do. do. 6 per cent. Pref.	6	6	2⅜	—	5 4 4
County of London	8	8	1	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7⅜	—	6 13 4
London Electric	2½	4	2⅜		4 11 5
do. do. 6 per cent. Pref.	6	6	5	—	5 17 1
Metropolitan	7	7	6½		5 12 0
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9¼	—	6 11 6
South London	7	7	4	—	7 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅜		6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	101xd	—	5 18 10
do. Def.	1½	84/6	23½	—	7 9 8
Chile Telephone	6	6	6¼	+ ⅛	1 18 0
Cuba Sub. Ord.	7	7	8½xd	—	8 12 4
Eastern Extension	10	10	19⅝	+ ⅜	5 3 3
Eastern Tel. Ord.	10	10	193	+6A	5 3 6
Globe Tel. and T. Ord.	10	10	19⅝	+ ⅜	5 3 3
do. Pref.	6	6	114	—	5 4 4
Great Northern Tel.	24	22	28	— ⅛	7 17 2
Indo-European	10	10	85½xd	+ ½	7 1 0
Marconi	25	15	2⅜	— 1/16	6 6 4
Oriental Telephone Ord.	12	12	2⅜xd	—	*5 4 0
United R. Plate Tel.	8	8	7⅜	+ ⅜	*5 16 0
West India and Panama	Nil	Nil	x/.	—	Nil
Western Telegraph	10	10	193	+ ⅞	*6 3 3
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	55	+2½	4 5 9
do District	Nil	1	41⅛	+1⅛	2 10 0
Underground Electric Ordinary	Nil	Nil	3⅛	—	Nil
do. do. "A"	Nil	Nil	7⅜	—	Nil
do. do. Income	2	4	87½	+1	*4 11 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	85		7 11 9
do. do. 2nd Pref.	Nil	6½	8⅝	—	7 2 0
do. do. 5 per cent. Deb.	5	5	80½	—	6 4 3
Brazil Tractions	Nil	Nil	47	2	8 10 2
British Columbia Elec. Ry. Pcc.	5	5	76½	—	6 9 9
do. do. Preferred	5	93/-	68		*7 0 0
do. do. Deferred	8	12s/-	71½	—	*8 12 6
do. do. Deb.	4½	4½	73	—2	5 16 5
Mexico Trams. 5 per cent. Bonds	Nil	Nil	72⅜		7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	42½		Nil
Mexican Light Common	Nil	Nil	19½	—	Nil
do. Pref.	Nil	Nil	41½		Nil
do. 1st Bonds	Nil	5	65½		7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	18	83xd	+ ¼	4 18 6
British Aluminium Ord.	10	5	17/9	—	5 12 8
British Insulated Ord.	15	15	11/6	+ ⅛	6 14 10
Callenders	15	15	2½		6 13 4
6½ Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	16/-	—	6 18
Edison-Swan	10	Nil	8/-	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	25/6	—	7 17 0
English Electric	8	5	15/0	—	6 7 0
do. do. Pref.	6	6	18/9	—	6 8 8
Gen. Elec. Pref.	6½	6½	21/3		6 2 4
do. Ord.	10	5	18/6		5 8 1
Henley	15	15	2½	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	14/6	+9d.	—
Met.-Vickers Pref.	8	8	22	—	6 11 9
Siemens Ord.	10	10	25/9		*7 15 4
Telegraph Con.	20	20	26/2	—	*4 18 6

*Subject to Income Tax.

THE INDUSTRIAL SITUATION IN JAPAN

(With Statistics of Electrical Imports and Exports).

The Department of Overseas Trade has recently issued a report by Sir E. T. F. Crowe (H.M. Commercial Counsellor) and Mr. G. B. Sansom (H.M. Commercial Secretary), of Tokio, on the commercial, industrial and financial situation in Japan during 1921 and up to June 30th, 1922.

Probably the most interesting section is that dealing with high production costs, for, as the report remarks, many people outside Japan still regard it as a cheap country. The case of copper is very instructive on this point, and of particular moment to the electrical engineer. It illustrates clearly the changes which have taken place in the costs of production in Japan, while it also shows that up to the present, far from reducing prices, the action which has been taken has tended to maintain or even enhance them.

From Copper Producer to Importer.

Japan is one of the largest producers of copper in the world. Up to recent times she ranked fifth in the list. Before the war her output averaged 60,000 tons a year, and for the last 20 years or so she had been exporting about £2,500,000 every year. Next to silk and cotton yarns, copper was her most important export. The principal mines were owned by a few of the richest families in the country, and the copper business was looked upon as very prosperous and remunerative. In 1919 and 1920 imports of copper appeared for the first time, the values being as high as 26,000,000 yen and 22,000,000 yen respectively. Consumption in Japan had increased while production had fallen off owing to increased costs.

In 1921 the import continued, but on a much smaller scale, the total being only 8,000,000 yen, which, however, was larger than the export. In 1922 the business began once more to assume big proportions, and for the first four months the import of copper ingots was no less than 270,000 piculs, valued at 10,225,000 yen, while an entirely new trade was started in waste brass, of which 223,000 piculs, valued at 5,500,000 yen were imported.

The copper mine-owners declared that they were unable to produce copper at a price which could compete with the imports from America, and the Government, in order to protect an important domestic industry, increased the duty from 1.20 yen per 100 kin to 7 yen. For a short period imports ceased but in June imports were again beginning to come in.

It is estimated that consumption in Japan is about 6,000 tons a month, while production has dropped below 5,000 tons. In 1917 Japan produced on an average 10,000 tons monthly. The problem facing mine-owners is whether to attempt to produce copper more economically and meet competition or to maintain the price at a high level by reducing output.

The latter uneconomic policy has been followed by the colliery owners who curtailed output by 17½ per cent. in order to bolster up prices. It is this tendency, the report rightly points out, of continually forcing up prices and preventing them from finding their natural level which must seriously damage Japanese trade unless it is remedied in time. The immediate effect has naturally been to keep the cost of living at the high level to which it mounted during the war.

Fewer Competitive Exports.

Japan's competitive power in foreign markets has consequently suffered. Her export trade has maintained its value by reason principally of her predominance as a world supplier of silk. Other branches, including even shipments of cotton tissues, have decreased considerably. Meanwhile, her purchasing power seems to have diminished but little, although there are signs that a fall will soon commence.

But there seems to be an excellent future in Japan for the British electrical engineer, whether it be in selling the larger and more complicated machinery and apparatus, not yet successfully made in the country, or in organising the manufacture there of the simpler goods. Great encouragement may be derived from the order placed with the English Electric Co. by the Imperial Government Railways for 34 electric locomotives.

Electrical Programme.

There is a vast programme of railway electrification which remains to be completed, and a number of hydro-electric combines have large power schemes in hand. A feature of the latter is the inclusion of storage plants requiring large and high dams. These plants would be run in parallel with a system of ordinary river plants and will supply the necessary power during the months when water is scarce, thus increasing the supplying capacity.

The Imperial Government Railways have adopted a ten years' improvement and extension scheme in pursuance of which they intend to construct 331 miles of road this year. One of the most notable undertakings in this direction is the submarine tunnelling at Shimonoseki. Experts have been engaged in studying the formation of the sea beds in the Straits and drawing plans which have at last been completed. In accordance with these plans the Railway authorities have decided to start work shortly and completion is expected by 1928 at an estimated cost of 18,000,000 yen. The tunnel, when constructed, will extend four miles. Another important undertaking to be started this year is the electrification of the Tokio-Yokosuka-Odawara lines. This work is to be completed by the end of the next fiscal year.

The following estimates have been approved by the Imperial Diet: Construction expenses, 67,750,200 yen; improvement expenses, 123,742,529 yen.

Sir E. T. Crowe does not devote much space to describing the iron and steel situation, which is of considerable interest to the electrical and allied trades. The subject was dealt with fairly exhaustively in a recent issue of *Commerce Reports*, where it was pointed out that Japan has made rapid strides in its wire manufacturing industry, and to-day is turning out wire rope, plain wire, and wire nails of good quality. The production of these commodities, however, is not sufficient to meet the needs of the Japanese, resulting in heavy purchases of foreign wire goods. The demand for wire products is principally in galvanised plain and bright wire and wire nails. To a less extent there is a call for wire rope and cable, insulated wire and cable, woven wire fencing, wire cloth and screening. The Japanese demand for wire manufactures is best presented by figures. In the five months ended May this year the Japanese market received from the United States 21,995 tons of galvanised plain wire, 15,527 tons of wire nails, 3,951 tons of bright wire, 131 tons of wire rope and cable, 148 tons of insulated wire and cable, 24 tons of wire fencing, 20 tons of wire cloth and screening, 122 tons of other nails (including tacks), and 1,108 tons of miscellaneous wire manufactures. Receipts in this period also included 322 tons of cut nails and 40 tons of horseshoe nails.

Boiler plates for the Japanese-made locomotive, war vessel, steamship, and other equipment are largely imported. In May of this year 1,839 tons of boiler plates and 2,189 tons of other steel plates of American manufacture were taken by the Japanese.

Steel Materials for Electrical Machinery.

Japan has also made great strides in electrical work and is turning out small motors and motor fans in sufficient quantities to preclude imports. Large machines in quantity, as well as transformers, are likewise manufactured. Hydroelectric power schemes comprise perhaps the greatest activity among present-day undertakings. Three of the big power companies have merged, and when the projects undertaken are completed, the four cities on the island of Honshu—Tokio, Kyoto, Osaka, and Kobe—will have bountiful supplies of electric power for their lighting and industrial needs. This activity has resulted in an increased demand for the steel materials required in electric power transmission and electrical machinery. Light structural shapes for transmission towers, electric cables, tinned armature binding wire, and electrical sheets (armature and transformer sheets) are the principal products of steel entering into this work. Transmission towers fabricated in the United States have been shipped, knocked down, in heavy tonnages in the past two years. Steel and aluminium cables have also been purchased from American manufacturers. It is estimated that the normal consumption of electrical sheets for transformers, dynamos, and motors, is in the neighbourhood of 10,000 tons in a year. There are 20 or more Japanese factories in which these sheets are used. In recent years about 80 per cent. of the sheets used in the electrical industry were of American manufacture. The American product runs more uniform in quality and thickness, and is therefore in great favour among the Japanese. In addition, states *Commerce Reports*, the Japanese market offers attractive opportunities for the so-called specialities, among which might be mentioned airplane wire, music wire, umbrella wire, galvanised telegraph and telephone wire, flat steel wire for clock springs, strip steel, box bands, cold-drawn screw stock, shafting, metal lath, expanded metal mesh, sheet steel piling, ammonia cylinders, and copper rail bonds.

The following statement shows the import and export trade of Japan in 1920 in electrical and similar goods. For purposes of comparison, figures for 1919 have been added, together with a note of increases or decreases.

IMPORTS.

Country whence imported	1919 Yen	1920 Yen	Increase or decrease Yen
Posts and materials for electric lines.			
United States	151,000	81,000	− 70,000
Submarine telegraph or telephone cables.			
United Kingdom	—	1,613,000	+ 1,613,000

Country whence imported	1919 Yen	1920 Yen	Inc. or dec. Yen
Insulated electric wire (metal armoured).—			
Total	71,000	1,000	− 70,000
United States	3,000	1,000	− 2,000
United Kingdom	68,000	—	− 68,000
Insulated electric wire, other.—			
Total	145,000	145,000	—
United States	145,000	140,000	− 5,000
Ammeters and voltmeters.—			
Total	255,000	309,000	+ 56,000
United Kingdom	1,000	4,000	+ 3,000
United States	250,000	301,000	+ 51,000
Voltmeters.—			
Total	519,000	306,000	− 213,000
United Kingdom	6,000	4,000	− 2,000
Switzerland	198,000	—	− 198,000
United States	292,000	173,000	− 119,000
France	21,000	93,000	+ 72,000
Accumulators.—			
Total	100,000	82,000	− 18,000
United Kingdom	3,000	—	− 3,000
Sweden	—	5,000	+ 5,000
United States	97,000	68,000	− 29,000
Telegraphic and telephonic instruments and parts.—			
Total	265,000	586,000	+ 321,000
United Kingdom	5,000	22,000	+ 17,000
France	8,000	3,000	− 5,000
Denmark	3,000	5,000	+ 2,000
United States	247,000	535,000	+ 288,000
Steam Boilers and parts.—			
Total	8,335,000	6,680,000	−1,655,000
Kwantung Province	6,000	1,000	− 5,000
United Kingdom	2,636,000	2,929,000	+ 293,000
United States	5,626,000	3,358,000	−2,268,000
Italy	2,000	226,000	+ 224,000
Steam turbines.—			
Total	836,000	1,701,000	+ 865,000
United Kingdom	—	91,000	+ 91,000
United States	558,000	1,521,000	+ 963,000
Switzerland	152,000	79,000	− 73,000
Steam Engines.—			
Total	540,000	491,000	− 49,000
United Kingdom	121,000	222,000	+ 101,000
United States	367,000	170,000	− 197,000
Italy		98,000	+ 98,000
France	35,000	—	− 35,000
Gas engines, petroleum engines, and hot-air engines.—			
Total	966,000	4,771,000	+3,805,000
United Kingdom	38,000	3,254,000	+3,216,000
Sweden	160,000	44,000	− 116,000
United States	757,000	818,000	+ 61,000
France	—	604,000	+ 604,000
Water turbines and Pelton wheels.—			
Total	1,787,000	779,000	−1,008,000
United Kingdom	637,000	—	− 637,000
France	355,000	41,000	− 314,000
Switzerland	778,000	91,000	687,000
Sweden	—	134,000	+ 134,000
United States	15,000	460,000	+ 445,000
Dynamos, motors, transformers, &c.—			
Total	5,245,000	6,080,000	+ 835,000
Kwantung Province	10,000	3,000	− 7,000
United Kingdom	187,000	376,000	+ 189,000
Sweden	292,000	975,000	+ 683,000
United States	4,763,000	5,485,000	+ 722,000
Dynamos combined with motive machinery.—			
Total	736,000	684,000	− 52,000
Kwantung Province	105,000	—	− 105,000
Sweden	199,000	—	− 199,000
United States	431,000	529,000	+ 98,000
Filaments for incandescent lamps.—			
Total	119,000	112,000	− 7,000
United Kingdom	15,000	24,000	+ 9,000
France	13,000	12,000	− 1,000
United States	89,000	65,000	− 24,000
Carbon for electrical use.—			
Total	682,000	583,000	− 99,000
United Kingdom	50,000	25,000	− 25,000
France	4,000	—	− 4,000
United States	627,000	554,000	− 93,000
Incandescent electric lamps.—			
Total	72,000	29,000	− 43,000
United Kingdom	1,000	8,000	+ 7,000
United States	70,000	21,000	− 49,000

EXPORTS.

Country to which exported	1919 Yen	1920 Yen	Inc. or dec. Yen
Electrical machinery and parts thereof.—			
Total	4,443,000	5,211,000	+ 768,000
China	1,409,000	1,326,000	− 83,000
Kwantung Province	1,687,000	1,468,000	− 219,000
Hong Kong	66,000	67,000	+ 1,000
British India	134,000	172,100	+ 38,000
British S.S.	35,000	52,000	+ 17,000
Dutch India	446,000	338,000	− 108,000
French Indo-China	33,000	10,000	− 23,000
Asiatic Russia	160,000	77,000	− 83,000
Philippine Islands	43,000	44,000	+ 1,000
Siam	39,000	10,000	− 29,000
United Kingdom	72,000	530,000	+ 458,000
France	39,000	89,000	+ 50,000
United States	6,000	16,000	+ 10,000
Canada	5,000	30,000	+ 25,000
Chile	17,000	11,000	− 6,000
Argentine	9,000	47,000	+ 38,000
Egypt	7,000	17,000	+ 10,000
Cape Colony and Natal	24,000	11,000	− 13,000
Australia	155,000	707,000	+ 552,000
New Zealand	27,000	108,000	+ 81,000
Peru	5,000	1,000	− 4,000
Brazil	—	11,000	+ 11,000
Telephones and parts thereof.—			
Total	630,000	641,000	+ 11,000
China	143,000	112,000	− 31,000
Kwantung Province	218,000	277,000	+ 59,000
Hong Kong	1,000	—	− 1,000
British India	5,000	—	− 5,000
Dutch India	36,000	1,000	− 35,000
Asiatic Russia	220,000	247,000	+ 27,000
Electric lamps.—			
Total	1,677,000	2,145,000	+ 468,000
China	456,000	293,000	− 163,000
Kwantung Province	196,000	162,000	− 34,000
Hong Kong	145,000	92,000	− 53,000
British India	39,000	33,000	− 6,000
British S.S.	17,000	7,000	− 10,000
Dutch India	39,000	14,000	− 25,000
French Indo-China	19,000	18,000	− 1,000
Asiatic Russia	60,000	10,000	− 50,000
Siam	23,000	16,000	− 7,000
United Kingdom	3,000	3,000	—
France	11,000	14,000	+ 3,000
Italy	65,000	112,000	+ 47,000
United States	351,000	951,000	+ 600,000
Canada	54,000	263,000	+ 209,000
Peru	13,000	22,000	+ 9,000
Chile	20,000	27,000	+ 7,000
Argentine	1,000	8,000	+ 7,000
Brazil	1,000	—	− 1,000
Egypt	26,000	14,000	− 12,000
Cape Colony and Natal	9,000	—	− 9,000
Australia	66,000	9,000	− 57,000
New Zealand	10,000	—	− 10,000
Philippine Islands	34,000	50,000	+ 16,000
Insulated electrical wire.—			
Total	8,411,000	8,043,000	− 368,000
China	1,445,000	3,863,000	+2,418,000
Kwantung Province	1,444,000	1,494,000	+ 50,000
Hong Kong	203,000	149,000	− 54,000
British Indies	195,000	328,000	+ 133,000
British S.S.	135,000	41,000	− 94,000
Dutch India	1,660,000	926,000	− 734,000
French Indo-China	51,000	77,000	+ 26,000
Asiatic Russia	906,000	436,000	− 470,000
Philippine Islands	23,000	3,000	− 20,000
Siam	96,000	117,000	+ 21,000
United Kingdom	—	1,000	+ 1,000
United States	6,000	25,000	+ 19,000
Peru	110,000	7,000	+ 103,000
Chile	111,000	207,000	+ 96,000
Argentine	367,000	137,000	− 230,000
Brazil	14,000	81,000	+ 67,000
Egypt	20,000	30,000	+ 10,000
Cape Colony and Natal	132,000	10,000	− 122,000
Australia	1,315,000	15,000	−1,300,000
New Zealand	141,000	21,000	− 120,000

Yen = 2s. 0½d. (normally).

Indian Trade.—H.M. Senior Trade Commissioner in India (Mr. T. M. Ainscough, O.B.E.) reports that the trade returns of British India for the month of August, 1922, published by the Department of Statistics, showed an increase in the values of both imports and exports as compared with the preceding month and the corresponding month of last year. There were, however, large decreases in the imports of machinery (Rs.94 lakhs), railway plant and rolling stock (Rs.67 lakhs), and electrical instruments (Rs.16 lakhs).

THE NORTH-EAST MIDLANDS ELECTRICITY DISTRICT.

Electricity Commissioners' Inquiry.

At the Town Hall, Sheffield, on October 17th, Sir John Snell (chairman), Sir Harry Haward (vice-chairman), Messrs. H. Booth and A. Page, accompanied by Mr. E. W. Hudson (solicitor), and Mr. D. S. Cumberlege, sat as an Electricity Commission to inquire into a scheme submitted by the Sheffield Corporation for the constitution of a Joint Electricity Authority for the North-East Midlands area.

Mr. W. E. Hart, town clerk, in presenting the case on behalf of the Sheffield Corporation, said that the Sheffield scheme* was the only one which had been submitted in response to the invitation of the Commissioners, and it had the support of the Rotherham Corporation, and in some measure that of the Chesterfield Corporation. From small beginnings they had built up a large and prosperous undertaking on which they had spent nearly four million pounds; in Sheffield they sold 103 million kWh per annum. The average total cost of electricity produced was 1.726d. per kWh, and the average price obtained was 1.75d.

They started with the advantage that the Commissioners had issued a Provisional Order determining the area,† but he hoped that the exclusion of Wath-on-Dearne was not final. The area covered by the scheme was about 1,030,000 acres, and the population about 1,320,000. Having regard to the size of the area, its population, and the intensity of its industry, it was a reasonable and suitable area; he believed it would lend itself to efficiency and economy. They submitted that the onus of any body asking for exclusion was to justify its case. There would be an important question as to the exclusion of the North-East Lincolnshire district.

The Town Clerk sketched the working of the scheme and said it was proposed to link up the Blackburn Meadows station with Rotherham, and from Rotherham or Blackburn Meadows there would be a line to Kiveton Park, Worksop, and Manton; for further supplies they would have to increase their plant at Blackburn Meadows. The second station would be at Sprotborough, near Doncaster, and from that station they would carry transmission lines to Doncaster. The third line would be through Kiveton Park, Barnboro, and on to Chesterfield.

Dealing with various objections, the Town Clerk said the West Riding County Council had sent in an objection stating the view that the time was not opportune owing to the financial condition of the country, and later it sent in a further objection that no scheme would be acceptable to it unless it made suitable provision for extending the supply throughout the district to all local authorities which had power to demand a bulk supply. While that was quite right as a matter of principle it was not a question that needed to be considered at the moment, because a supply was wanted, and the whole question was: Could it be included on terms that could be afforded? They were there to constitute an authority and not to discharge duties. The acquisition of existing undertakings would have to be carefully considered later.

A curious document had come from the Nottinghamshire County Council, he went on. All he could say with regard to it was that the person who compiled it did not appear to have read the Act of Parliament. The objection was that there was no provision in the scheme that existing stations should not be included in the scheme, and the Notts County Council also wanted to know what was going to happen in a few years. He submitted that that was not the question before the inquiry, which had only to consider whether an authority should be constituted.

The Town Clerk detailed other minor objections from local authorities and private interests, and concluded by pointing out that no alternative scheme had been offered.

Alderman R. Styring, chairman of the Parliamentary Committee of the Sheffield Corporation, traced the growth of the Department. He knew the iron fields in the North Lincolnshire area were supplying themselves, and would be able to do so for a considerable time, but he pointed out that eventually a large station on the Trent, which would be the natural source and centre, would be established. He thought Sheffield and Rotherham should have fifty per cent. of the representation on the authority when it was set up.

In cross-examination, Ald. Styring said the reason why the Notts & Derby Power Co. had not been invited to conferences on the question of forming the authority was that the company had had possession of part of the district for a considerable time and had done nothing in it. He thought the district would be better served by the authority than by the company. With regard to finance, the scheme would have to stand on its own bottom. He did not suggest that generating stations owned by the colliery companies should be scrapped; they might be used by the authority.

The Chairman pointed out that months had passed during which the company could have prepared its own proposals and commented on the fact that Sheffield was the only place that had the public spirit to submit a scheme to the Commissioners.

The inquiry was adjourned until October 18th, when Mr. F. Parker Rhodes, chairman of the Denton Main Colliery Ltd., gave evidence on behalf of the South Yorkshire Coalowners' Association. He said he looked with very great apprehension on any scheme which was likely in any way to increase the burden of the rates. For that reason the members of his Association were opposed to the extension of the district, to any further extent, by municipal effort. They were doubtful of the basis upon which the scheme was founded, but they did not wish to take up an attitude of sheer obstruction. There were probably many advantages in the idea of linking up the existing power stations contemplated by the municipalities, but it did not seem to members of his Association that, in order to bring that about, a scheme such as the present one was necessary. It was very desirable in the best interests of the district, that the existing Yorkshire Power Co. should be, as far as possible, allowed to develop its undertaking.

In cross-examination by the Town Clerk of Sheffield, Mr. Rhodes said he and those associated with him thought the time was not opportune to go to the expense of linking up existing stations, because they could not look far enough ahead into the future; also that municipalities were not the best people to conduct businesses of that kind. Something could be done to improve the present position, but this was not the time to do it. He characterised the scheme as a rather bold project to be put in hand at the present time, as they did not know what it was going to cost. "If you make a mistake," he continued, "you come back upon the rates, and that is what I object to. Municipalities should not be entrusted with business of this kind. I want somebody who makes a living out of industry to look after it."

Pressed by the Town Clerk as to the reason for his fears that there would be losses on the rates, he said he had to fall back upon his own unfortunate experience with regard to Rotherham's municipal enterprises—electricity, waterworks, and sewage schemes. The only advantage of linking up a station to a colliery would be that it would be a stand-by.

In reply to Sir Harry Haward, Mr. Rhodes said that what he had stated represented the views of the South Yorkshire coal owners. He would not like to commit himself to saying that it represented the views of owners outside that area because he was not intimate with their conditions. It might be very likely that the Cannock Chase colliery supported a scheme such as the one under consideration and asked for representation. Every colliery had to be taken on its merits; if he were the owner of a non-coking colliery, undoubtedly he would take advantage of it.

Mr. A. Page: You would not object if you had private enterprise represented on the Joint Authority?

Mr. Rhodes: If private enterprise is made responsible for the development then we have no objection, because we know private enterprise will not go faster than it ought to do, and will count the cost first.

Asked for his opinion on the subject of the possible development of electricity in mines, Mr. Rhodes said he was not an electrical expert, and there was a difference amongst mining men with regard to the use of electricity in collieries. There were undoubted objections to the increased use of electricity underground. In the view of some engineers the objections were small; in the view of others, with whom he agreed, they were very great. The use of electricity on the surface generally depended upon local circumstances and the plant. Broadly, it might be taken as an admission from him that for subsidiary purposes—apart from the main operation of winding—the use of electricity was advantageous and economical.

The Chairman: You use electricity in the mines in some cases?—Yes, for the pump and the fan.

Have any of your mines adopted electrical winding?—I don't know.

You know at least that one mine in this district is electrically wound?—I hope it will be borne out by results.

Is it inherent conservatism on your part that you have not adopted electricity fully in the mines?—Oh, no, we are not at all conservative; we adopt new methods if we think we are going to improve things, but we are not radicals.

Your view is that electricity will not be of use generally in this coal field?—I would not say that, but up to the present steam has been generally used. It may be that in the future electricity will be generally used.

Is it wise that those responsible for the industrial development of the country should sit down and do nothing?—I would leave it to the Power Co. in the district, and let it develop all it can.

That is not an answer. Having regard to the contingency of a bigger electrical area, is it wise to make a survey of the requirements of the area?—I don't quarrel with that.

Would not the logical conclusion of your attitude be that there would be no progress at all?—Not at all.

Mr. Walter Benton Jones, chairman of the South Yorkshire Coal Trades Association, agreed with Mr. Parker Rhodes' evidence, and said coalowners viewed with very great alarm the possibility of an electrical scheme being put into operation which was largely controlled by public bodies. In his view no such scheme as that proposed was necessary.

Sir Harry Haward pointed out that the scheme did not enable the authorities to put any charges on the rates other than the existing ones.

* Elec. Rev., July 15th, 1921; p. 103.
† Elec. Rev., October 1st, 1920; p. 434.

Mr. Jacques Abaday, on behalf of the Sheffield & Rotherham Manufacturers' Association, said they were not opposed to setting up a Joint Authority, but would support it, subject to safeguards and modifications. He contended that both Sheffield and Rotherham had more plant than they required at present, and asked that they should not buy more.

The Town Clerk of Sheffield said he would undertake that no further capital expenditure for plant should take place for five years without special application to the Commissioners and the Association Mr. Abaday represented.

On October 19th evidence was given by Mr. Charles P. Markham, of Chesterfield, chairman of the Staveley Coal and Iron Co., who represented the Derbyshire & Notts Coalowners' Association, which had a tonnage of 21 millions, coal and iron, per annum. He gave an account of the present electrical equipment of the collieries in the Doncaster area with which he is connected, and said the capacity was 9,000 kW. There was also 7,000 kW installed at the Parkgate Ironworks, which were on the same ring. They were about to supply the Great Northern Railway Co. with 3,000 kW, and were supplying the Doncaster Corporation and the village of Carcroft, and generally where people wanted electricity. Electricity was produced at an extremely cheap rate because, with the exception of Parkgate, it was all derived from exhaust steam turbines. The Staveley electrical line was from 35 to 40 miles long. At the Staveley works there was 9,000 kW, and the whole of the steam was derived from waste gases from the coke ovens and furnaces. In the works and collieries under his control in Derbyshire there was some 12,500 kW installed, 150 transformers, and a very considerable length of pipe line. They were supplying from Staveley about a quarter of what Sheffield was turning out. He had been anxious to extend the use of electricity. Various little companies had been started, and they had got the workmen to take shares in them. One of them was at Birmingham, another at Staveley. They were supplying Chesterfield Corporation with about a million kWh per year at 0.4d. They charged the little companies 1d. for high-pressure energy.

Sir John Snell said he had not been aware that electrical development in the Staveley district had gone so far.

Mr. Markham said the groups had rejected a scheme for a super power station. They preferred smaller units. He objected to the proposed new authority, on the grounds of its composition and its size, and suggested that there should be only six members—two from the Corporations, two from the iron and coal masters, and two from the consumers, with an independent chairman, possibly paid. An authority of 24 members would be unworkable. Corporation bodies were always changing, and there was no continuity of policy. They would be very much distressed, as manufacturers, if they were to be handed over to Corporations which admittedly could not produce as cheaply as they could produce themselves.

In cross-examination by the Town Clerk of Sheffield, Mr. Markham said that if the consumers' objections to representation were removed, they would still want to know what the big power stations (like Rotherham and Sheffield) were going to do. As manufacturers they looked with amazement on the antics of Rotherham and Sheffield, either of which huge stations would drive the whole district. He spoke of the Rotherham station as a huge white elephant, without even enough water for the turbines. There were private concerns possessing their own plant, and generating at less cost than the Sheffield Corporation could, and they did not like the idea of having to buy electricity from the Corporation at a very heavy price.

The Chairman: Are you not under a misconception. Nobody is going to compel you to buy from this authority.

Mr. Markhamh: We have been given to understand that we are bound to take electricity from the super power stations.

The Chairman said that was a misconception of the scheme, and Mr. Markham said in that case his objection fell to the ground.

The duplication of lines was then discussed, and witness said his groups would be willing to work with the Authority to avoid this.

Mr. Booth: So long as it is established that it won't, of necessity, interfere with you in any way, have you any objection to the Joint Authority?

Mr. Markham: No. In reply to the chairman, Mr. Markham added that he agreed with the principle of inter-connection.

Sir Henry Haward recalled Ald. Styring, and put to him a suggestion that, instead of Chesterfield having two representatives on the Authority, Doncaster two, and Worksop one, these three authorities, together with Mexborough, should have three representatives, thus leaving two places for manufacturers, colliery owners, railway companies, and others.

Ald. Styring thought this was an admirable suggestion.

Mr. W. M. Selvey, electrical engineer, gave technical evidence in support of the scheme, and described the proposed developments during the two periods of five years each. Among the possibilities which had been taken into account was the electrification of the railways, and provision had been made for the supply of 40,000 kW for that purpose in the second period of development. The scheme would be satisfactory.

The Town Clerk of Sheffield: It restricts the expenditure on capital as much as possible?

Mr. Selvey: That is so.

And you think that any other method than the one suggested would not be so effective?—That is so. This method will give an adequate supply at low running costs.

In cross-examination by Mr. Harker, the witness said that they estimated they would sell 401,000,000 kWh at the end of the first period of five years, of which about 261,500,000 kWh would be taken by Sheffield and district; Rotherham would take 86,000,000 kWh, Chesterfield 21,000,000, Doncaster 18,000,000, Mexborough 8,000,000, and Worksop 3,000,000. Of the 14,000,000 kWh that it was estimated would be sold in the Chesterfield "outside" area, Mr. Selvey thought about two-thirds would be supplied to collieries. He knew that collieries were making their own electricity before he heard Mr. Markham's evidence.

The estimated "individual development" coal consumption for the first period would be 391,000 tons compared with 355,000 tons under the scheme. This would mean a saving of 36,000 tons per annum. Questioned as to how this estimated consumption was arrived at, Mr. Selvey replied that the explanation would occupy a long time. He had had the full assistance of the most expert engineers in that area.

On October 20th Mr. H. F. Bidder continued the cross-examination of Mr. W. W. Selvey, who stated that, despite the fact that there was a large amount of spare energy in the form of waste heat and gases in the area, which would obviously be larger when the hoped-for revival of trade came, he had serious hopes of selling electricity in that district.

Answering Mr. W. P. Donald, the witness said that a striking feature of the times was the increasing number of new uses of electricity. The firms in Sheffield which supplied their own electricity were diminishing in number. There was every reasonable hope and belief that it would be possible to sell at the average price of 0.7d. under the scheme.

Mr. Selvey was re-examined by the Town Clerk of Rotherham with regard to the suggestion that one purpose of the scheme was to get rid of the Rotherham undertaking's surplus power. Mr. Selvey accepted that the minimum load in Rotherham that week had reached 20,000 kilowatts.

Mr. des Forges: With a maximum demand of 20,000 kilowatts you are getting towards the point where there is not the enormous surplus that the opposition seems to think there is likely to be?

Mr. Selvey: If anybody is coming after this surplus they had better hurry up. He went on to say that in view of the possibility, and almost certainty, that within a reasonable period there would be electrification of railway traction in this district, the railway load allowed for in the scheme was reasonable.

The Chairman pointed out that the cost of constructing the generating station at Sprotborough was estimated to be £15.9 per kilowatt. Before the war the cost would have been about £9. On what basis was that figure arrived at?

Mr. Selvey replied that the figures were frequently revised to keep pace with the advancing cost. It was his view that the basis of £15.9 per kilowatt would be likely to go down in the course of the next five years, which would mean that the estimates would be so much improved. Mr. Selvey emphasised that this was one of the best coalfields in England, with the best coal, the best pits, and the best area for development. It was likely to increase very much in the sense of the greater use of power in the production of coal.

The witness was asked to give his candid opinion as to the best delimitation of the district. Mr. Selvey agreed with the whole of the scheme except that he would not raise any objection to the exclusion of the Buxton area. The Worksop area would develop into a dense colliery district. East Retford should be included in the scheme as it could not get a supply from any other source. Gainsborough was a little remote at present, but in the end it would require and get a supply. A very great extension of industry would be seen at Scunthorpe, where the tendency was more and more to make the finished product instead of, as in the past, merely making the raw material of pig iron. He agreed with the suggestion of the Chairman that if the colliery companies combined with this scheme it would involve no increased cost to the collieries, a possible benefit to them from the sale of surplus energy, and additional safety during industrial trouble.

The Chairman: Looking at it from a purely engineering and economical point of view, is it your opinion that all these undertakings, both public and private, will in the course of time be interconnected so as to bring about the greatest benefit for all, as well as the greatest benefit to the individual in question?

Mr. Selvey: That is most emphatically my view.

This concluded the case for Sheffield, and Mr. des Forges, Town Clerk of Rotherham, then went into the witness-box on behalf of the Corporation. Having got its Order in 1898, he said, and the power station having been opened in 1901, the area developed electrically probably as rapidly as any other part of the country. In 1901-02, when the station was opened, the total number of kWh sold was about 87,000. Ten years later it had risen to 2,900,000. Then they got what they looked upon as the boom period of 1917-18, when they sold 21½ million kWh. During the slump period last year the sales fell to 18,000,000 kWh, but now they were returning again

to the more prosperous periods. They anticipated that this year they would exceed the sale of 40,000,000 kWh.

On October 21st Sir John Snell pointed out that the promoters had not put forward a definite proposal as to the terms on which they proposed to retain existing generating stations as part of the scheme. The Commissioners were, therefore, unable to say whether the resulting cost of electricity under the scheme would be greater or less than at present. He asked the promoters to give serious consideration to this matter.

Mr. Bidder, addressing the Commissioners on behalf of the L. & N.W. and the Midland Railway Companies, said their attitude towards the scheme was neither one of opposition nor of support. They were perfectly satisfied to leave the interests of electricity supply in the hands of the Commissioners, certain that the scheme which was ultimately sanctioned would meet their needs. It was certain that these railways would be electrified, and it was in view of a coming, but not in any sense an immediate, event that they asked for protection. The railway conditions in this area were very special; a combination which electrification would most benefit. Economical working could only be secured if a considerable area of railway was worked from the same source of supply. The railway companies asked the Commissioners to say that the amount of electricity which they would be entitled to take should be so defined as to include a supply that would take them to a reasonable distance from the source of supply, and the railway companies had agreed with the promoters upon a clause which they asked should be included in the final form of the scheme. With regard to the important question of the railway companies' right to demand a supply of electricity, the scheme conferred no such right at all.

Sir John Snell said the Commissioners' model clause, which would be inserted in the scheme, contained a definite requirement that the Joint Authority should supply a railway company on terms.

Dr. H. B. Fletcher strongly supported the scheme on behalf of the Dronfield Urban District Council, and complained of the neglect of the Derby and Notts. Electric Power Co., which had had the sole right to supply electricity in the district for the last 20 years. He said this neglect had hindered the development of the district. When Dronfield supported the Bill of the Derby & Notts. Co. in 1901, it was given to understand that the company would at once proceed with the erection of a generating station at Sheepbridge, but up to the present the only station it had supplying energy was at least 30 miles away, and consequently of no use to the Dronfield district. Anyone requiring electricity had to install the necessary plant and make it for himself, which six firms had already done, besides other private house lighting plant.

Mr. Farmer, on behalf of the West Riding County Council, said that body had passed a resolution expressing the opinion that the acquisition of electrical undertakings in the West Riding was economically impracticable at present. The County Council also urged that for the moment the Joint Electricity Authority should be considered an advisory or supervisory body, to make the best use of existing undertakings by linking-up and the extension, as far as was economically practicable, of generating and distributing plant. He was aware that this went to the root of the whole matter. It had been represented to the Commissioners that unless they set up such a body as the promoters proposed they could do nothing, but he suggested that this was not the case. There was no need to stagnate. The provisions of Section 4 of the Act of 1919 had been vitally affected by an amendment in the Act of 1922. The view of the County Council was that if people availed themselves of the section referred to, a great deal could be done by linking-up and that there was no necessity to set up a Joint Electricity Authority. The County Council also attached the greatest importance to direct representation on the Authority.

Mr. Skinner, for the Derbyshire County Council, also argued in favour of direct representation. The suggestion that the Derby & Notts. Power Co. should be excluded was a serious matter from the point of view of the District Councils in the south of the district, especially Matlock and Blackwell, because their potential source of supply at the moment must be the Power Co.

Mr. Featherstone, on behalf of the Worksop Urban District Council, gave general support to the scheme, but spoke strongly against the suggestion that Worksop should be deprived of direct representation.

The inquiry was then adjourned indefinitely.

Sir. John Snell suggested that during the adjournment the promoters should seriously consider the questions of representation which had been raised, and he also expressed the hope that some of the outstanding difficulties between the power companies and the promoters might be removed or improved before the resumption of the inquiry.

When Did It Happen?—We notice that the U.S. Department of Commerce is warning American manufacturers and exporters *not to overpay the postage on their foreign letters.* Well—well—

THE RADIO TELEPHONE BROADCASTING SCHEME.

Marconi Firms' Proposals.

To define the present position regarding the [illegible] broadcasting by wireless telephony, a fifth meeting of manufacturers was held on October 18th at the Institution of Electrical Engineers, over which Sir William Noble, formerly chief engineer to the General Post Office and now of the C.A.V. presided. Sir William explained the present position of the Postmaster-General and the company's one of complete [illegible] ment. On May 18th there was a meeting at the General Post Office of persons and firms concerned. Twenty-three firms were represented, and it was obvious that 23 could not build stations, so they had finally agreed to form one company—the British Broadcasting Co. This would be a [illegible] utility service for the broadcasting of news, information, concerts, lectures, educational matter, speeches, weather reports and theatrical entertainments"; it would have a capital of £100,000 in £1 shares, guaranteed by the British Thomson-Houston Co., Ltd.; General Electric Co., Ltd.; Marconi's Wireless Telegraph Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Radio Communication Co., Ltd.; and the Western Electric Co., Ltd.; which would be immediately responsible for £60,000 if necessary.

The directorate would consist of eight directors and a chairman. One director would be appointed by each of the six companies named and two by the other members of the company. These two directors would retire annually, but would be eligible for re-election. The chairman would be some well-known public man not connected with any of the constituting companies, and the company had secured the services of Lord Gainford, late P.M.G. These were the principal points in the Articles of Association.

The main provisions of the agreement were: Any *bona-fide* British manufacturer of wireless apparatus could join the company by taking one or more shares, and on signing the agreement the member would pay £50 (to show good faith). The money so received would not be used by the company, but put to a separate account and returned to a member should he leave the company. Every member must undertake that the apparatus he sold, except batteries, accumulators, and aerial equipment, was made in this country. He must engrave or otherwise mark the apparatus he sold, so that its origin was known. The royalty payable to the B. B. Co. would be:—

Description of Apparatus	Sum or Royalty payable.
On each crystal set	£0 7 6
On each microphonic amplifier without using valves	0 7 6
On each crystal set and one valve	1 7 6
On each crystal set and two valves	2 2 6
On one valve set	1 0 0
On each two-valve set	1 15 0
On each three-valve set	2 5 0
On each four-valve set	2 15 0
On each other set a royalty *pro rata* to the above	
On each telephone ear-piece	0 0 3
On each loud speaker with or without trumpets ...	0 3 0
On each valve	0 0 2

Broadcasting apparatus must not be made for any person not a member of the company, and under the conditions laid down for the sets to be approved by the P.M.G., only members of the company could have sets approved, which would be sealed and returned to the member, who would retain the sealed approved set for reference when necessary. Each set would be stamped with the approved mark "Type approved by P.M.G., B.B.C.," and a copy of the mark would be supplied to each member of the company.

For transmission purposes every member who had any inventions must give free use of them to the B.B.C.—*i.e.*, all patents would be pooled, so that the B.B.C. would be free of all royalties—that was one of the advantages of one broadcasting company.

By the licence the P.M.G. guaranteed the B.B. Co. that no foreign-made sets would be allowed to be sold for broadcasting purposes.

The Postmaster-General could not protect the company for a longer period than two years. That was to say, there would be no foreign competition for two years. The company, in consequence, would not guarantee the service for more than two years. Before that period expired, however, there would be a further conference. There had been a considerable concession with regard to wave length. The limitation of 500 metres had been abolished and there was now no limit. This would mean that anyone with a broadcasting set would not only be able to receive efficiently the broadcasting programmes, but would be able to tune in for any outside station.

It was confidently hoped that this would mean a [illegible] able addition to the numbers applying for licences so that the income of the B.B. Co. would enable it to provide really high-grade programmes. The Broadcasting Committee was fully alive to the necessity of having good programmes, and it was only by doing so that the success of the scheme would be assured.

Also, it was negotiating with the P.M.G. to get

authority to raise the power of the broadcasting stations from 1½ to 7 kW. [illegible] measure at least, Marconi House would be allowed as a broadcasting station for London, and it was promised that [illegible] would be at an early date a temporary station at Manchester.

The income to be raised by the P.M.G. for broadcasting would cost the [illegible] to the Post Office and 5/- to the B.B.C. The licence would apply only to apparatus with the approval of the P.M.G.

A general discussion followed and some doubt was expressed on whether the patent could be protected against illicit sets. According to the *Financier*, the company is limited to a maximum amount of 7½ per cent.

Sir W. [illegible] said that sets which had already been sold could not be sold [illegible] but if they did not comply with the Post Office [illegible] regulations the owners could not get a broadcasting licence. If traders had already in stock goods bought before July 15th from abroad, and satisfied the Postmaster-General on that point, they would be allowed to sell them.

Asked whether one who obtained parts from abroad, assembled them in the country, and sold them as British made was a [illegible] manufacturer, Sir William said it was intended that everything should be made in this country with the exceptions he had mentioned. Raw material could be imported, of course, as it could not be obtained in the country.

Mr. Godfrey Isaacs, of the Marconi Co., explained that the Broadcasting Co. was not to make profits. If 100,000 firms wanted to become members of the company, by the articles of association those which had more than one share would have to release them in order to admit the others. So that it was possible to have 100,000 shareholders holding one share each.

Mr. Phillips, a manufacturer's representative, explained in detail the safeguards the Postmaster-General had insisted on in order to ensure equality for all manufacturers, large and small.

A resolution empowering the committee to proceed with the registration of the Broadcasting Co. was carried unanimously.

The committee of the Radio Association, at a meeting held on October 18th to consider the proceedings of the British Broadcasting Co's. meeting, issued the following statement:

"The Radio Association deplores the fact that thousands of licence-holders were entirely ignored in settling the form which broadcasting is to take, and that the general public is receiving no adequate protection against the growth of a monopoly.

"Those present at the meeting were afforded no opportunity of seeing the articles of association of the company, although they gave practically unlimited powers to a small group.

"A deposit of £50 is to be demanded from small manufacturers who subscribe for a £1 share. What is the purpose of this deposit, and to whom does it go."

"The royalties are altogether too excessive, and bid fair to cripple an important British industry.

"The Radio Association looks to the Postmaster-General to give an early explanation of these measures."

THE SOUTH-WEST MIDLANDS ELECTRICITY DISTRICT.

Establishment of Advisory Joint Committee.

It will be recalled that, in accordance with the provisions of the Electricity (Supply) Act, 1919, the Electricity Commission provisionally delimited the above-named district in October, 1920, in August, 1921, the Birmingham Corporation and the Shropshire, Worcestershire & Staffordshire Electric Power Co. submitted a joint scheme for the re-organisation of the existing supply of electricity within the area, and the Commissioners held their first inquiry in connection with the matter in November of the same year. The decisions come to by them as a result of that inquiry were announced in March, 1922, and in the following July the Electricity Commissioners held their second local inquiry.

The matter has now been carried a step further by the issue of the Electricity Commissioners' South-West Midlands Electricity District Order, 1922, constituting the district and establishing the South West Midlands Advisory Joint Committee (appointed by the Birmingham Corporation and the Shropshire, &c., Co.).

The Order [illegible] has been submitted to the Minister of Transport for confirmation, and will come into operation as soon as it has been approved by a resolution passed in each House of Parliament, is a brief one. The scheme constituting the district and establishing the Committee is set out in a schedule, while the first annex contains the main outlines of the technical scheme. The second annex gives the agreements that have been come to between the Birmingham Corporation, the Leicestershire & Warwickshire Electric Power Co., and the Shropshire, Worcestershire & Staffordshire Electric Power Co. The third annex contains additional provisions as to the generation and transmission of electricity.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North Eastern Centre Chairman's Address.

The opening meeting of the 1922-23 session of the North-Eastern Centre was held at Newcastle-on-Tyne, on October 23rd, when Mr. J. G. C. Baldwin delivered his inaugural address. At the last annual meeting Mr. Fawssett was elected chairman, but, acting upon medical advice, he declined the position, and Mr. Baldwin, who had been elected one of the vice-chairmen, undertook to fill the vacancy.

Mr. Baldwin took as his subject "The Progress and Potentialities of the Telephone in the United Kingdom," and opened with an interesting historical *résumé*.

In the United States at present there was one telephone to approximately eight of the population of 105,000,000. The development in the United Kingdom, with a population of 47,000,000, had never attained to more than one telephone station to 89 of the population. Telephone development in this country would depend primarily upon a return of commercial prosperity, and also on a better appreciation on the part of the public of the facilities afforded by a liberal provision of telephones.

Rapid development soon created, at the larger exchanges, serious difficulties in switching, which were eventually surmounted by the invention of the "multiple." It is not generally known that, although the multiple was invented and eventually perfected in America, it was devised independently in this country (much about the same time) by Mr. F. B. O. Hawes, of the United Telephone Co. Unfortunately he did not benefit by his invention, being forestalled by the patenting of the American product in this country.

It had been left for the British Post Office to conduct the first experiments in automatic switching in this country. The experiments were commenced in 1902, and the first automatic exchange was opened by the British P.O. in May, 1912, at Epsom. Since then 17 such exchanges had been placed in commission, their capacities ranging from 75 to 9,600 lines. The equipment for 9 of them was of the Automatic Telephone Co.'s type; for four of the Siemens type (two village); for two of the Western Electric Co.'s rotary type, one was of the Lorimer type, and one of the "Relay" pattern. Four exchanges were on order for Dundee (North Electric, 3,500 lines), Marton, Yorks. (Automatic Telephone Manufacturing Co., 80 lines); Southampton and Swansea (Siemens, 3,500 lines).

The questions whether automatic apparatus would satisfactorily fulfil the necessary switching functions, whether the British climate would affect prejudicially the operation of machine switching; and whether the British public would receive the automatic system favourably had been answered in favour of the automatic system. Hitherto the policy adopted by the Post Office had been confined to the application of automatic working to individual exchanges, and in no case had a self-contained area been dealt with. Plans were now, however, in hand for the establishment of automatic working in a number of multi-exchange areas, wherein the whole of the local traffic between exchanges situate therein would be dealt with exclusively by machine switching. There were possibilities of effecting large savings by the establishment of machine switching and the adoption of automatic working on a large scale in certain multi-exchange areas might be expected in the near future.

The Chairman then referred to long-distance telephony and concluded with an interesting reference to radio-telephony.

Prospecting by Electricity.—In a recent issue of *Le Génie Civil*, J. Machaut reviews the various methods of ore prospecting by electrical and other means. He refers, *inter alia*, to the application of Hertzian waves tried by Loewy (Austrian) and Lembach (German). The first method tried was not very satisfactory, as, in order to obtain accurate results, very short wave lengths are necessary, and the waves have to be capable of orientation. Further, the receiving set should be portable. The other method, due to the same authors, seems more easy of application. It is based on the variation in capacity of a transmitting aerial with the dielectric constant of the surrounding medium. This increased capacity is converted into an increase in the wave-length transmitted, this increase being easily measurable by wavemeters. Considerable space is devoted, with illustrations, to Schlumberger's method, based on the electrical conductivity of the earth. Conductivity is of two types: (1) metallic conductivity peculiar to the metals and certain minerals (pyrites, mispickel, pyrolusite, magnetite), the current being transmitted through these substances without any transport of matter or chemical reaction. (2) Electrolytic conductivity (water containing salts in solution), as a result of which electricity is propagated through these liquids, giving rise to chemical reactions by the dissociation of the salts in solution into positive and negative ions. The method of sending the current into the ground and measuring the results, &c., are described. It would appear that the latter method is the one most promising in results. Apparatus have already been constructed for applying this method.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Electric Fire.

A number of new and improved designs of electric fires for the coming winter have been put on the market by Messrs. Belling & Co., Derby Road Works, Montague Road, Upper Edmonton, N.18. Fig. 1 illustrates one of these which is of a novel shape and construction. The heating element is in two 1-kW bars. One of these is controlled by a separate switch, while the other is operated by a two-way switch



Fig. 1.—The Belling "Duplex" Fire.

which also controls the element of a boiling ring fitted in the top of the appliance. The body of the fire is of oval shape, the top and bottom are made of cast iron while the main body is of sheet steel. The dimensions of the fire are:—Height 17 in., width 18 in., and depth 11 in.

The Ampliphone.

A writer in *Le Génie Civil*, for September 16th, describes a new type of loud-speaking receiver for wireless sets. The general arrangement of this is shown in the illustration, fig. 2. In the "ampliphone," as M. Quinet, the inventor, calls the new device, a small moving coil B, 25 mm. in diameter, is suspended from a corrugated membrane M. The coil has a fine wire winding connected to the primary *p* of a transformer T, the secondary *s* of which is connected to the ordinary amplifier of the receiving set. The coil B is free to oscillate inside the annular magnetic field NS, formed by a winding E on the centre core N of the magnet, and taking 1 ampere at 6 volts. The 2-mm. annular air gap

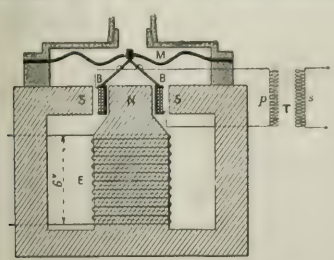


Fig. 2.—The Ampliphone (Section).

between N and S is sufficient to allow the coil to oscillate and vibrate the membrane M by the combined action of the magnetic field and the current received from the transformer.

The coil B, the casing of which is non-metallic, is stoutly fixed by a light non-magnetic cone to the centre of a German silver diaphragm 80 mm. in diameter, and 0.3 mm. thick. This diaphragm, which is corrugated, is securely fixed to the edges by screws. It is surmounted by a resonance box and a thick mouth-piece not shown in the figure.

Moorwood Fires.

A new line of electric fires has been placed on the market by Messrs. Moorwoods, Ltd., of Harleston Iron Works, Sheffield, in which is embodied a patent heating element, shown in fig. 3. This element consists of a base of white refractory material with shallow grooves separated from one another by a very thin web; the heating strip is not coiled but zig-zagged in one piece only, thus making a flat element which lies between the webs. It is claimed that the strip thus formed is so strong, even when hot, that it cannot sag or drop, and that touching of adjacent turns is quite impossible. When in use, owing to the thinness of the webs allowing the strip elements to lie close together, the appearance produced is that of a solid red hot bar.

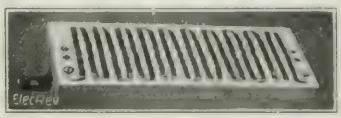


Fig. 3.—Moorwood Heating Element.

This element is standardised for all the Moorwood fires and cooking apparatus, and is so designed that the electrical connections are made in the act of mechanically fixing the element in place; this is a simple operation, being effected by means of a couple of wing nuts. Similarly the back cover of the fire is secured in place with wing nuts, and an element can thus be replaced without using any tool. Fig. 4 shows a two-bar fire, with two rotary switches; the elements when in place are slightly proud of the surrounding frame, so

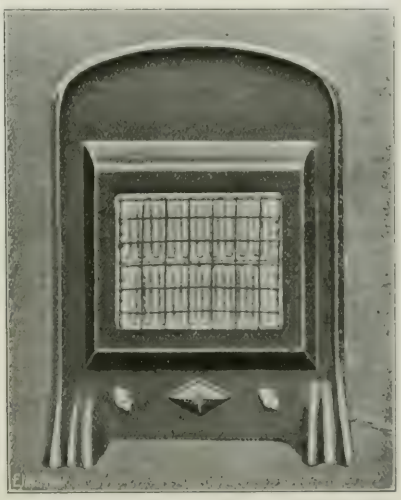


Fig. 4.—Moorwood Fire.

that the frame receives little heat, and the heat is radiated over a wide angle. The insulation is of mica, and all connections, &c., are concealed from view. The makers claim that the element is practically indestructible, and its construction enables the heating strip of a boiling plate, for instance, to be brought very close to the bottom of the utensil which is being heated. A heat-resisting handle is fixed on all Moorwood fires.

"Falco" Rustless Steel Fires.

"Falco" electric fires and heaters need no introduction, but amongst the 1922-23 season's designs, the Falkirk Iron Co., Ltd., of Falkirk, has produced something new in such devices. The appeal of the rustless steel electric fire should be irresistible for several reasons; indeed, it may truly claim to be a labour-saving appliance. Not only does the electrical equipment eliminate all dirt, dust, and smell, but the rustless steel body carries the matter a stage further and will keep clean without constant attention. Two patterns are at present available; the "Argyll" has a 2-in. frame with moulding mounting on the outer edge, flat splays to the fire and berry moulding round the edge, while the "Darnley" has a 2-in. O.G. frame with curved coves to the fire and bob moulding fitted on the edge. Both types are provided with a trivet bob, two switched and five of the makers' standard bars (capacity: 3,750 watts), being otherwise of standard construction. The overall dimensions of the new fires are: height 24¼ in., width 18 in., depth 7¼ in., and the weight is 35 lb. They are neat in appearance and should prove a great convenience.

NEW PATENTS APPLIED FOR, 1922.
(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C.1.

27,072. "Device for ... of suspended insulator chains." A. Remanitin. October 9th. (France, October 8th, 1921.)
27,089. "Electric ... for motor-cars, &c." P. G. P. McCulloch and W. E. Marshall. October 6th.
27,090. "Electric ... for motor-cars, &c." P. G. P. McCulloch and W. E. Marshall. October 6th.
27,091. "Electric ... for motor-cars, &c." P. G. P. McCulloch and W. E. Marshall. October 6th.
27,094. "Distributors for magneto-electric machines." British Thomson-Houston Co., Ltd., H. W. H. Warren and A. P. Young. October 6th.
27,095. "Electric motors." British Thomson-Houston Co., Ltd. (General Electric Co.). October 6th.
27,096. "Control of electric switches." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. October 6th.
27,097. "Multiple-armature relay." F. Aldendorff. October 6th. (Germany, October 19th, 1921.)
27,106. "Leclanché batteries." E. E. Dutt and S. H. Godfrey. October 6th.
27,118. "Sky signs." J. M. Dickie. October 6th.
27,124. "Electrically-propelled vehicles." F. Foster. October 7th.
27,134. "Knobs, terminals, &c." A. Round and R. W. Seeby. October 7th.
27,144. "Head lamps for motor, &c., vehicles." C. B. Robinson and Robinson Bros., Ltd. October 7th.
27,158. "Electric switch." M. C. Richardson, Richardson & Whittaker, and J. E. Whittaker. October 7th.
27,168. "Dynamo-electric machines." Electro Dynamic Construction Co., Ltd., and N. Pensabene. October 7th.
27,171. "Alternating-current dynamo-electric machinery." Metropolitan-Vickers Electrical Co., Ltd., and G. M. Pestarini. October 7th.
27,172. "Electric switchgear." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. October 7th.
27,180. "Apparatus for use with high-frequency circuits of telegraphic or telephonic systems." J. A. Coomes and J. A. Coomes & Co., Ltd. October 7th.
27,181. "Sound-amplifying instruments." J. A. Coomes & Co., Ltd., and J. A. Coomes. October 7th.
27,201. "Roofs, and lighting of same." British Thomson-Houston Co., Ltd. October 7th.
27,242. "Chain for suspending electric fittings." A. N. Haddow and A. P. Rutherford. October 9th.
27,245. "Sparking plugs." H. Martin. October 9th.
27,261. "Machinery for conversion of alternating into continuous current." E. E. Dutt. October 9th.
27,262. "Wireless apparatus." A. Stewart and A. Campbell. October 9th.
27,268. "Valves for wireless telegraphy and telephony." A. Collins. October 9th.
27,270. "Train control." A. L. Ruthven. October 9th.
27,280. "Electric lamps." A. S. Siccama. October 9th.
27,294. "Electric warning devices for sparking motors." Vox Maschinen Akt. Ges. October 9th. (Germany, January 16th.)
27,295. "Conductor rails for electric railways, &c." Siluminite Insulator Co., Ltd., and F. V. Wythes. October 9th.
27,300. "Electric switches." C. D. S. Cranke. October 9th.
27,323. "Automatic devices for opening and closing electric circuits." A. E. M. Van der Meesch. October 9th.
27,340. "Passenger cars." W. Voss. October 9th. (United States, October 8th, 1921.)
27,376. "Memorandum-recording attachments for telephones." A. P. Hennessy. October 10th.
27,390. "Amplifying device for sparking plugs." J. C. Blow and W. Holmes. October 10th.
27,411. "Wireless aerial tuning inductances." J. B. Bignamy. October 10th.
27,412. "Wireless one-unit telephone receiving sets and intervalve coupling." J. B. Bignamy. October 10th.
27,424. "Sparking plugs." G. H. Wilson. October 10th.
27,442. "Electric transformer oil boxes." Akt. Ges. Brown, Boveri et Cie. October 10th. (Switzerland, October 15th, 1921.)
27,443. "Speed-controlling mechanism for papermaking, &c., machines." British Thomson-Houston Co., Ltd. (General Electric Co.). October 10th.
27,464. "Arrangement for high-frequency telegraphy or telephony." Dr. E. F. Huth Ges. October 10th. (Germany, August 30th.)
27,490. "Crystal detectors for wireless apparatus." W. C. J. Schlie. October 11th.
27,510. "Wireless telephone apparatus." Dudley Limber and Saw Mills, Ltd., and C. Goodall. October 11th.
27,526. "Electric signalling apparatus." F. C. Tipping. October 11th.
27,529. "Magneto apparatus." A. F. Dixon and H. H. Thompson. October 11th.
27,544. "Electric ... apparatus ... switching mechanism." T. B. Hewett and Metropolitan Electric Tramways, Ltd. October 11th.
27,547. "Electric heating devices." A. Ryner. October 11th.
27,561. "Electric ... of sound." S. G. Brown. October 11th.
27,564. "Means for reception and or reproduction of vibrations." E. W. C. Russell. October 11th.
27,567. "Electric ... tubes &c." C. O. Tuke and General Electric Co., Ltd. October 11th.
27,575. "Electric accumulators." J. A. Hill. October 11th.
27,582. "Electric ... apparatus ... Naamlooze Vennootschap Philips' Gloeilampenfabriken. October 11th. (Holland, October 27th, 1921.)
27,583. "Electric ... Maschinenfabrik ... October 11th. (Belgium, January 13th.)
27,584. "Electric ... H. Maurer Comm. Ges. October 11th. (Switzerland, October 18th, 1921.)
27,612. "Electric light baths." W. M. Edwards. October 12th.
27,639. "Apparatus for notching or punching core plates for dynamo-electric machines &c." F. O. Adams and Lancashire Dynamo and Motor Co., Ltd. October 12th.
27,650. "Electric ... G. McKenzie. October 12th.
27,665. "Coils, holder, formers, or containers for wireless telegraphy, &c." G. H. ... October 12th.
27,668. "Sparking plugs." M. S. Mason and Smithbrook Engineering Co., Ltd. October 12th.
27,670. "Electric ... E. Hess. October 12th.
27,678. "Slip fitting for electric conduit, &c., tubes." R. J. Murphy and C. L. Reed. October 12th.
27,681. "Control of trains." A. R. Angus. October 12th.
27,700. "Electric connection fittings." B. G. Stephens. October 12th.
27,701. "Means for production or reproduction of sound, &c., vibrations." S. G. Brown. October 12th.
27,704. "Electric discharge tubes." General Electric Co., Ltd., J. W. Ryde. October 12th.
27,716. "Electric ... S. Pope. October 12th.
27,719. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co. ...). October 12th.
27,722. "Electric transmission or reproduction of sound." S. G. Brown. October 12th.
27,723. "Electron discharge devices." British Thomson-Houston Co., Ltd. October 12th. (United States, October 13th, 1921.)
27,726. "Magnetic separators." B. H. Bedell. October 12th.
27,737. "Electric vulcaniser." J. S. Bones and F. Ellenger. October 13th.
27,754. "Sparking plugs." C. Bichler, J. Hughes, and L. Marseille. October 13th. (France, October 15th, 1921.)
27,757. "Repairing broken trolley wires of tramways." J. W. Waddington. October 13th.
27,761. "Tramway loops and points." J. E. Heywood. October 13th.
27,766. "Electric bells." Cable Accessories Co., Ltd., P. W. Davies, and T. H. Reeves. October 13th.
27,804. "Instruments for reception of telephonic sounds." B. G. Steggles. October 13th.
27,822. "Sparking plugs." V. K. C. Logan and A. H. Seton. October 13th.
27,833. "Outdoor junction boxes for electric circuits." Johnson and Phillips, Ltd., and W. J. P. Orton. October 13th.
27,857. "Electric ... systems." R. H. Carter and Siemens Bros. and Co. (Laidlaw partly). (E. A. Laidlaw). October 13th.
27,850. "Electric installations." H. Crochat Etablissements. October 13th. (Belgium, October 14th, 1921.)
27,858. "Dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd., and G. M. Pestarini. October 13th.
27,866. "Rheostats." H. Saville and C. H. Thornton. October 14th.
27,867. "Variable electric condensers." H. Saville and C. H. Thornton. October 14th.
27,868. "Systems of generation of alternating currents." E. V. Robinson. October 14th.
27,877. "Variable resistance devices." H. P. T. Letroy. October 14th.
27,886. "Sparking plugs." H. G. Longford and A. H. Seton, Sphinx Manufacturing Co., Ltd. October 14th.
27,889. "Wireless apparatus." A. S. Gosling. October 14th.
27,892. "Commutators, &c." A. Leigh. October 14th.
27,894. "Magneto electric machines." R. Bosch Akt. Ges. October 14th. (Germany, November 11th, 1921.)
27,914. "Electricity meters." R. Amberton and R. H. Barbour. October 14th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed, and abridged, and all subsequent proceedings will be taken.

1921.

9,493. "Electric motors." R. Minicus. March 24th, 1921. (186,362.)
14,411. "Visual signalling apparatus for use in connection with colliery and like winding." T. Modgeley and R. A. Hopkinson. May 23rd, 1921. (186,373.)
14,341. "Electrically-actuated clocks." M. P. Favre-Bulle. May 23rd, 1921. (Convention date not granted.) (163,694.)
14,659. "Electric heaters." C. H. W. Morrison and M. & P. Enterprises, Ltd. May 26th, 1921. (186,383.)
14,872. "Telephone call distributing systems." Western Electric Co. and G. Deakin. May 28th, 1921. (186,388.)
15,028. "Electrical controlling devices for electric motors." M. Walker. May 31st, 1921. (186,389.)
16,629. "Dynamo-electric machines for motor-cycles and the like." S. L. Price. June 16th, 1921. (186,391.)
17,115. "Inductances for loading telephone circuits." Felten and Guilleaume Carlswerk Akt. Ges. June 25th, 1920. (Addition to 157,316.) (165,403.)
17,300. "Electric switches." J. B. Tucker. June 24th, 1921. (186,408.)
17,326. "Influence electrical machines." L. Vogel. July 2nd, 1920. (165,725.)
17,331. "Safety apparatus for the automatic disconnection of faulty electric circuit sections." M. Hochstadter. June 24th, 1921. (Patent of addition not granted.) (186,413.)
17,461. "Automatic electric cut-outs for dynamo-electric machines." J. B. Bignamy. June 27th, 1921. (Cognate application 24,356/21.) (186,418.)
17,518. "System for long-distance control of electric motors from one of a plurality of controlling stations." W. J. Mellersh-Jackson (Soc. des Etablissements Gaument). June 27th, 1921. (186,420.)
17,859. "Oscillating-gear applicable for electric fans and other purposes." A. H. Railing and A. E. Angold. July 1st, 1921. (186,429.)
17,958. "Electro-magnetic and polarised relays." T. Lenaghan. July 1st, 1921. (186,433.)
18,358. "Distant control device for electric circuits." P. Nouvel. August 12th, 1920. (167,747.)
18,474. "Electrically-heated ovens." H. H. Berry. July 7th, 1921. (186,449.)
18,753. "Electrical measuring instruments." J. W. Record. July 12th, 1921. (186,454.)
19,375. "Self-aligning contacts for electrical apparatus." B. Raettig. July 18th, 1921. (186,465.)
19,394. "Means for introducing capacity effect in alternating electric current systems and apparatus." T. F. Wall. July 19th, 1921. (186,467.)
19,586. "Renewal of the filaments of thermionic valves for use in wireless telegraphy or the like." A. H. S. Colebrooke and W. A. Williams. July 21st, 1921. (186,469.)
19,660. "Electric drives for paper machines and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). July 21st, 1921. (186,470.)
20,666. "Electric player for pianos and similar instruments." J. Lawler. August 3rd, 1921. (186,484.)
22,074. "Automatic trolley retrievers for electric tramcars." Chilian Electric Tramway & Light Co., Ltd. (A. Bowen). August 19th, 1921. (186,494.)
22,334. "Terminal block or switch for electric motors adapted for running on alternating or continuous current supply." W. C. Fairweather (Desk Manufacturing Co.). August 23rd, 1921. (186,496.)
22,381. "Manufacture of tungsten." General Electric Co., Ltd., and C. J. Smithalls. August 23rd, 1921. (186,497.)
22,585. "Electrodes, more particularly for electron-discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). August 25th, 1921. (186,499.)
22,798. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 2nd, 1920. (168,508.)
23,953. "Protective devices for electric transformers." T. W. Ross and Metropolitan-Vickers Electrical Co., Ltd. September 8th, 1921. (186,514.)
26,038. "Automatic electricity meter." O. K. Heesch. August 27th, 1921. (186,534.)
27,678. "Electric switches and the like." G. Ellison. October 18th, 1921. (186,627.)
27,678. "Electric switches and the like." G. Ellison. October 18th, 1921. (186,527.)
30,158. "Electric cooking utensils." H. Graetz and F. Graetz. November 11th, 1921. (186,538.)
30,687. "Mercury-vapour lamps for curative light treatment." Ges. Quarzlampen. December 30th, 1920. (173,525.)

1922.

3,553. "Telephone call distribution system." Western Electric Co., Ltd., and ... February 7th, 1922. (186,556.)
3,975. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (General Electric Co.). February 10th, 1922. (186,557.)
16,973. "Motor-driven sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (Divided application on 185,024.) (186,565.)

THE

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EFFICIENCY IN INDUSTRY.

INDUSTRIAL unrest, as we have pointed out in these columns more than once, arises from a multitude of causes. Nothing could be more foolish, then, than to act as if it were the consequence of one cause only; and the advocacy of one specific remedy as the certain cure for the disease, when it can, at best, merely allay one or two troublesome symptoms, must lead but to its aggravation.

Industry depends upon trade. A product cannot be manufactured unless it has first been sold, and the fact of a sale presupposes the existence of a buyer. Markets do not spring up by themselves, but have to be discovered and built up. A market may exist in a potential form, for there was a use to which the plough could be put ages before prehistoric man discovered that plants grew from seeds; but before an article can be sold, there must be a prospective use for it, a prospective user of it, and the wherewithal to pay for it, either at once or at some future time. Thus, in spite of the superficial and inaccurate thinking of some modern economists, there is a real need for the trader; and since the place of use is seldom the best place for manufacture, there is need for the transporter too.

Reasoning in this way, it is not difficult to build up the whole complex fabric of modern life, or rather, to see how it has been built up during the course of ages. Everything has arisen as a result of the two primary needs, or instincts—self-preservation and reproduction.

Since industry depends upon trade, and one essential of trading is something to pay with, the financier is evolved. He depends, for the funds with which his business is done, upon savings, that is to say, upon the practice of economy. Those who save and invest their savings are not only providing for themselves, but are making it possible for others to support themselves.

Unemployment is the result of depression in manufacturing industries. There are limits to the possibilities of manufacturing for stock, especially during a period of falling prices, and in most cases these limits have been reached, if not passed, long since. If manufacturing industries are to be revived, orders for goods have got to be obtained, so that energetic selling is one of the first essentials. Next, since this is a country which cannot live without imports, the export market must be properly cultivated, and in the case of the war impoverished countries, the prospective customers must be rendered able to buy.

The market having been obtained, and being sedulously cultivated all the time, it is necessary to see that the best and most economical methods of production are employed. This does not mean the lowering of wages, or it need not mean that. It does not mean only the abolition of ca' canny and restriction of output. The blame for high costs of production cannot truthfully be laid at the door of the worker only. The limits between which a selling price must lie are, on the one hand, the cost of manufacture, and on the other, the price at which the prospective user will not find the purchase a paying proposition. Electricity cannot be sold at 0.1d. per kWh, for that is below the cost of generation

and distribution; and it cannot be sold at £1 per kWh. because people would use gas, or candles, or go to bed early. So production costs must be as low as possible, and every means that exists of getting and keeping them low must be employed.

This necessitates the use of the best equipment, and it also necessitates the most efficient use of that equipment when installed. This sounds obvious enough, but it is far from being universally the case that a manufacturing plant is used in the best possible manner. It is not a question of machines only, though machines enter largely into it. Feeder departments often do not lead up properly to the assembling department. Different parts of the same apparatus do not synchronise in their arrival, and some are kept waiting about, occupying floor space and preventing its legitimate use, and being exposed at the same time to the possibility of damage. Parts do not assemble properly when they do arrive, and time has to be wasted in the making of adjustments which ought not to be necessary. In electrical apparatus it too often happens that many things are left to be done in the shops which ought to have been properly laid out in the drawing office. This not only wastes time in the first place, but may lead to breakdown on test, and to unnecessary trouble perhaps years after, if repairs are required.

All these are points for which, not the worker, but the management and the staff are responsible. They all add to the cost, and consequently to the difficulty of selling the product. In those cases in which selling prices are regulated by groups of manufacturers, the price level arrived at should be that at which one can afford to sell and should have a definite relation to the cost of production. The fixing of prices for munitions on a basis of the production costs of the worst-equipped factory in a district cost the country countless millions during the war.

Many ways in which manufacturing efficiency can be improved are dealt with in a useful little book by Mr. J. E. Powell, entitled "The Output Problem."* It appears, from Mr. Powell's experience, that it is no uncommon thing for a manufacturer not to have any approach to an accurate notion as to the output of which his plant is capable. Indeed, he goes so far as to say that the existence of the premium system of payment by results may be regarded as an admission of inability to estimate the possible output—but we anticipate. We consider that he amply proves the case for the existence of a Progress Department, whose duty it shall be to co-ordinate effort and remove causes of delay between departments and between sections.

Manufacturing processes must be the subject of careful thought by men trained for the work. A great deal too much is left to foremen, who already have enough to do in arranging the work of the operatives. There are very few foremen in engineering works who will not get a job done. They will make an attempt at it, and generally the result will be satisfactory, but it is far from probable that it has been accomplished in the most efficient way. The planning of the work must be done in the office and possible difficulties must be anticipated. Shop experience, of course, needs to be duly taken into consideration, and with a combination of skilful planning and practical knowledge, the best methods of carrying out the work ought to be capable of being evolved. The capacity of machines and tools of modern design must necessarily, if the proper research has been carried out, be better known in the office than in the shop which is about to make its first use of them, and plant must be worked at its best efficiency. It does not pay to take care of the machines at the expense of a reduced output.

The question of the record of industry has an important bearing upon the subject of efficiency, but we must reserve consideration of this for another occasion.

* "The Output Problem." By J. E. Powell. London: The Library Press, Ltd. Pp. x + 108. 6s. net. (The Manufacturing Problem Series, edited by Edward T. Elbourne.)

High-Pressure Transmission.

An article published in *The Times Trade Supplement* recently brought together some interesting data with regard to the development of power transmission over great distances at very high pressures in the United States, showing how the success of the 240-mile Big Creek line from the hydro-electric stations in the mountains to Los Angeles, working at 150,000 volts, led to the construction of a 186-mile line to San Francisco working at 165,000 volts, and this again was followed by the adoption of a pressure of 220,000 volts for a line 200 miles long from Pit River to San Francisco, to carry 120,000 kW, with a loss in transmission of only 7 per cent.

The cost of these remarkable installations per kilowatt and per mile decreases as the pressure is increased, though not in the same proportion; the carrying capacity increases as the square of the pressure, while the cost is roughly in proportion to the pressure. Hence raising the pressure is economically sound practice, provided that the saving is not off-set by additional cost of maintenance, which condition appears to be fulfilled. It is not surprising, therefore, that a further step is in contemplation—namely, the conversion of the Big Creek line from 150,000 to 232,000 volts—for which purpose an experimental line has been put in operation at the latter pressure. This process will double the carrying capacity of the line, which is at present 130,000 h.p. The change is necessary because it is proposed ultimately to transmit 1,000,000 h.p. to Los Angeles from the Big Creek water-power development, and the adoption of the higher pressure implies a saving estimated at seven millions sterling as compared with the lower, the whole outlay on the undertaking being estimated at no less than 40 millions. The copper cables alone, nearly one inch in diameter, for the Pit River line weighed 11,000,000 lb., the largest order of the kind on record, and cost about £1,800,000; the total cost of the line was about £7,000,000.

Such enormous undertakings are possible only in a country blessed with almost inexhaustible natural water-powers. In this country it is held to be cheaper to transport coal than to transmit energy over great distances, and unless tidal powers are developed, the opportunity of carrying out such magnificent schemes will not fall to the lot of our engineers at home; but the Empire possesses water-powers fully comparable with those of the Pacific Coast of North America, and when the occasion arises to make use of them, we have no doubt that British engineers will prove to the world that they can cope with the problem successfully. Already transformers and switchgear for a line pressure of 110,000 volts are being built in England, and it is interesting to note that a British insulator is being tried out on the Big Creek experimental line, with results said to be very encouraging.

On this side of the Atlantic the most progressive people appear to be the French, who handle 45,000 volts without diffidence, even on somewhat make-shift apparatus, as will be gathered from some of the illustrations accompanying our report of the Electrical Review French Tour. The highest pressure they have as yet put in operation is 120,000 volts on the line from the Basse-Isère to Saint Etienne.

German Export Orders.

The directors of an electrical manufacturing company at Aix-la-Chapelle state that a considerable falling-off in export orders has taken place in recent months, as well as in orders for home accounts. Yet, according to the experience hitherto gained in the export trade, the further extraordinary depreciation of the mark should have led to an increase in the foreign orders. It is assumed that as the contrary result has taken place, other countries are apprehensive of an economic collapse of Germany, and under these circumstances and despite the favourable opportunity afforded by the fall in the mark, they are not disposed to place orders on a large scale on the usual condition of making large payments to Germany in advance.

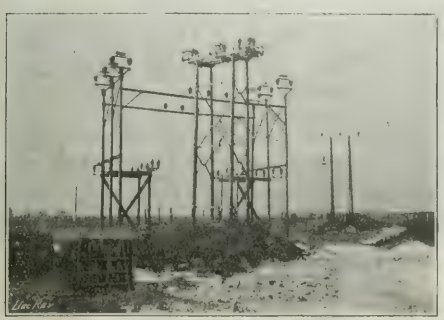
THE "ELECTRICAL REVIEW" FRENCH TOUR.

(*Continued from page 582.*)

The (temporary) sub-station at St. Nicholas is a brick building with a slate roof, and contains two 2,500-kVA transformers, stepping down from 45,000 volts to 15,000 volts, at 50 cycles; these are water-cooled, with the aid of a cooling tower close by, the circulating pumps being situated inside the building and driven by motors. The switchgear is mounted on an open iron framework, and shielded with wire screens; only the disconnecting switches are indoors, horn-break switches being mounted on a gantry in the open air, as shown in an accompanying illustration. Lightning arresters of the multi-

far as possible; the poles are of lattice steel or reinforced concrete, and sometimes of wood. Generally a rectangular iron frame surrounds the conductors at each pole, to guard against falling wires.

Leaving St. Nicholas, the procession of cars took the road to Lens, passing through war-scarred country. In a few miles the Labyrinth was reached, a region so named from the complexity of the trenches; the ground has remained untouched since the war, and the chalk has been so thoroughly churned up with the soil that the land is believed to be useless for agricultural purposes.



Open-air Switchgear for 45,000 Volts.



On the Road to Bethune.

cylinder type are provided, with water resistances and horn gaps. The practice is to open-circuit the low-pressure side of the transformers before opening the high-pressure air-break switches. This sub-station and a similar one are "reconstruction" jobs, and have worked perfectly well for 18 months; the permanent sub-stations which will replace them will be equipped with oil switches. Eventually the pressure will be raised to 80,000 volts; when this is done, there will be no water in the sub-station, the transformers being oil-cooled.

The incoming mains enter the station through holes in

After passing the site where once was the village of Thelus, a memorial to the men of the Canadian Artillery who fell at Vimy in April, 1917, was seen; the route lay along the top of the Vimy Ridge, and on the descent towards Lens many concrete and steel "pill-boxes" were noticed. Near Loos a stop was made to inspect the great mine crater, which is preserved in its original condition by the French Government. Lunch was taken at the Hotel des Gobélins, Béthune, the only place in the district where it was possible to feed so large a party, and afterwards a visit was paid to the power station of





Open-air Switchgear for 15,000 Volts, and Cooling Tower for Circulating Water, at St. Nicholas Sub-station.

glass plates; the busbars are of copper rod on insulators. In addition to the 45,000- and 15,000-volt circuits, switchgear is provided for 5,000 volts.

Supply is given to the sub-station from Neuilly-les-Mines, Béthune, or Bully, and from it to other sub-stations; there are some 300 transformer posts on the system. The engineer responsible for the work was M. Carrière, who explained the arrangement of the plant, and accompanied the party to Béthune.

The overhead mains are carried on glass insulators as

the Compagnie des Mines de Vicoigne, Nœux, et Drocourt at Beuvry, which had already been sighted on the way to Béthune.

This power station was planned in 1918, before the end of the war, to supply electricity to the company's coal mines at Nœux, and to a number of subsidiary electrical companies; the first orders were placed on May 24th, 1919, and shortly afterwards further developments led the company to order plant up to about 40,000 kW, which will be in commission within a few months, this

representing half the ultimate capacity for which the station is designed.

The installation comprises a boiler-house at right angles to an engine-room containing two 6,000-kW and two 10,000-kW turbo-alternators, a switchhouse, and a sub-station containing transformers which raise the pressure to 15,000 V on eight underground feeders and to 45,000 V on six overhead feeders. Cooling towers and water purifiers are provided. Two generating sets of 20,000 kW each will ultimately be installed in the existing engine-room, and the boiler-house will be duplicated. The engine room is served by a 40-ton electric travelling crane. In addition to two 15,000/200-V transformers for the auxiliary apparatus, two 5,000/15,000-V transformers are installed of 7,500 kVA and three of 12,500 kVA. Three 5,000-kVA, 15,000/45,000-V transformers are in place. Horn lightning arresters are provided for the 45,000-V feeders, and water-jet pressure limiters for the busbars at both pressures.

A railway line from the Nœux Mines passes the power station, and an ample supply of water is available from shallow wells—the latter being the main reason for choosing this site.

The first sod was turned in August, 1919, and in spite of the scarcity of labour and material, the first generating set was put in operation on August 20th, 1921. All the buildings are of reinforced concrete filled in with brick.



The Party at Beuvry.

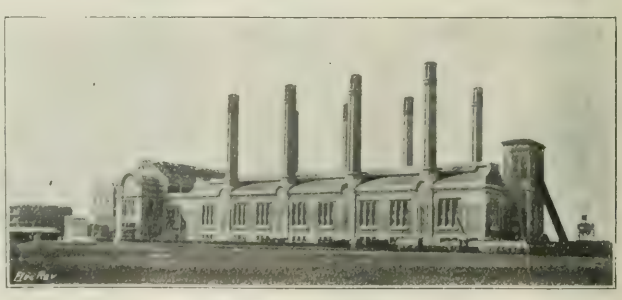


The Mine Crater near Loos.

The boilers installed are of special interest, being of the "Kestner" type of Messrs. Schneider & Co. (made in this country by Messrs. Ransomes, Sims & Jefferies, Ltd., sole licensees for the British Empire and many foreign countries). Essentially this boiler consists of two horizontal drums connected by straight vertical water-tubes, amongst which the hot gases from a furnace in front of the boiler pass many times. Each of the 16 boilers has a heating surface of 430 m.², and a grate area of 19.5 m.² (210 sq. ft.). The working pressure is 16 kg. (230 lb.), superheat 350 C. The normal duty is 10,000 kg. (22,000 lb.) per hour, which can be increased by 20 per cent. if required. Each boiler has 14 sets of tubes, each set consisting of 18 ordinary tubes and four larger tubes containing concentric water-circulating tubes. Green economisers are used, with 320 cast-iron tubes per boiler. Natural draught is provided by eight chimneys of reinforced concrete, 150 ft. high and 9 ft. in diameter at the top. These stacks are completely detached from the building, though they pass through it; they were built on the Monnoyer system. A forced-draught fan driven by a 22-h.p. motor is installed with each boiler. The fuel used (washery refuse) often contains 30 to 35 per cent. of ash, 13 to 14 per cent. of volatiles, and a fairly high proportion of water, so that special precautions have had to be taken to ensure the descent of the coal into the hoppers of the mechanical stokers, the passages being made as direct as possible, the sides of the chutes at a steep angle, and their capacity reduced to 5 tons per boiler, to prevent choking, with the incidental result that the firing floor is exceptionally well lighted, as our illustration shows. The low calorific value of the fuel has further necessitated a large grate area, the ratio to the heating surface of the boilers being 1:22.

The fuel is discharged from 20-ton railway trucks into a sunk hopper of 40 tons capacity, from which two belt conveyers are fed; these bring the fuel to two bucket conveyers which raise it to a bunker of 50 tons capacity at the end of the boiler house, from which again scraper conveyers take it to the boiler chutes. Storage tanks are to be provided alongside of the coal siding, to facilitate the quick release of rolling stock, the mixture of four classes of fuel, and storage to last over a two-days' holiday.

Ashes are removed from chutes below the grates by skips travelling on a runway, driven at 20 m. per minute by an endless rope; the skips are run on switches under the ash-chutes, filled, and returned to the runway, when they are automatically run out to an automatic hoist which deposits the ashes in a hopper over the railway.



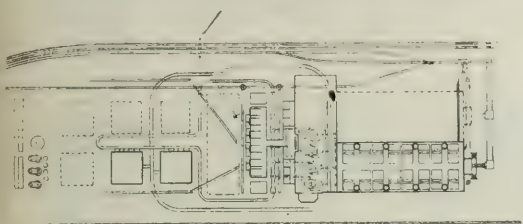
Beuvry Power Station.

The pump room, 275 ft. long and 33 ft. wide, between

the end of the boiler-house and the engine-room, contains, besides the feed and condenser pumps, three well pumps each capable of raising 100 tons of water per hour, the bore-holes being 2 ft. in diameter and 150 ft. deep. The well pumps are driven by vertical-shaft motors of 33 h.p. each.

Two 50-ton tanks receive the water of condensation and the drains from steam separators, and the exhaust from two small turbines which drive feed pumps—in all about 95 per cent. of the water evaporated. All the feed pumps are of the centrifugal type, two driven by steam turbines and two by 150-h.p. induction motors at 5,000 V, 2,800 r.p.m. Half these pumps are sufficient for all the boilers.

The engine-room is 275 ft. long and 66 ft. wide, and can accommodate six generating sets, of which four are installed. The turbines are of the Zoelly type, built by Messrs. Schneider & Cie., and run at 3,000 r.p.m.; the 6,000-kW and 10,000-kW alternators generate at 5,250 volts, 50 cycles, three-phase. The condensers have cooling surfaces of 8,600 and 12,900 sq. ft. respectively, and



Plan of Beuvry Power Station.

the circulation water is 1,840 and 3,150 tons per hour, the pumps being driven by motors of 137 and 250 h.p. Two motor-generators are installed, each consisting of a 5,250-V motor, a 250-kW d.c. generator working at 220 volts, and a reserve exciter of 40 kW at 120 V, the set running at 1,450 r.p.m.

The guaranteed steam consumption of the 6,000-kW sets at 4,800 kW (p.f. unity) is 13 lb. per kWh, with steam at 200 lb. and 320° C. superheat. The 10,000-kW sets under similar conditions at their economical load of 8,000 kW take 12 lb., including the steam consumed by the pumping sets. An Alba meter for the condensation water is provided for each turbine. The air-filters are of the Sturtevant wet type.

The condenser pumps are normally driven by a steam turbine through gearing, exhausting into a stage of the main turbine or to atmosphere according to the load. Provision is made for quickly uncoupling the pump turbine and driving the pump by a stand-by motor.

The main steam pipe is 13½ in. in diameter, and forms a closed rectangle. The long legs of this ring are fixed at the middle of their length, and at the angles of the rectangle ball joints are provided, the invention of M. Luc-Denis, which allow free expansion of the ranges, but remain perfectly steam-tight with superheated steam at high pressure. The eight boilers farthest from the anchored points are connected to the steam range by similar joints.

Two cooling towers are in operation, and two more will be required, with a fifth as stand-by, when the station is completed. Each can deal with 370 tons per hour, and covers an area 80 ft. square, with a height of 50 ft. The towers are constructed of reinforced concrete, filled in with brick, and the reservoirs are also of ferro-concrete, as well as the columns which carry the baffles, and the distributing tank; the baffles are of creosoted wood. The cold water duct is underground, of reinforced concrete, and forms a ring; the hot water is pumped up into an aqueduct extending the whole length of the engine-room, from the ends of which steel pipes strengthened with ferro-concrete carry the water underground to the coolers, again forming a ring. Owing to the great length of the aqueduct, two expansion joints are provided.

The well water being very hard, three purifiers are installed, and three more will be required for the completed station, having an output of 50 tons per hour each. The water is pumped into one of two concentric tanks on a water tower, holding 100 tons, the other tank holding 300 tons of softened water. From the tank the hard water gravitates to the purifiers, and after treatment it is filtered before passing to the cold water duct or to the water tower.

The switchhouse, adjoining the engine-room, is 196 ft. long and 25 ft. wide. The main circuit breakers for the alternators and the auxiliary services at 5,000 volts, with a set of bus-bars, are housed in the lower part of the switchhouse. Each alternator is provided with a transformer of the same capacity, and paralleling is done on the 15,000-V side, though the main breakers are between the alternators and the corresponding transformers. The 5,000-V busbars, however, enable an alternator to be coupled to a transformer other than that normally used with it. The sub-station building is separated from the switchhouse by a space 40 ft. wide, and contains on the ground floor four sets of busbars at 15,000 volts, which can be sectioned at the middle. On the same floor are the paralleling and feeder circuit breakers at 15,000 and 45,000 volts; above these are two sets of busbars at 45,000 volts, and the lightning arresters are on the second storey. Three 5,000-kVA transformers stepping-up from 15,000 to 45,000 volts are installed in the sub-station. Railways provide for the removal of all the transformers to a repair shop. At either end of the sub-station there is a separate building in which the transformer oil is cooled.

The general contractors for the power station were Messrs. A. Legrand and P. Munich, of Paris.

The visitors were received and conducted over the station by the managing director, M. Barthélemy, and M. Meunier, the station superintendent, and at the close of the visit Major Rich, in a brief address, expressed the gratitude of the party for permission to see these interesting works, which had been erected in so short a time since the war. M. Barthélemy, in response, said that the local residents were well aware that the British Army prevented the Germans from reaching that spot, and the many British cemeteries in the neigh-



Interior of Boiler-house, Beuvry.

bourhood bore witness to the gallantry of the British soldiers; the people would never forget what the British had done for them.

Special interest was shown by members of the party in the system adopted for communication with the sub-stations by a mode of "guided wireless" telephony, the messages being sent into lines paralleling the 45,000-V overhead mains for a short distance, and received on similar conductors at the sub-stations. Concerning this system, and the Kestner boilers, we hope to publish details in an early issue.

From this station power is transmitted as far as Calais. Ten pits are supplied at 15,000 volts, and one at 45,000 volts, and the system is interlinked with the State transmission lines.

(To be concluded.)

THE DERBY ELECTRICITY UNDERTAKING.

Inauguration of New Plant.

The Derby Corporation obtained its provisional order to supply electricity in 1890, and the works were opened in 1894, the plant consisting of three Lancashire boilers and six single-phase 100-h.p. alternators. Mr. T. P. Wilmshurst, to whose energy the development of this concern are mainly due, took charge in 1898, and the first increase in the plant was made in 1896 when two reciprocating engines of 250 h.p. each were installed. These were followed by the erection of a 1,000-h.p. engine and alternator, built by Messrs. Ferranti, Ltd.

The Derby electric tramway system was opened in July, 1904, and in order to supply the current the existing electricity works were greatly enlarged. It was determined to provide direct current as well as alternating, and four Parsons turbine generators were introduced. The single-phase alternating system was considerably augmented by the erection of two more 1,000-h.p. Ferranti engines and alternators, and by the substitution of water-tube boilers with mechanical feeding and chain-grate stokers.

The demands for electric power having grown, the committee in 1907 advised the Council to erect an up-to-date station. It was designed by Mr. Wilmshurst and opened in April, 1908.

The new installation consisted of two turbo-generators of 750 kW capacity. Shortly afterwards another turbine was erected. In January, 1913, Mr. Wilmshurst advocated the laying down of much larger plant than had previously been employed, and the Council installed a 2,000-kW turbo-generator by Messrs. Parsons & Co. of the three-phase alternating-current type. Again in 1914 and 1917 the committee asked for two more such turbo-generators. The Government diverted a set which was being built for South Africa of 4,000 kW, and in February, 1920, the committee determined to complete the works, and to install a much larger turbo-alternator and two large boilers with all their auxiliaries. The total estimated cost was £120,000.

Messrs. C. A. Parsons & Co., Ltd., of Newcastle, again secured the contract for the turbine, alternator, and condensing plant; the whole of the turbine plant in the new station was supplied by the same firm.

The site of the station is central, and although the coal sidings are a short distance from the works, the method of bringing coal into the boiler-house by means of four 5-ton electric lorries, with the recent installation of coal-handling plant at the Corporation's own sidings, is a very economical arrangement. From the point where the coal is received up to the removal of the ashes, the whole operation is, as far as possible, automatic. The coal is automatically weighed, falls by gravity on to the revolving grates, the ashes fall into a tunnel underneath, and are then conveyed to the ash elevator. The whole of the coal and ash-handling plant was supplied by the Ewart Chainbelt Co., with Messrs. Handyside and Messrs. Eastwood Swingler, of Derby, as sub-contractors.

There are at present eleven water-tube boilers, complete with Green economisers, induced-draught plant, &c., each boiler evaporating 25,000 lb. of water per hour at a pressure of 180 lb. to the sq. in., the whole being supplied by Messrs. Babcock & Wilcox, Ltd. The feed water is pumped into the boilers by three electrically-driven Rees-Roturbo centrifugal pumps, running at 2,000 r.p.m., each of a capacity of 10,000 gallons per hour, and by two steam Weir "Roto" feed pumps.

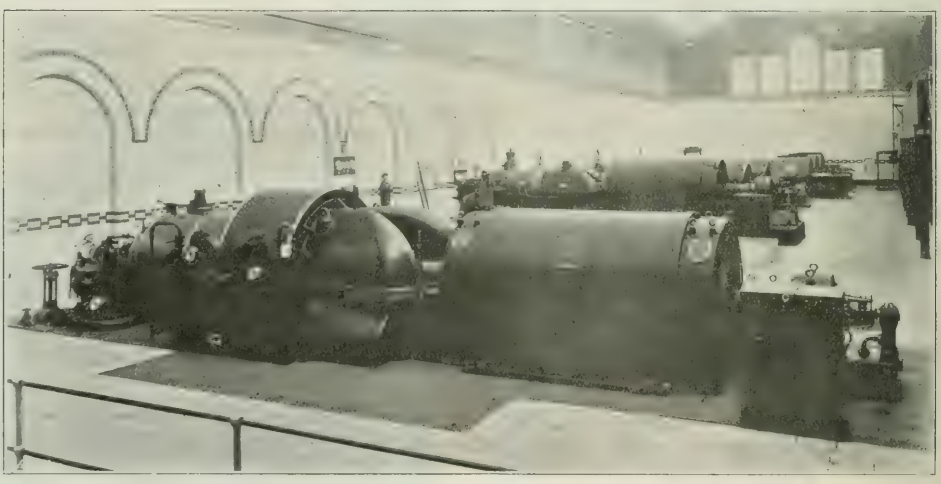


Fig. 1.—Turbine Room, Showing New Parsons Set in Foreground.

The old engine room is now used as a distributing station, and the only running plant consists of rotary converters and motor alternators. Water for condensing purposes is drawn from the river. Adjoining the river are the automatic water-softening plant and revolving screens.

The turbine room contains the following plant:—

Three d.c. turbo-generators, each of 750 kW, running at 1,800 r.p.m.

Three three-phase, a.c., 6,600-volt turbo-generators, each of 2,000 kW, running at 3,000 r.pm.

One three-phase, a.c., 6,600-volt turbo-generator of 4,000 kW capacity, running at 3,000 r.p.m.

The latest addition consists of a three-phase turbo-alternator of 7,500 kW capacity, running at a speed of 3,000 r.p.m., fig. 1.

The condensing plant, fig. 2, is in the basement directly underneath the turbine, has a cooling surface of 9,500 sq. ft., and is designed to deal with 72,000 lb. of steam per hour. It is supplied with cooling water by a motor-driven pump, developing 195 h.p., and delivering 500,000 gallons of water per hour. The pump is housed on the old Silk Mill Island, and draws water from the

main river, through a 13 ft. 6 in. diameter revolving screen by Messrs. Brackett & Co.

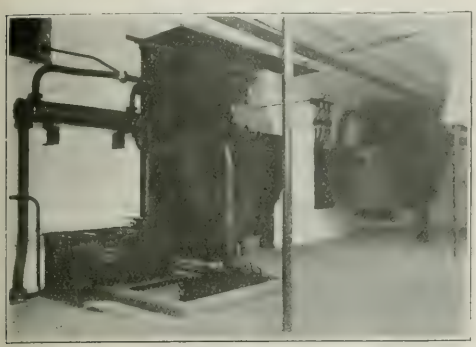


Fig 2.—Condensing Plant.

A Heenan & Froude fan supplies air for cooling the alternator, which is drawn through a wet air filter.

The turbine room, therefore, contains plant of 19,750 kW, or 26,500 h.p.

The switchgear is placed on a main gallery, and was chiefly supplied by the British Thomson-Houston Co., Ltd., of Rugby.

During the year 1921-22 the number of kWh generated was 15,878,346, with a coal consumption of 3.01 lb. per kWh (the coal consumption to date, 1922-23, approximates 2.75 lb. per kWh), and besides railways and collieries, the station supplies electricity to 266 different industries in the district. Owing to the trade depression, the sale of energy dropped in 1921-22 over 3 million kWh, but the current year is promising to be a record one.

On October 27th the Mayor (Councillor W. R. Raynes) started the plant which has just been installed.

The chairman of the Electricity Committee (Ald. W. G. Wilkins) mentioned that Derby now produced as much electricity as Leicester or Nottingham, notwithstanding the fact that it was only about half the size of those towns. As regarded coal consumption, Derby led the way amongst the towns for a radius of 30 or 40 miles. The general public had to thank the electricity department for its influence on the health of the people, and with 270 industries being driven by electricity, there were so many fewer smoky chimneys in Derby; and the smoke having been got rid of, buildings and vegetation had not suffered as they might have done. He believed there was a very encouraging outlook for the undertaking.

ELECTRO-FARMING.—I.

Introductory Article.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

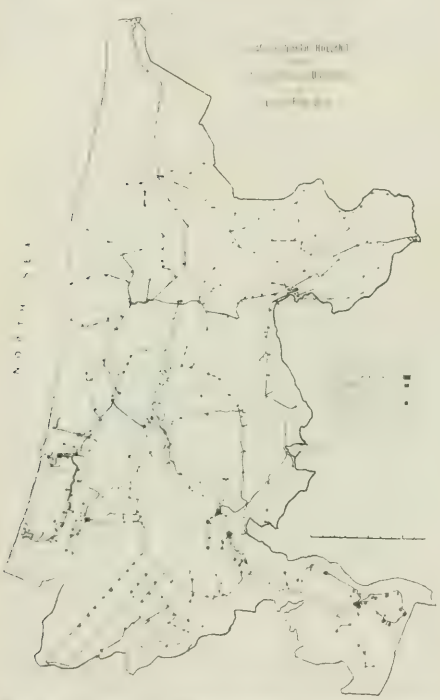
British electrical engineers do not seem to have as much faith as British farmers in the development of electrical applications to agriculture. Sufficient precedent for this new departure is to be found, however, on the Continent. Moreover, even in this country there are already a number of practical examples. This article is the first of a series which will endeavour to elucidate the problems that have arisen by means of a systematic investigation of the whole field. A preliminary survey was given in the early part of this year by the present author in a paper before the Institution of Electrical Engineers (see Electrical Review, April 7th and 14th, 1922). In these notes it is proposed to amplify the references given in the paper, and more particularly to bring the subject up to date.

On the Continent for some years past the greater part of the output of electric motor-building factories has been for agricultural purposes. In one week last June a German manufacturer turned out 160 electric ploughing sets—of course, it is highly probable that this was a special effort, that deliveries had been delayed for a few weeks previously, and that none were sent out for a few weeks afterwards. Still, the output of electric ploughs in England—the pre-eminent manufacturing country for steam, tractor, and horse ploughs—so far is nil, as nothing yet seems to have passed the drawing-board stage. In fact, British agricultural engineers look rather with disdain at the idea of farmers ever using electricity for such purposes (apparently they have not themselves visited the Continent). Probably every reader of this article has visited an agricultural show at some time or other. They will, therefore, be well acquainted with the fact that the machinery on show is driven by a seemingly uncountable number of small popping and coughing oil engines. At the recent Cambridge Show of the Royal Agricultural Society of England, not so much as a sixteen candle-power lamp was supplied with current by the local electricity supply undertaking. A short time ago the writer made a special trip to view Germany's largest annual agricultural show, which was held this year at Nuremberg. Every machine that was shown in motion was driven by an electric motor. A rough calculation indicated that nearly 2,000 electric motors were employed in this way. Oil engines were shown, but they were relegated to the makers' own stands. Of course, the German farmer's mental attitude to-day, at the sight of an agricultural machine driven by an oil engine, would be that the machine was probably as out-of-date as the engine which drove it. Hence the exhibitor would prefer to steer clear of oil-engine drives, even if offered for nothing. In this connection it is of interest to note the agrarian post-war policy of the Germans. After careful deliberations by all the interests concerned, it was decided that to bring German agriculture into the first rank it was essential to farm more intensively, and also to employ electricity more extensively. As regards the former, the German farmer already farms so intensively and employs so much artificial manure that it would seem hardly possible to do more. With reference to the question of electricity supply, great progress has been made, to the writer's own personal knowledge, for he has visited the farming districts recently and also a year ago. There is now hardly a group of farms that is not connected up. It is no wonder that the Germans have no money for such futile things as reparations when they are expending so many millions on themselves. With the true paternal ways of the German Government, the indication is that if a farmer does not see his way clear to use electricity on his farm, he is at liberty to farm elsewhere, for his farm will be wanted for a farmer who will use it.

Before the war considerable use was made of electricity on Continental farms. During the war, owing to the shortage of oil and coal, the non-belligerent countries made wonderful progress in this direction. Until to-day, in flat countries, such as Denmark and Holland (with many more days of suitable wind than in this country), the electric motor is actually displacing the windmills, notwithstanding the fact that capital is already invested in the latter. The main reason is, of course, that modern commercial requirements necessitate a continuous supply of power. It does not do nowadays to await the vagaries of the weather, and especially as

power is often required for pumping in these countries. Now pumping is most often required in wet weather, and in wet weather, as is well known, there is little wind.

In California well over 600,000 h.p. in motors is already installed on farms. In Great Britain a start has been made in some of the power supply areas, more particularly in the neighbourhood of Hereford, Inverness, and Fife. It is quite a common practice on the part of a colliery company which owns farms for the supply of fodder for its pit ponies, to employ electric power on the farms. The writer is electrically operating his own farm of 600 acres, near East Grinstead, but the field work is still in the experimental stage. Hay has been cured (not merely dried) this year on a full-size scale of three big ricks, by the aid of an electrically-driven Sirocco fan (see Electrical Review, August 25th, 1922, p. 287). Corn has also been matured and dried. Again, corn has been reaped by means of an



Plan of the existing electrical distribution to the farms of North Holland, showing how the Continental farmer has electricity brought to his very fields.

electrically-operated binder, and an electric plough is nearly ready to commence operations.

It is not a simple proposition to operate a farm electrically, for very few electrical engineers have studied the subject, which has many peculiarities, not to say prejudices. The idea of most engineers is that it is merely a matter of belting existing standard electric motors to the existing machines. But the experience of Continental manufacturers is such that they all produce special motors for agricultural work, and they would not have gone to this trouble without sufficient reason.

It is hoped that enough has been said in this introductory note to indicate that there is already a big field in the world for electro-farming enterprise, though possibly very little progress has been made so far in England. However, we must not be too insular in our ideas, for what is probably good for the world is also probably good for England. England wants a good share of the work in connection with the supply of the world's demands, so it is hoped that this series of articles will do something to arouse interest and supply some of the necessary data to this end.

ESTIMATES FOR LIGHTING INSTALLATIONS.

By Major J. C. Connan.

Considerable interest has recently been shown in the reasons for such wide variations between the prices put forward by different contractors for the same installation as are everywhere met with at the present moment. It appears to be thought that these variations are due to a few causes only, whereas they are very greatly influenced by at least eight, as can be seen by a consideration of the remarks that follow. It can also be seen that even where specifications and bills of quantities are supplied there is still left plenty of scope for difference in price between the final tenders. Where there are so many different types of material required, supplied in such great variety by so many competing firms, and few of them made by the same manufacturer, it is extremely difficult to obtain a consistent quality throughout the whole installation. By a careful selection of the samples before placing the order and rigid inspection during the erection, a high-class installation can be obtained, and no doubt if this procedure were always strictly applied, a much higher quality of estimate would be put forward, and consequently a smaller range of price difference would result.

An estimate for a lighting installation may be prepared on the lines detailed below, though much will depend on the size of the job and the ideas of the engineer running the department. Variations of this method will probably be the rule rather than the exception.

The following are the main steps in the calculation:—

1. *Data Sheet and Plan.*—It is quite useless to endeavour to put forward a competitive price unless reliable data are provided on which to base the estimate. This information should be conveyed to the contractor on a data sheet, and should consist of the dimensions of the area to be lit, conditions of walls and ceiling, construction of walls and ceiling, nature of work carried on in the area, presence of obstructions to free passage of the light, such as cranes, columns, large machines, &c., particulars of supply, any special wishes of the customer, &c. The plan, which should be to scale, should supplement this information and particularly indicate the point of entry for supply.

It is, of course, assumed that all contractors will be provided with similar information, as otherwise the estimates right from the start are not on a comparative basis.

2. *Work Out Sizes.*—By means of the above information, it is possible to fix the intensity of illumination and utilisation efficiency suitable for the class of work and area to be lit and by the aid of these to determine the size and number of lamps to be used. The positions of the individual lamps are then indicated on the plan and are mainly determined by the construction of the building and the type and arrangement of the machinery. The lamp positions being known, they are then grouped into circuits, the circuits grouped to distribution boards, and these in turn grouped to main supply. The current flowing in each circuit, sub-feeder, and main-feeder can now be obtained, and from their lengths, as taken from the plan, and the allowable voltage drop in each section, their sizes may be calculated. The size of the conductors being known, it is now possible to fix the size of conduit, &c.

Very considerable differences in the final estimate may be introduced here. First, in fixing the number and size of the lamps; secondly, in deciding on the manner in which the conductor shall be run; and thirdly, in calculating the size of the conductor.

Standard intensities of illumination for a large variety of trades, and reliable figures for utilisation efficiencies are now available, and unless a contractor chooses a lower figure than the standard in order to obtain a low estimate, there is no reason why all estimates should not be based on practically the same figures. His choice of the size of lamps to employ (and this will also fix the number) may vary from that of others, but is

limited very considerably by the class of work to be done in the area and the standard sizes of lamps available.

The manner in which the conductors shall be run (this fixes the length) will depend on the individual judgment and experience of the estimator, the nature of the building (more particularly that of the ceiling), and whether the conductors are to be carried on or below the surface. As can be seen, this leaves plenty of scope for variation in the final lengths taken. The total voltage drop from point of supply to lamp will be distributed over main feeder, sub-feeder, and circuit, and consequently the size of the conductor will depend on the percentage of the total voltage drop which is allowed for the conductor in question. In addition, the size of conductor will be influenced by the current density chosen. This should always comply with the I.E.E. rules unless otherwise specified.

3. *Take Off Quantities.* This is straightforward, may be done with the aid of a map-measuring instrument or rule, and for the same plan should not introduce any appreciable error. In all large installations it is greatly facilitated by using schedules in which the material for each circuit, as measured, may be entered up. A certain percentage should, of course, be added to the net quantities to allow for cutting and breakages and an item included for sundries, such as solder, tape, screws, &c.

4. *Decide on Quality of the Materials to be Used.*—It is probably at this point that the greatest variations in the estimates are introduced. For the same class of material there are wide differences in price depending on the quality, and even where the quality may be assumed to be the same, the price offered by a firm in a ring will differ from that put forward by one outside. It is seen, therefore, that even when it is rigidly laid down what quality of material is to be used, there may still be considerable differences in price. It would appear to be almost impossible to avoid this, particularly when competition is keen, and it is advisable, even when material is closely specified, to call for samples before the order is placed. It is not necessary to call for these with the estimate, but only from those few firms which, after a scrutiny of all estimates, appear to be the most suitable. All firms, when putting forward their quotations, should clearly indicate the quality of material which they are offering, and, if necessary, state the name of the maker.

5. *Price the Quantities.*—When operations 3 and 4 have been completed, this is straightforward work, and should introduce no error. Self costs should be used. To obtain total material add self cost.

6. *Take Off Labour.*—Speaking generally, this is usually the most unscientifically treated part of the estimate. It is customary to place this item in the estimate at so many shillings per point, the figures being based on past experience, but not necessarily being in the least suitable for the conditions of the job under consideration. It is preferable to calculate the time required to erect each item of material included, separately, and add to obtain total time for the job. This may be done most readily by the aid of labour constants to which suitable corrections may be made to allow for variations in the assumed standard conditions on which these constants are based.

7. *Price Labour.*—Add all the individual times found under 6 and price at current rate of wages for wiremen. Very considerable differences in the final estimates may be caused if the rate used is not the current trade union rate, the intention of the contractor being to use apprentices or non-union labour.

8. *Obtain Total Self Cost.*—This is made up of total material self cost as found under 5, and total labour self cost as found under 7, together with items to cover freight and packing when necessary, contingencies, to cover errors in calculation and unforeseen occurrences on the job, &c., percentage of engineers, travelling expenses, fares, and out-of-town allowances for wiremen when necessary, allowance for incurring the penalty, if any, corporation inspection fee, &c. Variations in the final estimate may be introduced here, particularly under the contingency item, but they should not be very large.

9. *Add Overhead Charges.*—The figures obtained under 8 represent the total net self cost of the job to the firm. To these must therefore be added such proportion of the overhead expenses as is considered appropriate for the size of the job. It is an extremely difficult matter to satisfactorily calculate this percentage, as it depends on so many conditions. Few of these will be the same for any two firms, and consequently considerable differences in the estimate may be introduced here. Many of the smaller firms, particularly those which keep no office staff, completely neglect this item, giving them a very considerable advantage on most small work, but at the same time almost inevitably leading to failure.

10. *Add Profit.*—To the gross self cost obtained by adding overhead expenses to net self cost is now to be added the profit. This will, of course, differ, depending on the keenness with which any one firm wants the job, but should not account for more than about 10 per cent. difference in the final estimate.

11. *Check.*—All previous calculations and prices should now be independently checked. It may be assumed that the estimator himself will have submitted his work to a rough check, but it is always advisable to have each separate item checked by another man before finally sending the estimate in.

12. *Dictate.*—The estimate is now in its final form and may be dictated. It is extremely important, from the contractor's point of view, so that his offer should have its fair amount of consideration, that he should clearly specify what he is putting forward and under what conditions he has calculated his price. Therefore, he should specify the number, type, and size of the lamps he proposes to use, the quality of material (wire, conduit, switches, &c., preferably with maker's name) he has included, and any regulation to which he proposes to adhere (such as I.E.E., corporation, or insurance); he should also particularly stress any points of his offer which he thinks may differ from those of his competitors and which, in his estimation, give additional advantages to the installation.

To obtain reliable estimates on a comparative basis, the whole of this work must be done. The contractor may be relieved of certain parts of it by the consulting engineer, who is responsible for a specification and bill of quantities, but it is only the larger jobs which can carry the extra expense of the engineers' fees. The most consistent results will, of course, be obtained when all offers are made to a specification, but many specifications needlessly enhance the cost of the work by introducing fads, and when all is said only put forward one man's idea of how the installation should be carried out; whereas estimates independently worked out by several contractors on the above lines give more scope for finding the best solution.

The above remarks deal primarily with estimates for lighting installations, but, with certain modifications, they are applicable to those for power installations as well.

The Berlin Accumulator Works.—The majority control of the undertaking of the Accumulator Works Co. of Berlin and Hagen, which dominates the secondary battery trade in Germany, including the Tudor type, and in which the A.E.G. is interested, has now passed into other hands. It had been intended at the recent meeting to propose the issue of preference shares, apparently with multiple votes, to prevent the "alienation" of the undertaking or the transfer of control to other parties. It was, however, found impossible to proceed with this scheme in face of the fact that out of the 13,104 shares represented at the meeting no fewer than 9,925 were found to be in the hands of the textile firm of Günther Quanat, of Pritzwalk, North Germany. Nevertheless, it was decided to increase the ordinary share capital by 20,000,000 marks and to offer the new shares to existing proprietors on an equal basis, so that the new control, which has resulted in the election of four new directors, will thereby be maintained. The interest held in the accumulator company by the Berlin Handels Gesellschaft, in which Herr Stinnes recently participated, has also been [illegible] on the re grouping of the accumulator company.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Bell" Electric Washer.

Electric clothes-washing machines of British manufacture are not so numerous that we can afford to ignore any developments of this nature, and we are therefore glad to be able to give some details of a purely British washer made by the "Bell" Washer Co., Feilden Street, Blackburn. The machine (fig. 1) is an adaptation of a hand-driven type and employs an oscillating dolly which, it is claimed, actually scrubs the clothes and forces water through them. The

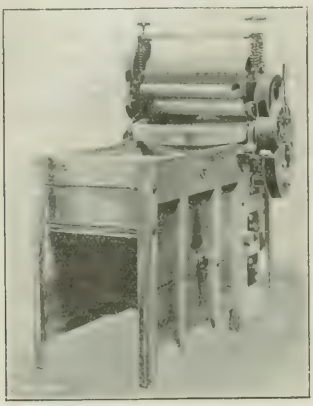


Fig. 1.—The "Bell" Washer.

wringer rollers are of more ample dimensions than those usually fitted to electrical washers, being about two feet in length and proportionately large in diameter. The principal feature, however, is the way in which the safety of the operator is ensured. The system is seen in fig. 2. Two rollers, about 2 in. in diameter, are mounted in a frame in such a way that when the machine is running the lower

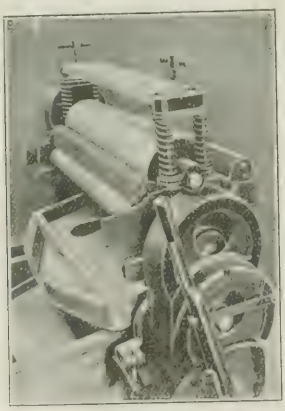


Fig. 2.—Safety Device.

roller is retained against the lower of the main rollers by a weak spring. The pressure is sufficient to pick up any article of clothing, but insufficient to drag in the operator's fingers should they come into contact with the small roller. Accidental contact with the main rollers is prevented by the frame in front of them. When the direction of the wringer is reversed, the guard can be swung over to the other side.

The "C. & H." Junior Wireless Set.

The "C. & H." junior set has been developed to meet the demand for a small, inexpensive, and simple wireless receiver that will enable one to receive the broadcast programmes without having any knowledge of electricity or wireless theory. The set consists of a polished hard-wood box with a matt surface ebonite top panel. The dimensions are 4½ in. square with a depth of 4 in.; the tuning coil and switch, contained inside case, are therefore protected. Although of such a small size this instrument, fig. 3, is not a toy.

All that is necessary to receive music and speech, &c., is to connect the instrument to an aerial wire and an earth and

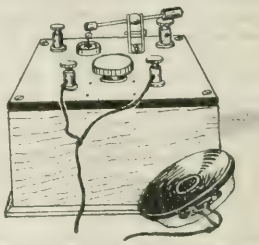


Fig. 3.—The "C. & H." Radio Set.

"listen in." With a well-constructed aerial of the regulation size, the set will have a range of approximately 15 miles from the broadcasting station. The set is manufactured by Messrs. F. Pratt & Co., 23, Queen Anne's Gate, Westminster, S.W.1.

An Electric Hygrostat.

A simple device to prevent the humidity inside a piano or cabinet rising below a fixed maximum has been recently put on the market. In the case of a piano a small hygrostat is fixed near the two and wired in series with two 8-c.p. carbon filament lamps placed at the bottom, which are permanently connected to the electricity supply. The function of the hygrostat is to switch on the lamps when the air reaches a predetermined degree of humidity; the warmth of the lamps sets up a circulation of dry air inside the piano, and, by raising its temperature above that of the surrounding air, prevents condensation taking place. The lamps remain on until the air reaches the necessary degree of dryness, and are then switched off. It is found that when pianos are fitted with this device they keep in better tune with much improved tone, and are rendered immune from all troubles arising from being left in a damp room. Mr. Percy Watson, of the Northern Electrical Co., Grimsby, is the patentee, and the device is being manufactured by Messrs. Berry's Electric, Ltd.

The "Mepic" Shop-window Heater.

Every shopkeeper knows how a misty window detracts from a display, and, indeed, often obscures it altogether. In order to get rid of this condensation and to keep the window glass clear, the Midland Electric Power Installation Co., has devised a low-wattage heater in the form of a cylindrical bar. This, it is claimed, entirely eliminates the moisture which would otherwise collect on the window, and it is so arranged that a number can be connected up end to end. The cost of energy is infinitesimal.

"Osram" Automobile Lamps.

The latest pattern of automobile headlight lamp—introduced by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2—is an 18-W gasfilled lamp for 12-14 V, in a 35-mm. diameter bulb. This is an intermediate size, specially manufactured at the request of the motor industry. The company's

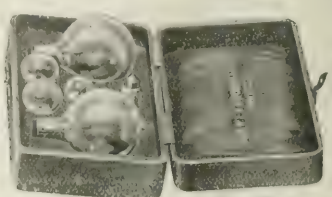


Fig. 4.—An "Osram" Automobile Lamp Case.

lamp case, one of which is illustrated in fig. 4, are a safe and convenient means of keeping spare lamps. The smaller size measures 5¼ in. x 3¾ in. x 1⅞ in., and carries two headlamps (up to 35-mm. diameter), two side or tail lamps, a dashboard lamp, and a "festoon" lamp. The larger case is designed to take headlight lamps with a maximum diameter of 50 mm.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The "Standard" Brush-Holder.

We are interested in a leaflet which has reached us relating to a patent brush-holder manufactured by the Standard Carbon Brush Holder Co., Ltd., which was reviewed in a recent issue of the Review. It is claimed that this new brush holder and the method of fixing it in the rocker embody many new features, and represent a considerable advance on any gear previously used.

On examination, we are of opinion that this gear is very similar to that which has been standard with Messrs. Flather and Co., of Leeds, for the last fifteen years, and presents no material improvement. The method of rigidly fixing the brush spindle in a slot in the rocker, the clock spring adjusted by means of a central rotating pin, the packing pieces to compensate for commutator wear, and the ease with which the brush spindle may be removed from the rocker, are all present in the Flather brush gear.

On comparison, the slight variations on the above features that the Standard Brush Co. have adopted will not be considered improvements by most practical engineers. The only important claim that the Standard Brush Co. make is that individual brush boxes may be removed without disturbing others, but this advantage does not to our mind seem of great importance when in the case of the Flather gear the whole spindle may be removed from the rocker by merely loosening two small set-screws.

While congratulating the Standard Carbon Brush Holder Co., on producing a gear with so many excellent features, we think that the credit for the novelty is due to Messrs. Flather & Co. It is surely a tribute to Messrs. Flather & Co. that this important feature in their motor design is likely to be adopted by other leading manufacturers as a standard.

Bates & Windibank.

London, *October 25th*, 1922.

Shift Engineers' Salaries.

The E.P.E.A. got, by the schedule, over 30 per cent. average increase for all the other grades, but only 12 per cent. for the shift engineers, yet the shift engineers are reduced by 3.6 per cent. at every reduction, while most of the upper grades are only reduced by 2.5 per cent. In the name of common decency, isn't it high time that the 12 per cent. squad marked time for a bit while the 30 per cent. merchants carried on with the reductions, if necessary? A reduction of 4 per cent. for all other grades would, in most cases, bring about the same total reduction in the wages bill.

Fairplay.

October 30th, 1922.

Your correspondent "Welfare" says that the E.P.E.A. has left a lot undone. Too true! but the elections are at hand. It is to be hoped that the shift men will not forget that, according to official figures in the *Journal*, the schedule, in addition to putting them at the bottom, gave them 12 per cent. increase against 33 per cent. for all the others. Let the election cry be "Grade 5 for all shift men and six-hour shifts for all stations over 20,000 kW."

It's no use going on being catspaws. Let us get on or get out. There are other unions that look after their own if the E.P.E.A. won't.

Fed-up.

October 31st, 1922.

The British Trade Outlook in Canada.

After reading your leading article to-day I should like to say that the prospects for a British manufacturer of electrical goods in Canada are not different from his prospects in Manchester or London. Sales in Canada follow most surely from those efforts which produce sales in England.

"Special Efforts," "Branch Factories in Canada," &c., are very fine trimmings, but are not the foundation material of a steady stream of orders.

The mystery, if there is one, lies rather in persistence. The British manufacturer need not expect results in Canada any more than he would in the home market, so long as he goes fishing on fine days only.

Until the location of his office or warehouse in Canada becomes familiar to all, until his telephone number and telegraphic address are stamped on the memories of buyers, until his travellers know all the jobbers and retailers by their first names, until he is recognised as an institution whose products have been, are, and will be available winter and summer, year in and year out, he will not have tapped the market for more than sample orders.

Agents should therefore be selected, or direct branches established, whose motto is patience and permanence. These in turn should be backed up by a willingness on the part of the manufacturer himself to supply purchasers with the goods they ask for and are accustomed to, rather than to attempt to restrict them to the products which his factory has been turning out in the past, for other markets.

W. H. Munro.

London, *October 27th*, 1922.

Fixing the Price Per Point.

Can you, or any of your readers, inform me of the method of arriving at a fixed price per point in a housing scheme where no meters are installed? It is desired to set a weekly charge for each house, varying according to size, which shall be fair alike to consumer and supply company.

J. Lander.

Glasgow, *October 30th*, 1922.

[The Fixed-Price Light Co.'s charges for a similar class of supply were outlined in our issue of May 15th, 1914.—Eds. Elec. Rev.].

Estimating for Internal Wiring Contracts.

It might interest Mr. Alan Kirk and your other correspondents on this subject to know that the Scottish contractors have worked to a standard schedule for some years.

"The Scottish Mode of Measurement for Electrical Work" was adopted in 1918 by the E.C.A. of Scotland in conjunction with the architects and surveyors, and embodies most of Mr. Kirk's suggestions. It is a Government publication, and can be got from H.M. Stationery Office for 1s.

Randolph.

October 23rd, 1922.

Salesmanship in Relation to Small Electric Fires & Cookers.

There is one point to which I would like to draw attention in connection with the above subject recently discussed at the E.D.A. Salesmanship Conference, namely, that the cost of wiring a heating point in many houses where lighting is already installed is prohibitive, and frequently is more expensive than the actual fire. If this item of expense were not present, the demand for electric fires would be much greater as there are a vast number of cases where the deciding factor for not installing electric fires was the cost of wiring.

F. E. Rowland.

London, *October 30th*, 1922.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR SEPTEMBER, 1922.

The September official figures of electrical export business show that the upward tendency of the last two months was, unfortunately, not maintained, the total amount for the month under review being £778,007, a falling off of over £85,000. Decreases occurred in all sections of the electrical exports with the exception of electrical machinery (£11,000 increase) and batteries and accumulators (£9,000 increase), the principal decreases occurring in insulated wires and cables (£28,000 decrease) and telegraph and telephone cable and material (£57,000 decrease). Electrical imports for the month only reached £200,932, a falling off of £118,000 as compared with the previous month, principally accounted for by a decrease of £100,000 in the electrical machinery import section.

Re-exports at £11,770 were £1,000 lower than in August.

Values of Electrical Exports and Imports for September, 1922.

	Exports.	Imports.	Re-exports.
	£	£	£
Electrical goods and apparatus	99,911	36,867	2,771
Insulated wires and cables ...	125,540	25,537	50
Glow lamps	28,503	14,375	1,105
Arc lamps and parts	693	1,795	165
Batteries and accumulators ...	44,014	18,613	450
Meters and instruments	19,840	5,233	839
Carbons	6,691	1,172	478
Electrical Machinery.—			
Railway and tramway motors	19,484	—	—
Other motors and generators	117,614	—	—
Switchboard (not telegraph or telephone)	8,961	—	—
Electrical machinery (unenumerated)	116,767	71,444	4,245
Telegraph and Telephone cable and material.—			
Telegraph and telephone wire and cable (not submarine) ...	30,818	1,997	—
Submarine telegraph and telephone cable	4,956		
Telegraph and telephone instruments and apparatus ...	154,215	23,899	1,867
Total	£778,007	£200,932	£11,770

THE TISBURY HYDRO-ELECTRIC SCHEME.

The enterprise of those who undertook the harnessing of the local water-power in order to provide a supply of electricity at Tisbury, in the neighbourhood of Salisbury, reached a practical stage in February last, when the plant was officially set in motion. In order to carry out the project, the Tisbury Electric Supply Co., Ltd., was promoted by Edmundson's Electricity Corporation, Ltd., in combination with the Salisbury Electric Light and Supply Co., Ltd. (which is closely connected with Messrs. Edmundson), and a number of local residents. Of the share capital of £5,000, half was subscribed by Edmundson's Corporation and the Salisbury E. L. and S. Co., Ltd., while the other half of the shares is held by about 60 local people. The plant was installed by Messrs. Edmundson, and the technical management of the undertaking is in the hands of the Salisbury E. L. and S. Co., Ltd., Mr. A. B. Randall being the managing director of the latter, as well as of the new company. The old Tisbury corn mill has been obtained by the company on a 40-years' lease from the Dowager Lady Arundell, who considerably helped the promotion of the scheme. The old water-wheel was removed to make room for the turbo-generator plant on the ground floor, while the room above serves the useful purpose of storage accommodation; the stable was converted into a storage battery room, and the Mill House is in course of being renovated preparatory to being occupied by the resident engineer-in-charge, Mr. A. Lee Cann. The various alterations and improvements to the water-way were carried out under the supervision of Mr. E. Doran Webb, chairman of the directors of the new company.

The water turbine was supplied by Messrs. Hay, Maryon & Co., and is capable of developing 24 h.p. with a flow of water of 2,000 cu. ft. per minute and at a head of 8 ft.; it drives by means of belting a d.c. 210-volt generator. A 4-cylinder internal-combustion engine to run on paraffin oil and direct coupled to a 20-kW generator has been provided by the Keighley Electrical Engineering Co., Ltd., and will be used as a stand-by, available for use in case of shortage of water or if it should be necessary to shut down the water-power plant for repairs or any other reason. The battery of accumulators was supplied by the Chloride Electrical Storage Co., Ltd., and has a capacity of 300 ampere-hours; the motor-generator is of Messrs. Higgs Bros.' manufacture, while the 5-panel control switchboard was made at the Park Royal Engineering Works, Ltd.

The method of distribution adopted is the 2-wire overhead one, and about two miles of mains had already been erected on creosoted poles when the supply commenced. Street lighting has been undertaken, and amongst the public buildings connected to the mains are the Victoria Hall, workhouse, police station, and three or four places of worship. A number of business and private houses, totalling about 30, were wired in anticipation of being electrically lighted, while agreements had been come to to light 20 other premises as soon as the supply became available. The company therefore started business with about 50 consumers, and in this respect Tisbury may be said to have done well, seeing that in Salisbury the supply company started in 1898 with 25 consumers, which number had increased to 57 at the end of six months.

Tisbury has approximately 1,700 inhabitants, and it is believed that it will be possible to generate by means of water-power practically all the electricity that will be required, at least for some time to come; the directors therefore confidently anticipate a successful future for the new company.

Liebmann Memorial Prize.—The American Institute of Radio Engineers has awarded the Liebmann Memorial Prize for 1922 to Mr. C. S. Franklin, research engineer of Marconi's Wireless Telegraph Co., Ltd., for his investigations relating to short-wave directional transmission and reception.—*The Times.*

REVIEWS.

Railway Electric Traction. By F. W. Carter. Pp. viii+412; figs. 204. London: Ed. Arnold & Co. Price 25s. net.

There is ample room for another book on electric traction, and it is all the more satisfactory that this book should come from so eminent an authority on the subject as the present author. The present volume, in addition to its other merits, possesses that of being well written. Its one great drawback is its one-sidedness. Had Mr. Carter treated the single-phase system with the same thoroughness and competence as he has treated the continuous-current system he would have attained a far finer result. As it is, the strong bias he expresses against the single-phase system does discredit to his learning. A few years hence we may hope to find scholars writing about traction from an independent and objective standpoint, but at present most authors seem to be too anxious to further certain interests or advocate views of their own. The present book, therefore, we consider to be an excellent treatise on continuous-current traction. It certainly contains much useful, if somewhat scrappy, information on alternating-current systems, but the opinions are essentially those of a strong advocate of the continuous-current system, and, from their one-sidedness, might equally well be used, *mutatis mutandis*, by a strong advocate of the single-phase system. "The question of system must be viewed broadly, if it is to be decided judicially" is a statement which the author found easier to make than to act upon. When we are told that in America "Time has dissolved the illusions (*re* systems), and little of the controversy now remains," we wonder what all this booming of the 3,000-volt continuous-current system means, or what is the object of the vigorous activities of the rival American firms carried out on this side of the Atlantic. Certainly many eminent American engineers will disagree. Again, to describe Continental development as bureaucratic engineering does not reveal true scholarship, any more than giving the Prussian railways credit for leading the 1-phase system in Europe does. Nor is it right to infer that decisions can scarcely be re-considered. How about the French, Dutch and Berlin railways; also some of the early American railways where changes were made after great expense had been involved? And who would be so bold as to say that the 1,500-volt, continuous-current system will become the standard system in Great Britain?

Coming now to the contents, the author does well to emphasise that hitherto electrification has usually been adopted as an expedient for overcoming abnormal difficulties of working. The useful part of the book begins with the chapter on "The Locomotive." The author considers the tram-suspension to be the commonest drive for locomotives—probably American locomotives is meant here. It remains to be seen whether this drive or the drives favoured in Europe will ultimately survive. The author's view that the former is based on "natural and sound lines of evolution" seems premature. There is much excellent matter in this chapter, some of which is essentially mechanics, and might equally well be found in a treatise on steam locomotives. Under "riding of locomotives" a number of important matters are dealt with, such as: pressure on rails, interaction between wheel and rail, motion on curved track, alignment, equations of motion, inertia, blows on rails, gear-teeth and journals. Vibrations in side-rod locomotives are dealt with at length, but more attention might have been paid to the modern remedy—elasticity.

The chapter on railway motors deals first and fully with continuous-current motors for motor-coaches, but the locomotive types are treated rather meagrely. Regeneration is not well considered—in a book of this kind the engineer has a right to expect the principles set forth in detail. Motor control fills a long chapter, in which the writer is very successful. For calculating the resistance steps in the starter the author presents a method based on the use of universal curves, which should be useful to switchgear designers, who constantly deal with this matter. Though contactors are still used on 1-phase locomotives, we should like to see due attention given to the controller or tap-switch type, which has been widely used of late years in Europe. The chapter on the distribution system contains a lot of useful information. The question of interference with communication circuits gives the author a good chance of indicating his preference for the continuous-current system, though he does not dwell on its effects when a short-circuit with unlimited power behind it occurs. Of course the 1-phase system is capable of producing much disturbance, entailing, at times, costly remedies, such as removing the weak-current circuits from the track. It should not be forgotten, however, that in some cases these circuits had to be removed to make room for the overhead equipment, or to prevent danger from broken wires, whatever system was adopted. Mr. Carter, indeed, reminds us that the steam-worked railway has grown up around the steam locomotive, and that it would be unfair to electrical operation to judge it as limited by the methods of steam operation. As is well known, the chief interference trouble experienced in this country has been caused by rotary converters feeding continuous-current tracks.

In connection with power equipment and systems of electrification, here again we find widely-varying views, indicative of vigorous and healthy development. On the one hand there

is the great movement for a common 50-cycle supply for all needs, including traction; on the other hand, there is the sharp separation of the traction from the other loads, with the consequent possibility of a separate frequency for traction with coarser regulation, &c.

Two chapters are devoted to the mechanics of train motion—a subject with which the author has made himself fully conversant. It is this kind of information which will make the book of such great value to railway engineers, and which in itself would be sufficient to justify its recommendation.

The book is well printed and illustrated, but some of the photographs are poorly reproduced—indeed, they appear to be taken from catalogues rather than from originals. The reader will have gathered that, in the reviewer's opinion, Mr. Carter is much more at home with American than with Continental practice.

Alternating Current Electrical Engineering. By Philip Kemp. Second edition, 1922. Pp. xii+515; 406 illustrations. London: McMillan & Co. Price 17s. net.

The first chapters of this book deal with elementary a.c. theory. The treatment is simple and commonplace, and does not differ appreciably in method from other text books of the same type.

Chapters XI to XXXI deal with practical applications of the theory given in the preceding chapters. These chapters are uniformly superficial. They are in most cases very readily followed, and an inexperienced reader might easily have the delusion that he knew something about the subject treated, after perusing them.

The earlier parts of the book seem to be very accurate, but this standard is not wholly maintained. Definite mistakes are generally avoided, but vague statements which are quite as blameworthy abound. For example, in dealing with current transformers on p. 192, it is stated that "the phase displacement is roughly proportional to the secondary current." On p. 318, in the chapter on Transmission of Power, the reason given for using stranded conductors in e.h.p. lines is to obtain "a uniform distribution of stress."

The book is evidently a commercial success and will probably have many admirers. The reviewer is not among these admirers and he must put on record his opinion that the real educational value of the book is very small.

The work of the publishers is well done, but some of the illustrations have done duty in too many books and catalogues already.

Wireless for the Home. By Norman P. Hinton, B.Sc. A.C.G.I. Pp. xii+87; figs. 35. London: Sir Isaac Pitman and Sons, Ltd. Price 2s. net.

This little book is an excellent guide for those who, with no knowledge of the subject, wish to fit up receiving apparatus for the new broadcasting scheme, especially if they defer till the last the reading of Chapter 1, which introduces, with little explanation, the names of apparatus described later on. The book is, in fact, just the sort of introduction to the subject which will be useful to those who want to make a start with the new hobby at once without spending the time and trouble required for the study of fuller and more advanced text-books.

The author strives, usually with success, to be simple, though it is easy to see that he is often longing "to let himself go." His explanations are rather sketchy and disconnected at times, but in some cases, as in the difficult one of heterodyne reception, they are delightfully clear, and they are always concise, unlike so many books written from a popular standpoint.

In the chapter on the aerial, the dimensions given for the aerial itself are not those now in force, but this is a small matter, as the correct dimensions are laid down in the licence, and, with this exception, all information in the book is accurate and up-to-date.

There are a few misprints, as "times" for "miles" on page 22, and "tripod" for "triode" in fig. 31a, which, incidentally, should read "fig. 31," but the book is excellently printed on good paper and contains 35 well-reproduced illustrations and diagrams.

BUSINESS NOTES.

Bankruptcy Proceedings.—John William Paul Adams, Market Street, Polesworth, Warwickshire, electrical engineer.—The public examination of this debtor was held on October 25th at the Court House, Corporation Street, Birmingham. The statement of affairs showed liabilities of £271, against assets of £91, or a deficiency of £180. Debtor attributed his failure to bad trade and becoming guarantor for another. It appeared that he commenced business in 1917, and was successful until March, 1921, when by reason of the coal strike the takings declined, and did not recover. Debtor was closely questioned with reference to a newsagent's business which he alleged had been carried on by his daughter, assisted by his wife. After further questions the examination was adjourned.

Horace John Albert Maullin, 206, Lozells Road, Hockley, Birmingham, house painter, and also trading as the Wilton Engineering Co., at 124, Devonshire Street, Birmingham, electrical engineer.—The public examination of this debtor was held on October 25th at the Court House, Corporation Street, Birmingham. The statement of affairs showed liabilities of £254, against assets of £44 10s., or a deficiency of £209. Debtor stated that he commenced business as a house painter in 1890 with a capital of £900. The electrical engineering business was commenced in February, 1921, with the idea of providing employment for two of his sons. He had £400 capital at the time, all of which was expended in plant and machinery. He had been in financial difficulties for some time, and several unsuccessful attempts were made to dispose of the business as a going concern. He would not have been in difficulties if he had not branched out into the electrical business. The examination was closed.

W. Shaw, Junior, electrical engineer, 26, Westcliffe Road, Shipley.—Receiving order made October 28th on debtor's own petition.

E. W. Morgan, company director and electrical engineer, Eccles Mill, Monton Lane, Eccles.—Last day for proofs for dividend, November 15th. Trustee: Mr. J. G. Grant, Official Receiver, Byrom Street, Manchester.

R. T. Morrison, electrical engineering contractor, 82, Lumb Lane, Bradford.—First and final dividend of 4s. 8d. in the £, payable November 8th at the Official Receiver's office, 12, Duke Street, Bradford.

A. Kershaw & C. H. Wood (Kershaw & Wood), electrical engineers, 9, Bradford Road, Dewsbury.—Trustee, Mr. C. Turner, 155, Norfolk Street, Sheffield, released September 22nd.

Company Liquidations.—Southport Tramways Co., Ltd.—A meeting of members is called for November 30th at 88, Kingsway, W.C., to hear an account of the winding-up from the liquidators, Messrs. H. A. Stagg and T. Bower.

Rotax Motor Accessories Co., Ltd.—A meeting of members is called for November 29th at Rotax Works, Willesden Junction, N.W., to hear an account of the winding-up from the liquidator.

Rhondda Tramways Construction Syndicate, Ltd.—A meeting of members is called for December 1st at 62 and 63, Queen Street, E.C., to hear an account of the winding-up from the liquidator, Mr. W. B. Cownie.

Midland Electric Co. (Southport), Ltd.—A meeting of members is called for December 4th at the offices of Messrs. Davies & Crane, Hoghton Chambers, Southport, to hear an account of the winding-up from the liquidators, Messrs. W. A. Bond and J. A. Bond.

Dissolutions of Partnership.—J. Glenn & Co., motor engineers and electricians, Ayston Road, Uppingham, Rutland.—Mr. J. H. Glenn, Mr. W. Glenn, and Mr. S. J. A. Walker have dissolved partnership so far as regards Mr. W. Glenn, who retires from the firm.

The Re-echo Wireless Manufacturing Co., manufacturers of wireless receiving sets, 16a, Hatton Wall, E.C.—Messrs. S. F. O'Hara, J. B. Bignamy, and H. R. Howling have dissolved partnership.

Baillie & Hutchison, electrical engineers, 85, Main Street, Cambuslang.—Mr. J. C. Baillie and Mr. W. B. Hutchison have dissolved partnership. Mr. Hutchison will attend to debts and continue the business on his own behalf.

Hayes & Hayes, electrical engineers, Fulwood House, Fulwood Place, High Holborn, W.C.—Messrs. L. and W. M. Hayes have dissolved partnership.

Trade Announcements.—With reference to the death of Mr. Fernand Espir, notified in our pages last week, we learn that the remaining partners in the business, Messrs. Jules and Henri Espir, will continue to conduct the business of the firm under the same name at 3, East India Avenue, London, E.C.

New showroom premises at Townend, Pontefract, have been opened by the Electrical Contracting & Motor Co.

Catalogues and Lists.—Messrs. William Sanders & Co., Falcon Electrical Works, Wednesbury.—A price list of "Rushall" cable sockets in sizes of from 15 to 200 A.

Holophane, Ltd., Elverton Street, Vincent Square, S.W.1.—An illustrated leaflet dealing with the "Filterlite" totally-enclosed bowl for semi-indirect lighting.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.—Leaflet No. 180, illustrating and describing ironclad motor starting panels. Full dimensions are given.

Messrs. Lionel Robinson & Co., Ltd., 3, Staple Inn, W.C.1.—An illustrated folder giving prices of "Ballsok" insulating beads.

Messrs. Bastian & Allen, 58, Haymarket, S.W.1.—An illustrated pamphlet describing the "Bastian" hot-water geyser.

Messrs. A. C. Alexandra & Co., 10, Iddesleigh House, Caxton Street, S.W.1.—Two price lists of "Omega" electric lamps for domestic and other uses.

T. V. Wireless & Electrical Supplies, Latimer Road Works, Teddington.—An illustrated price list of electrical accessories.

The British Vacuum Cleaner & Engineering Co., Ltd., Parsons Green Lane, S.W.6.—Catalogue No. 228, dealing with pneumatic suction plant for various purposes.

Messrs. Herbert Kennedy & Co., Ltd., 47, Victoria Street, Westminster, S.W.1.—In our issue of October 20th we acknowledged the receipt of an illustrated booklet describing what was referred to as the "Electroscope." The right designation of the instrument is, of course, the Elverson "Oscilloscope," and we trust no confusion was caused by the error.

Glasgow Electrical Engineering Co., Ltd., 45-47, Pitt Street, Glasgow.—An illustrated booklet describing automatic self-regulating wind dynamo installations.

Bayliss Duddleston Electric Supplies, Weaman Street, Birmingham.—Particulars of the "Victory" 500-W bowl-fire.

L. G. Hawkins & Co., Ltd., 116, Charing Cross Road, W.C.2.—A pamphlet entitled "The Illusive Therm," advocating the use of electricity in place of gas and illustrating a number of domestic appliances.

Messrs. Ferguson, Pailin, Ltd., Edward Street, Higher Openshaw, Manchester.—Catalogue Section No. 160, A2, giving illustrated descriptions of industrial and mining-type switchgear, including automatic and non-automatic draw-out and non-draw-out patterns for wall or floor mounting.

Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.—A folder advertising time switches for use in connection with shop-window lighting, &c., and a pamphlet illustrating and describing the action of these switches.

Messrs. Dieny & Lucas, Ltd., 329, High Holborn, W.C.1.—An illustrated price list of squirrel-cage and slip-ring motors made by the Société Alsacienne de Constructions Mécaniques—the firm's principals.

The Wholesale Fittings Co., Ltd., 23, 25, and 27, Commercial Street, E.1.—An illustrated and priced catalogue of lighting fittings of "Supastone" "three-ply" glass.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—A well-illustrated list of "Sunco," "Belling," "Cosmos," "Jackson," "Flamingo," "Revo," "Heatrae," "Premier," and "Magicoal" electric fires. Priced.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—Incandescent Lamp Handbook No. 3c, giving particulars of lamp bulbs for various makes of automobiles. Also a booklet (L. 228) dealing with the "Tungar" rectifier, and a folder illustrating artistic lighting pendant fittings.

Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C.1.—A stock list (November) of d.c. motors.

Messrs. Henderson & Thornton, Ltd., 3, Percy Street, Tottenham Court Road, W.1.—October net trade price list of electrical accessories, including conduit and fittings, switch- and fuse-gear, wall plugs, lampholders, &c.

"Lamlok," Ltd., 36, Rusthall Avenue, Chiswick, W.4.—Two illustrated and priced pamphlets dealing with the firm's lamp-locking device, and a mailing-card bearing a sample.

Messrs. W. J. Furse & Co., Ltd., Traffic Street, Nottingham.—Two illustrated descriptive pamphlets dealing respectively with an electrically-controlled curtain for theatres, and electric lighting dimmers.

The Anglo-American Electrical Co., 101, St. Vincent Street, Glasgow.—An illustrated pamphlet dealing with the "Pallas" vacuum cleaner; also a description of the "Anglectra" bell transformer.

The Runbaken Magneto Co., Ltd., Derby Street, Manchester.—An illustrated price list of automobile accessories, including accumulators, sparking plugs, dimming switches, &c.

The British Empire Exhibition.—We have received from the director of the British Engineers' Association, 32, Victoria Street, London, S.W., a brochure giving full particulars of the Shipbuilding, Marine, Mechanical, and General Engineering Section of the British Empire Exhibition, Wembley Park, 1924, for which the Association has authority to let space to any British engineering firm. It is urged that provisional applications for space should be sent in at once.

A Test of Strength.—A test of the strength of "Osram" lamps was provided by a collision between two motor cars and a street lighting standard at Windsor recently. Although the standard was broken in three places, the 200 c.p. "Osram" lamp mounted on it remained intact. This method of testing lamps, however, is considered too expensive for general adoption.

"Freezor" Fan Competition.—The General Electric Co., Ltd., announces that the following have been awarded prizes for the best window display advertising "Freezor" fans:—1st (£25), Messrs. Edmundson's Electricity Corporation; 2nd (£10), Messrs. Thomas Gunn, Ltd., Fore Street, E.C.2; 3rd (£5), Mr. L. Hancock, Grimsby; consolation prizes (£1) Messrs. Watson, Marsh & Co., Harding Bros. (Hereford), and H. Fenimore (Eton).

Small Electrical Vehicles.—As a consequence of the high selling prices of German motor cars equipped with internal combustion engines and the high working expenses, attention is now being directed by two firms to the introduction of small electrical vehicles for town use. The efforts lie in the direction of producing light one- or two-seater cars, and light delivery cars for the transport of about 2 cwt. of goods and capable of rendering services to many small traders.

Fuller's United Electric Works, Ltd.—Circulars have been issued calling a meeting, by Order of the Court, to be held at Winchester House, E.C., on November 9th, for the purpose of passing a resolution to enable the company to enter into a compromise or arrangement with its creditors, and for the re-organisation of the company's finances. A statement of facts, leading up to the present position, has been issued. Preliminary meetings of the creditors and shareholders have already approved the outline of the proposed scheme, and the resolutions to be passed at the forthcoming meetings are to enable the scheme to receive final approval.

New London Commerce Degree Bureau.—A new bureau under a University of London Trust, has been opened at 46, Russell Square, W.C.1, for the assistance of external students for the University Commerce Degree. Students in the provinces and elsewhere reading for this degree who cannot attend suitable colleges or classes are invited to communicate with the secretary (Mr. H. J. Crawford, B.A.). There is a staff of experienced educational advisers. The bureau is also the recognised employment agency for London University graduates, and employers wishing to get in touch with London-trained men and women are requested to make their wants known to the secretary. We understand that the Bureau's charges are small, as it is not a profit-making body. Prospectuses may be had from the secretary.

Lead.—Reporting under date October 28th, Messrs. James Forster & Co. state:—"The Metal Exchange this week has been the centre of an enormous speculative activity in tin, spelter and lead, the transactions on the latter metal reaching 6,000 tons, half of which was for January shipment; large purchases have also been made for February and March. Trading in actual lead has been on a very small scale, consumers being well supplied. Although trade is better than it was, there is certainly nothing to justify such a market as we have had this week. Arrivals this month are again on a large scale, London and Liverpool alone up to date having received about 15,500 tons, according to the Customs Entry Lists."

Tenders for Lamps for Johannesburg.—The *South African Mining Journal* quotes the following prices recently tendered to the Johannesburg Municipality as an indication that the lamp trade is in a decidedly unsettled state at present:

Tenderer.	Price per dozen. 210/60, 240/60. s.	d.	210/20. s.	d.	Country of Origin.
Gilbert & Co., Ltd.	13	6	14	6	United Kingdom
British Agencies, Ltd.	14	0	14	0	Switzerland
S.A. General Elec. Co.	11	0	11	0	U.S.A.
Niven & Mitchell	12	2	12	2	Austria
C. Kleudgen, Ltd.	12	0	12	0	Germany
Sauler & Franks, Ltd.	15	6	16	6	England
Griffin Eng. Co., Ltd.	13	2	14	2	England
Griffin Eng. Co., Ltd.	12	0	12	0	Germany
Siemens Bros. & Co., Ltd	12	6	12	6	England
Bennert & Lenz, Ltd.	11	9	11	9	Holland
Rice, Wilson & Herd	11	0	11	0	England
Bartle & Co.	7	6	7	0	Austria
Metro-Vickers Elec. Co., Ltd.	11	5½	11	5½	England
B.G.E. Co., Ltd.	12	0	12	0	England
Hubert Davies & Co., Ltd.	12	4	12	4	Holland

"It is to be noted," says our contemporary, "that the lowest tender was 7s. 6d. and 7s. a dozen, the country of origin being Austria; further, that the lowest British offer was the same as the only American offer, namely, 11s. a dozen. It is evident that British manufacturers are up against severe competition."

Local Exhibition.—The Douglas (I.O.M.) Electrical Exhibition was opened by the Mayor (Councillor Kelly) on October 26th. It remains open until November 7th. Among the exhibitors are Messrs. Siemens Bros. & Co., Ltd., Carron Company, the General Electric Co., Ltd., R. Seddon & Sons, Lawton & Co., Christian & Shaw, J. C. Faragher & Co., T. W. Broadbent, and G. H. Blackburn. The exhibition, which is being held in the Royal Hall, is very comprehensive, every domestic application of electricity being represented, apart from numerous industrial appliances.

The Welsh National Museum.—The electrical installation at the National Museum of Wales, which was opened on Saturday, was carried out by Messrs. Fred Price & Co., Ltd., Cardiff. The fittings were especially designed to conform to the architectural design of the building, and much forethought was necessary in connection with the print galleries. The whole of the reflector glassware in the various galleries is of the "Moonstone" pattern, used in conjunction with the "Britannia" gasfilled lamps.

A German Review of Russian Electrical Prospects.—Some wholesome repression of the over-sanguine expectations regarding the rebuilding of Russia and the openings existing there for the electrical industry are furnished by Dr. M. Klein in a recent exhaustive study of that country's economic possibilities. On the development of Russia's water resources, he says there are existing some 20,000,000 h.p., 10,000 h.p. available in single installations, of which 2,500,000 h.p. takes first place for development. Bearing in mind that industrial Germany before the war had hardly 3,750,000 installed kW employed, it is difficult to see how Russia could utilise 2,500,000 h.p., for the creation of new industries there is still a question of the future. Besides this, the water power lies in regions which, on geographic or climatic grounds, makes the erection of big electrical works an impossibility. The Murman land, for instance, with its 1,000,000 h.p., lies north of the Polar circle and is, besides, thinly populated. The same criticism applies to Turkestan. There also the presumption of industrial development is lacking. The electrification of the railways is also out of the question, for the needed traffic is absent, one of the chief requirements in the economy of electric traffic. If, too, the circumstances in Germany and in Russia are compared (the data are taken mostly from the year 1910), it will be seen that, with a somewhat greater extent of network in the latter country, the passenger traffic is only one-tenth that of the German, and that from a square kilometre of land in Germany 150 times more goods are forwarded than in Russia. Lastly, if the huge wealth in timber in Russia be regarded, it is hard to see how electrical working can compete with the steam locomotive, which can obtain its fuel alongside the line on which it runs. More to the point, it would be, if the improvement of Russian navigation were taken in hand, for before the war more goods were forwarded by Russia's rivers than by its railways. One positive proposal Dr. Klein makes, at least, for the rebuilding of Russia, with the help of electricity. In the Ural, where most of Russia's industries are located, it would be possible to create a great timber trade. Side by side with this existing works must be improved and modernised. In such a development the electrotechnical industry would be afforded a rich field of working. Such industrialisation would, however, be quite upside down if begun by the building of power stations, because the Russian population would only be able to contribute to a feeble extent towards the large costs of such undertakings. The electrotechnical industry can only actively and usefully enter an appearance when production and traffic, whose servant it is, have reached a certain stage of progress.—*Elektrotechnik und Maschinenbau.*

Book Notices.—"The Metropolitan-Vickers Gazette," August and September.—The first of these two numbers contains papers and articles on "Electric Traction," by Sir V. L. Raven (reproduced); "Protective Apparatus for Turbo-Generators," by Mr. J. A. Kuyser (reproduced); "The Thermionic Valve," by Mr. H. C. McGuffie; "An Overload Inverse Time-Limit Relay with a Definite Adjustable Minimum"; "The Operating Time of D.C. Solenoids for Oil Circuit Breakers," by Mr. G. E. Gittins, B.Sc.; and a description of the plant extensions at Stoke-on-Trent.

The September number includes "Radio Broadcasting," by Mr. H. G. Bell, M.Sc.Tech.; "Modern Domestic Heating by Electricity," by Messrs. J. W. Buckley, M.Sc., and J. G. Pearce, B.Sc. (Eng.); "Post-war Electrical Driving Equipments in Lancashire Cotton-Spinning and Weaving Mills," by Mr. V. Mallalieu, and continuations of Sir V. L. Raven's and Mr. Kuyser's papers.

"Elevating and Conveying Machinery for Handling Loose Bulk Materials: Part II.—Conveyors," by H. Davies. London: Wightman & Co. (for the Association of Engineering and Shipbuilding Draughtsmen).—In this reprinted lecture belt conveyors of numerous types are fully described and formulæ for their design are given. Other types dealt with include tray, worm, and bucket conveyors.

"Hydro-Electric Engineering," Vol. II.—Electrical, by A. H. Gibson. Pp. viii+313; illustrated. London: Blackie and Son. Price 30s. net.

E.D.A. "Stunts."—An ingenious suggestion for solving that burning question of the day: "How to reduce the gas bill," is contained in the latest publication of the E.D.A. (No. 307). We recommend it to all electrical men who are endeavouring to increase their business, and it may also provide a way out of their dilemma for the gas companies.

Another device possessing topical interest is a leaflet (E.D.A. 327) in which the words "Conservative," "Liberal," and "Labour" are conspicuously brought out in a message urging the reader to "Vote for Electricity." Both these publications are extremely likely to catch on with the general public.

The Temporary Closing of Coventry Works.—At the meeting of the Coventry City Council, on Tuesday, the Mayor (Ald. W. H. Grant) reported upon an interview with the directors of the English Electric Co. with reference to the temporary closing of its works in the city. The result was that the directors expressed themselves as very sorry that they were not able to alter their decision. They explained they had, in addition to the Coventry works, other large undertakings at Rugby, Stafford, Bradford, and Preston fully equipped for dealing with the products they manufactured, and that these works had been for a considerable period on short time. The effect had been to materially increase the manufacturing costs, and they had, therefore, found it necessary to concentrate on those works which were best equipped for the company's specialities. The deputation was assured that the closing was merely temporary, and that as soon as conditions improved the works would be re-opened. It was not the intention of the company to remove or dismantle any of the plant, but to employ a very large number of the displaced men at the Rugby works.

Sheffield Steel Products Co., Ltd.—As the result of an inquiry into the financial position of the company, made by Messrs. W. B. Peat & Co., it was found that there was such a deficiency as to render continuation of the business impossible without reconstruction, which should produce further working capital. Sir W. B. Peat was last month appointed receiver and manager on behalf of the debenture holders, and proposals for reconstruction were to be prepared. On Tuesday last, however, a petition for compulsory liquidation by judgment creditors for £4,200 came before the Winding-up Court in London. It was then explained that the petition would stand over until next term.

Arbitration Failure in Australia.—The Sydney *Daily Mail* says that the annual report of the secretary of the Electrical Trades Union admits the inability of the present system of industrial arbitration "to provide for the realisation of the workers' social ideas." The system has already been condemned by a number of employers' federations.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British Trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

L.P.C. Electrical Co. (lettering and design). No. 428,699. Class 5. Unwrought and partly-wrought metals used in manufacture. Jacob Lerman, trading as the L.P.S. Electrical Co., L.P.S. Works, Avenue Road, Acton, W. October 25th, 1922.

M.E.W. (lettering and design). No. 426,737. Class 8. Wireless communicating instruments and apparatus. Mitchells Electrical & Wireless, Ltd., McDermott Road, Peckham, S.E.15. October 25th, 1922.

Crystor. No. 427,369. Class 8. Apparatus for wireless telegraphy and telephony. Sydney L. Forbes, 5, Edwardes Place, Kensington, W.8. October 25th, 1922.

Bat. No. 428,448. Class 50. All kinds of insulating materials and preparations. Lindsay & Williams, Ltd. Bennett Street Works, Ardwick, Manchester. October 25th, 1922.

New Belgian Wireless Concern.—The Société Belge Radio-Electrique has been formed in Brussels with a share capital of 4,000,000 fr., and the participation of the Société Générale de Belgique and other banks.

The Brewers' Exhibition.—An outstanding feature of the 39th Brewers' Exhibition, held at the Agricultural Hall from October 28th to November 3rd, was the amount of electrically-driven machinery on show. The electrical resources of the hall must have been taxed to the limit. Apart from this, however, several firms displayed electrical appliances for various purposes, and we hope to say more about these in our next issue.

Chinese Notes.—The Electric Company of Harbin has been registered with the Ministry of Agriculture and Commerce.

The Kunshan Telephone Co., in Kunshan, Kiangsu, has petitioned the Ministry of Agriculture and Commerce for registration.

Negotiations between the Japanese and Chinese authorities concerning a scheme for transmission of electric power from Fushun to Moukden—first mooted in 1918—have been concluded, and surveys for the erection of cable standards across country were commenced in July; the work on this undertaking is nearly finished. The 1,500-kW extension to the plant of the Chinese Electric Light Co., at Moukden, contracted for by Messrs. Andersen, Meyer & Co., has been delivered during the year.

The Pin Kiang Electric Service Co., of Kirin, has been registered in the Ministry of Agriculture and Commerce.

The Hangchow Electric Light Co. is erecting outside the Ken Shan Men a large installation for the supply of electricity to the inhabitants of the Hangchow suburbs.

During February the new Soochow Electric light company began to operate, competing very successfully with the older company. It was rumoured that the new company obtained much support from those who had formerly patronised the old, or original, electric light company of Soochow, because, so it was contended, a good deal of Japanese money was invested in the old company.

South African Notes.—German magnetos have reappeared on the S.A. market, and are being freely advertised there. The summer spurt in the S.A. demand for electrical machinery and materials should last until the new year at least, as many municipal building schemes remain uncompleted. The recent installation of electric pumps for Elisabethville's water supply system provides an illustration of the growing Katanga market for electrical material.—*S.A. Engineer & Electrical Review.*

Peruvian Customs Exemptions.—It is reported from Lima that the President of the Republic has issued a decree exempting from import duties transport material (motor-cars, &c.), and telephone and telegraph material.

Ladies at Play.—We congratulate the Ediswan Ladies' Football Team on the capital start they have made for the new season. In the three games played to date they have proved victorious, their victims being Clapton, Osram, and East Ham. Their gaol total, 15 for, 2 against, speaks well for both their attack and defence.

Boiler Tools and Instruments.—The National Boiler and General Insurance Co., Ltd., has published a well-illustrated brochure setting out the equipment necessary for the satisfactory operation of boiler plant. The matter included comprises gauges, valves, scaling hammers, various testing instruments, indicators, and numerous other accessories.

New Italian Companies.—The Azienda Idroelettrica Giulia has been formed at Gorizia for the construction of hydro-electric plant and the generation and distribution of power in the communes and provinces of Gorizia and Trieste.

There has been formed at Rezzoaglio the Società Anonima Idroelettrica di Rezzoaglio, with a capital of 200,000 lire, for the establishment of a power station and the distribution of current in that city.

There has been embodied at Milan the Società Idroelettrica Alto Noce, with a capital of 100,000 lire, for the development of the water power of the River Noce and its feeders.

For Sale.—By direction of the Disposal Board, Messrs. Geering & Colyer will sell by auction at H.M. Dockyards, Chatham and Sheerness, on November 21st and following days, electrical plant and accessories. Holmfirth U.D.C. Electricity Department invites tenders for one 120-b.h.p. Bates and Scholes gas engine. (See our advertisement pages today.)

LIGHTING AND POWER NOTES.

Blackpool.—Electricity in Bulk.—The Electricity and Tramways Committee has received a letter from the Electricity Commissioners intimating that the Commission has asked the St. Annes Urban District Council to approach the Corporation with regard to the terms upon which it is prepared to give a bulk supply of electricity to meet the requirements of electricity consumers in the district of St. Annes and Lytham. A letter has also been received from the Clerk to the St. Annes Urban District Council inquiring the most favourable terms which the Corporation is prepared to offer for a bulk supply of electricity to the district. The communications have been referred to the chairman, the vice-chairman, and two members of the Electricity Committee with full authority to act and submit an offer to St. Annes.

Brighton.—New Plant.—The Town Council has decided to erect two water-tube boilers at the Southwick station at a cost of £22,066, and application is being made to the Electricity Commissioners for sanction to borrow that amount.

Buxton.—Loan.—The Town Council has decided to make application to the Electricity Commissioners for sanction to borrow £2,576 for the purchase of new plant.

Cardiff.—Reorganisation of Administration.—The Electricity and Tramways Committee has been divided into two committees dealing with electricity and tramways respectively, and all matters relating to public lighting will be dealt with by the Public Works Committee.

Chichester.—Electricity Supply.—A Special Electricity Order issued by the Electricity Commissioners on September 30th gives the Corporation power to supply electricity within the city and to a number of neighbouring parishes.

Chulmleigh (Devon).—Inauguration of Undertaking.—The chairman of the Parish Council recently set in motion the machinery at the new power station, which has been installed by local enterprise. Electricity is generated by water power and is distributed by overhead transmission lines.

Continental.—France.—The details of the agreement have been settled between France and Switzerland for the importation, by a 135,000-V transmission line, of electricity from the latter country into France. The line will start from Miécourt, in Switzerland, being linked to the network of the Berner Kraftwerke, which owns the station of Olten-Gosgen (Mühlberg). The power transported will be 28,000 kW. It will feed the Mulhouse district (the transformer station being situated at the Ile Napoléon), the districts of Colmar and Münster, and will be linked up at Wintzenheim-Turckheim to the existing 70,000-V transmission line belonging to the Société d'Electricité de Strasbourg. It will be continued to Sarrebourg-Creutzwald by a 70,000-V transmission line to Solec, now under construction, and belonging to the Société Alsacienne et Lorraine d'Electricité. Altogether the scheme represents the greatest interlinking of networks existing in France. The transformer stations required are not yet taken in hand, but will be so shortly. At the Ile Napoléon the 135,000-V transmission line will work in parallel with that from Laufenbourg at 70,000 V and that at Rheinfelden at 40,000 V. In the near future a station will be set up at Kembs, and probably a pumping station in the valley of Kaysersberg (Upper Rhine), the Commission du Rhin having agreed to the French utilising the waters of the Rhine.

Application has been made by the Société Hydro-électrique de la Tardoire for a concession to construct a network to serve some 13 communes in the *départements* of Charente and Dordogne.

The Société Agricole d'Electricité du Canton de la Ferté-Alais has applied for permission to set up a high- and low-pressure distribution system to serve 18 communes in the *département* of Seine-et-Oise. In the same *département* Government sanction has been asked for the establishment, by the Société Co-operative Agricole d'Electricité de Versailles Ouest, to distribute electricity to 12 communes in the Versailles region.

An extensive distribution scheme in the county bordering on the Upper and Lower Rhine is contemplated by the Electricité de Strasbourg company, which is applying for a concession to carry out the work.

In order to avoid a repetition of the troubles caused by the drought last year at its hydro-electric stations, the Société Sud Electrique is establishing a steam-operated sub-station near Nimes. The new plant will be of 3,000 h.p. and will be equipped with Thomson-Houston alternators.

Germany.—The production and consumption possibilities of the 100,000-V network of middle German were set forth at at recent meeting of the Elektrowerke Gesellschaft in Berlin. The network has a length of 1,500 km., and is thus half as big again as the projected 100,000-V network in Bavaria. The dynamo capacity linked up with the network amounts to some 700,000 kW. Various extensions both of the network and the generating plant are contemplated. By these installations the whole of the province of Brandenburg, including Berlin, the province of Saxony, and the Free States of Saxony and Anhalt, will be effectively supplied. Almost all of the above network has for some time been in parallel working.—*Elektrotechnik und Maschinenbau.*

Besides the big Bayernwerk scheme to develop the water resources of Bavaria on a large scale, a number of smaller schemes are in hand, including an installation on the Inn River, near Mühldorf, by the Innwerk-Bayrische Aluminium Gesellschaft. It is planned to give 100,000 h.p. A second is an installation on the Wagginger See in Upper Bavaria, calculated to yield a maximum of 7,000 h.p. A third is on the Main River near Oberwallenstadt, which will shortly be finished. Both these undertakings belong to the Munich Gesellschaft für Licht und Kraftversorgung.

Crieff.—Electricity Supply.—The Crieff Electric Supply Co. has been formed with a capital of £12,000, to supply electricity for lighting and power to the district.

Devizes.—Electricity Supply Scheme.—A strong syndicate of prominent local people has been formed with the view of establishing an electricity undertaking for Devizes and district, and Messrs. May & Hawes have been appointed consulting engineers to prepare a scheme for submission to the Electricity Commissioners with the syndicate's application for a Special Electricity Order.

Gillingham (Kent).—Extension of Supply.—A canvass is to be made of the residents in Wigmore and Hempstead with a view to extending the area of supply to include these districts.

Great Harwood.—Inauguration of Supply.—On October 27th the electricity supply was formally inaugurated by Councillor J. Bentley, J.P., chairman of the Council. Electricity is obtained from the Whitebirk generating station of Blackburn Corporation. Cables have already been laid in the main streets, and it is expected that the majority of the business premises will be supplied at an early date.

London.—Hammersmith.—The Electricity Committee recommends that a revision of prices be put into force as from the September meter readings. The proposals are broadly as follows:—Lighting: First 2,000 kWh per annum, 6d. per kWh; the charge will then be reduced by stages until a consumption of 20,000 kWh per annum is reached, when the charge will be 3d. per kWh. Power: First 2,000 kWh, 1.75d. per kWh; graduated reductions for larger quantities up to 14,000 kWh, after which the charge will be 1.4d. per kWh. Thermal storage supplies: 1½d. per day for each 100 W. Showroom supplies: Similar to power rates. Special rates for garages and kinemas. A special tariff is introduced for customers agreeing to take a minimum quantity for a year or for five years.

Stepney.—The Electricity Committee is adopting a "free" wiring system to small houses and tenements.

Malton.—New Power Station.—The Northern Electric Supply Co. has notified the Urban Council that in order to meet the increasing demands for electricity it has decided to erect a new power station.

Mansfield.—Extension of Supply.—The Town Council has decided to supply electricity to Pleasley Hill at a cost of £4,000.

New Zealand.—Hydro-Electric Progress.—A feature of the Public Works statement is that the total expenditure on the development of railways, roads, bridges, and hydro-electric installations exceeds that of the previous years by £3,000,000.

This is chiefly due to the installation of labour-saving machinery, which has reduced the cost of constructional earthworks by 30 per cent., and to additional work undertaken to prevent unemployment. Good progress is announced in all hydro-electric works, the contracts for the material for which have all been placed in Great Britain.—*Reuter* (Wellington).

Birkenhead.—The Borough Council of Birkenhead (N.Z.) is about to seek authority from the ratepayers to undertake a comprehensive scheme involving an expenditure of £98,500. Included in the project is a proposal to install electric lighting in the district.

Nanawatu-Oroua.—The Power Board in the Nanawatu-Oroua district (North Island) is shortly to take a poll for authority to raise £500,000 to provide for the reticulation of the local area electricity supply. About 700 miles of transmission lines and transformers, equipment, &c., would be required.

Wellington.—A report recently issued says that the City Council has for some time been faced with the question of the voltage which shall be used when the Government electricity supply is available. At present it is 100, but other places in the Dominion use 230. The difficulty is that a change will involve the alteration of all existing installations, which means an outlay of £750,000. To overcome this difficulty the Council's electrical engineer has proposed a voltage of 115, so designed as to be ultimately convertible to the 230 standard. Outside experts have been consulted, and they are unanimously in favour of a voltage of 230, which the Council has adopted, leaving the financial question to be adjusted later.

Auckland.—A schedule of electric street lighting to supplant the existing service has been adopted by the City Council. It is anticipated that the work will be completed by 1927, when the cost will reach £25,000 per annum.

As a result of an interview between representatives of the Auckland Electric Power Board and the Minister for Public Works, the Minister has undertaken to proceed at once with the erection of a transmission line from Horahora to Auckland.—*Reuter's Trade Service.*

North Wales and Chester Electricity District.—Inquiry Postponed.—With reference to the local inquiry with respect to the above-named district fixed for November 14th at the Assembly Room, Town Hall, Llandudno, the Electricity Commissioners feel that in view of the impending general election it would be in the interests of all parties to postpone the inquiry. They have accordingly decided to postpone the inquiry until Tuesday, November 21st. The time and place of the inquiry will remain unaltered.

Portsmouth.—Extension of Area.—The Electricity Commissioners have made a Special Order sanctioning the extension of the electricity supply area of the Corporation by the inclusion of the urban districts of Havant and Warblington, and the rural district of Havant.

Ripon.—Application for Order.—Application is being made for a Special Order to supply electricity within the city and in the surrounding district.

South Africa.—Electricity Commissioners.—The new Electricity Commissioners appointed under the Electricity Act are Sir Robert Kotzé, Mr. J. A. Vaughan, and Dr. H. J. van der Byl, the Industrial Adviser.—*S.A. Engineer and Electrical Review.*

Graaf-Reinet.—The municipalty is seeking the sanction of the Provincial Administration to borrow £57,000 for various town improvements, including a scheme for supplying the district with electricity.

Southwick.—Electricity Supply.—The Urban District Council has applied to the Electricity Commissioners for a Special Order, authorising it to generate and distribute electricity for public and private purposes within the district.

Sunderland.—Price Reductions.—The Electricity Committee has decided that the charges for electricity for lighting in shops, offices, theatres, private residences, and domestic premises be reduced by 10 per cent., as from the December readings of the meters.

Watford.—Extension of Supply.—The Urban Council has decided to supply electricity for public lighting to Hunton Bridge. The engineer has been instructed to report on the possibility of a reduction in the general tariff for electricity charges.

TRAMWAY AND RAILWAY NOTES.

Canada.—Ontario.—According to *The Times*, the Timiskaming and Northern Ontario Railway Commission recommends electrification of the provincial railway at a cost of $9,000,000 (£1,800,000).

Continental.—France.—The Orleans Railway Co. has for some time past had under consideration the possibility of utilising the water resources of the Central region of France to generate electricity to work the steep-gradient lines in the Montluçon district. The programme now in hand comprises the electrification of the Paris to Vierzon section (200 km.), with extensions later to Limoges and Brive, the electrification of these lines forming the first stage of the conversion of the great artery from Paris to Brive, Montauban, and Toulouse. The electrification of the Saint Sulpice to Gannat and the Brive to Clermont sections to assist the connection between Bordeaux and Lyons will be commenced about the same time. The Paris to Vierzon section will derive its electrical energy from the hydro-electric station at Eguzon, which is about to be built on the Creuse River and from the power stations in the Paris area. The Vierzon to Brive, the Saint Sulpice to Gannat, and the Brive to Clermont sections will derive their power from the groups of works in the Central region. Two of these works, Coindre and Cellette, are now in course of construction. These groups of hydraulic and power stations will be linked up by 150,000-V lines. The goods, passenger, and express trains will be drawn by electric locomotives similar to those in use on the Paris to Juvisy line, but more powerful. The completion of this first section of electrification will take from four to five years. The completion of the whole programme will extend over a period of about 20 years. Alternating current, three-phase, at 50 periods, will be used, transformed to continuous current at 1,500 V in sub-stations to be erected at various points.—*La Houille Blanche.*

Ilford.—Year's Working.—The report of the engineer and manager of the municipal tramway department (Mr. L. E. Harvey) for the year ended March 31st, 1922, shows that the total revenue was £79,838, as compared with £70,050 in the previous year. The working expenses amounted to £61,404, as against £61,871, leaving a gross surplus of £18,434 (£8,179). Capital charges absorbed £11,246, and £965 was credited as interest. The balance (net profit) of £8,153 was transferred to the reserve and depreciation account. This result shows favourably against a net deficit of £499 in 1920-21. £17,012 was spent on capital account, the bulk of this sum being devoted to the purchase of new cars. The car-mileage increased by 68,432 to 863,061, and the number of passengers carried by 867,984 to 11,299,254.

New Zealand.—Auckland.—The extension of the Auckland city tramway service along the Great South Road is to be put in hand early in January. The cost of the work, including equipment, will be approximately £75,000.—*Reuter's Trade Service* (Melbourne).

South Africa.—Railway Electrification Contracts.—In response to a question in the Union Legislature, Mr. J. W. Jagger, Minister of Railways and Harbours, recently gave some interesting and hitherto unpublished information regarding the tenders received by the Government for the electric locomotives required for the Pietermaritzburg-Glencoe section of the railway. It will be remembered that the successful tenderer was the Metropolitan-Vickers Electrical Co., Ltd., Manchester, which quoted £10,918 per engine. This firm sent in two tenders, the one accepted providing for the use of Swiss mechanical parts, and the other, providing for the use of all British parts, working out at £11,642 per engine. Other tenders received were from the English Electric Co., Ltd., London, £11,554; the Allgemeine Elektricitats Gesellschaft, £12,947; the Siemens-Schuckertwerke, £12,947; the International General Electric Co., £15,105; Sir W. G. Armstrong, Whitworth & Co., Ltd., £21,037; and Messrs. Brown, Boveri & Co., Switzerland, who sent in two tenders, one at £15,200 for all-Swiss locomotives exclusive of erection in South Africa, and the other at £11,650 providing for German electrical parts, and also exclusive of erection in South Africa. —*S.A. Engineer and Electrical Review.*

TELEGRAPH AND TELEPHONE NOTES.

Canada.—Telautograph Installation.—The Grand Trunk Railway Co. has installed in its Bonaventure station, Montreal, the telautograph system, by which handwriting is transmitted electrically over wires. The instruments in commercial use include a type by which messages may be either sent or received, another type which receives only, and additional equipment includes a selective switch key, by means of which a message written on a metal plate in an instrument used in sending, can be directed for written reproduction at any one or more of the receiving instruments used in the system, as desired. The exact handwriting of the sender is reproduced at the receiving instrument at the other end of the wire. The installation at Bonaventure is to provide the public with prompt information of train arrivals. The sending machine is located in the dispatcher's office, one receiving machine is in the station master's office, and another in the information bureau. The machines are operated on direct current. To transmit a message a special pen is connected to the transmitting machine by guide rods. As the message is written on the metal plate, every impression is exactly recorded in indelible ink, on a paper tape, in full view of the writer, and by a very fine adjustment of the current is faithfully reproduced in synchronism on the receiving machine paper tape.—*Canadian Railway and Marine World.*

India.—Wireless Telephony in Madras.—Seven sets of automatic wireless telephones for Malabar have been taken from Bombay to Malapuram. Major Benning, of the Marconi

Co. in India, has also gone to Malabar from Bombay, and has had an interview with the Hon. A. R. Kapp, Special Commissioner for Malabar. He was to conduct a survey for the purpose of choosing the places at which installations are to be put up. The telephones were expected to be ready in October.—*Indian Engineering.*

South America.—Italian Cable.—It is reported from San Paulo that the subscriptions to the share capital of the Compagnia dei Cavi Sottomarini Italiani (Italian Submarine Cable Co.) in Argentina, Chile, Peru, Uruguay, &c., have already reached £1,000,000 sterling. This is equal to 25,000,000 gold lire, the Italian Government having agreed that sterling paper shall be considered as equal to 25 Italian lire. Landing rights at Rio de Janeiro and at Santos are said to have been obtained from the Government of Brazil.

The Telephone Service.—New Exchange.—The new Chorlton-cum-Hardy (Manchester) telephone exchange was opened on October 28th. There are 800 subscribers, with ample provision for extensions. The transfer to the new exchange will mean discarding the existing magneto system.

Wireless Telegraphy.—Rate Revision.—Marconi's Wireless Telegraph Co. states that from November 1st the rates for the ordinary and deferred half-rate services, "*via* Marconi," to all places in the United States of America, except New York City, will be amended by adding to the ordinary rate to New York City, which remains at 9d. per word, the respective landline charges to all points in the United States beyond New York City. The deferred rates are in all cases half the ordinary rates.—*Financier.*

Wireless Telephony.—Broadcasting Licences.—The regulations under which broadcasting licences will be issued are now complete. It is intended to supply every post office in the country, if possible, with licence form books by November 1st. Postmasters will issue them only for receiving stations in their own districts, and applicants who apply at other post offices than those in the district where the station is situated will be referred to the proper branch office. The particulars to be entered by the postmasters on the licences are: The name and address of the applicant, the address of the receiving station, and the date of expiry. The licences will be dated and initialled. Each will have a counterfoil, to be retained in the post office concerned. As regards dates of expiry, initial licences issued up to December 31st will expire on the following September 30th; those issued during the three months which ended on September 30th will fall due for renewal on June 30th next year, and those issued in the quarter which ended June 30th will become renewable on March 31st. In the second and subsequent years the renewal date for licences will be the anniversary of the date of expiry of the initial licence. No declarations of any kind will be required from the public. Notice to renew will be sent to the licensee ten days before the date of expiration, and the second notice four days after the date of expiration. If the licence is not renewed within ten days of the second notice the Post Office will take steps to inspect the station to see whether it is, *primâ facie*, still in use.—*Morning Post.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen.—November 10th. Electricity Department. One 10,000-kW turbo-alternator, with surface condenser and auxiliaries. (October 20th.)

Australia.—Melbourne.—Postmaster-General's Department. November 16th. Insulated signal cable (Sched. 958).

November 21st. Switchboard parts (Sched. 67).

December 12th. 1,416 switchboards (Sched. V68). October 20th.)

January 10th, 1923. Telegraph power plant (Sched. W.A. 647). (October 20th.)

Victorian Railways. November 29th. One industrial electric storage battery truck (4,000 lb. carrying capacity).*

January 24th, 1923. Fifty miles insulated copper wire.

January 19th, 1923. Electricity Commissioners. Steam turbine-driven boiler-feed pumps (Spec. 23/4) for the Morwell power scheme. (October 20th.)

January 15th. Switchgear and accessories, for the Morwell power scheme. (See this issue.)

January 26th. H.p. steam, drain and feed piping, valves, traps, &c. (See this issue.)

January 23rd. Melbourne Tramways Board. 500 kW rotary converter and a 750 kVA transformer. *Reuter's Trade Service* (Melbourne).

Birmingham.—November 27th. Electric Supply Department. E.h.p. switch gear. (October 20th.)

Bristol.—November 14th. Electricity Department. One 4,000-kVA single-phase turbo-alternator with condensing plant. (October 20th.)

Dublin.—November 14th. Irish Postmaster-General's Department. 90 tons h.d. copper wire, 25 tons bronze wire, 70 tons g.i. wire. (October 27th.)

November 13th. Great Northern Railway (Ireland). Stores for six months, including electrical fittings and lamps, electric cable and wire, &c. (October 27th.)

Dukinfield.—Stalybridge and Dukinfield Joint Sewerage Board. Electric motors and starters for the sewage disposal works, Bradley Hurst. Mr. F. Moss, clerk, Market Place, Ashton-under-Lyne.

Hull.—November 16th. Electricity Committee. Four natural-draught cooling towers. (See this issue.)

India.—November 17th. High Commissioner for India. D.c., l.p. two and three-core cables. (October 20th.)

Leeds.—November 10th. Electricity Department. Iron castings for 6 or 12 months. (October 20th.)

London.—St. Marylebone.—November 29th. Electricity Department. Turbo-alternator and condensing plant, water-tube boilers, fan-draught water-cooling tower, and rotary converter plant. (See this issue.)

Maidstone.—November 8th. Board of Guardians. Internal telephone system, Coxheath Institution. Mr. F. Post, clerk, King Street.

New Zealand. — Wellington.—December 5th. Public Works Tender Board. Telephone system for the Mangahao power house and sub-stations, &c.*

January 9th, 1923. Five sets 11,000-V sub-station switchgear, for the Mangahao power scheme.*

January 9th, 1923. Two sets 11,000-V sub-station switchgear, for the Lake Coleridge power scheme.*

Dunedin.—December 8th. City Council. One 150-h.p. 3-phase motor and reduction gear for the Mornington cable tramway system.*

South Africa. —Pretoria. —November 23rd. Municipal Council. H.p. and l.p. switchgear, transformers, and cables in connection with the extension of the electric light and power supply.*

South Shields.—November 15th. Electricity Department. Two water-tube boilers with mechanical stokers, economisers, induced draught plant, and steel chimney, also ash-handling plant and extension to boiler-house. (October 20th.)

Spain.—November 10th. The Harbour Works authorities at Valencia. Three electrically-operated cranes.

Stoke-on-Trent.—November 15th. Electricity Department. Mains and cables for 12 months. (October 27th.)

Warrington.—November 13th. Electricity Department. H. and l.p. paper and lead-covered cable. (October 20th.)

York.—November 21st. North-Eastern Railway Co. Telegraph apparatus and telegraph wire and line stores for six months. (October 27th.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Brighton.—Corporation. Accepted:—
Boilers required for the electricity works extension.—Yarrow & Co. (1922), Ltd.

Government Contracts.—The following Government contracts were placed during September, 1922:—

Admiralty (Contract and Purchase Department).
Secondary cells.—Fuller's United Electric Works, Ltd.
Electric lighting and power wiring.—G. E. Taylor & Co.
Electrodes.—Quasi-Arc Co., Ltd.
Electric fuses.—L. Weekes, Ltd.
Motor-driven special-type lathe.—J. Holroyd & Co., Ltd.
Electrically-driven oval-hole cutting machine.—Scriven & Co., Ltd.
Motor-driven milling and drilling machine.—H. W. Kearns & Co., Ltd.
Electric seam-welding plant.—British Insulated & Helsby Cables, Ltd.
Platinum.—Johnson, Matthey & Co., Ltd.
Automatic telephone equipment.—Relay Automatic Telephone Co., Ltd.

War Office.
Carbons.—General Electric Co., Ltd.
Electric wire.—Enfield Ediswan Cable Works, Ltd.

Air Ministry.
Accumulators.—Chloride Electrical Storage Co., Ltd.; Peto & Radford, Ltd.
Electrical wires and cables.—Hooper's Telegraph & India Rubber Works, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; Macintosh Cable Co., Ltd.; Enfield Ediswan Cable Works, Ltd.
Direction-finding stations.—Marconi Wireless Telegraph Co., Ltd.
Magnetos.—British Thomson-Houston Co., Ltd.

Crown Agents for the Colonies.
Cable.—W. T. Henley's Telegraph Works Co., Ltd.
Electric light poles.—Bullers, Ltd.
Telephone switchboard, &c.—Relay Automatic Telephone Co., Ltd.
Wireless apparatus.—Radio Communications Co., Ltd.
X-ray apparatus.—Watson & Sons (Electro-Medical), Ltd.

Post Office.
Manufacture, supply, drawing-in and jointing cable (Bradford, Haworth, Cullingworth, &c.).—Western Electric Co., Ltd.
Duplex and telephone repeaters (Taplow telephonic repeater station).—General Electric Co., Ltd.
Telephone exchange equipment: Birkenhead.—British L. M. Ericsson Manufacturing Co., Ltd. Sub-contractors: (for batteries), D. P. Battery Co., Ltd.; (for motor generators), Crompton & Co.
Creed apparatus.—Creed & Co., Ltd.

Telephone apparatus.—British L. M. Ericsson Manufacturing Co.. Ltd.; Phœnix Telephone & Electric Works, Ltd.
Testing, protective apparatus, &c.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.
Terminal blocks.—Electric & Ordnance Accessories, Ltd.
Submarine cable.—W. T. Henley's Telegraph Works Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Enfield Ediswan Cable Works, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.
Leclanché porous cells.—General Electric Co., Ltd.
Stationary secondary cells.—Accumulators of Woking, Ltd.; Van Raden and Co., Ltd.
Ducts.—Doulton & Co., Ltd.; Hepworth Iron Co., Ltd.; Oates & Green, Ltd.; Robinson & Dowler, Ltd.
Glow lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Tungsten lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; English Electric & Siemens Supplies, Ltd.; General Electric Co., Ltd.
Lead strip and sheet.—Walkers, Parker & Co.
Electric motors.—General Electric Co., Ltd.
Mouthpieces, No. 1.—North British Rubber Co., Ltd.
Distribution cable plugs.—British Insulated & Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.
Creosoted wood troughing.—Calder & McDougall, Ltd.
Insulated copper wire.—W. Geipel & Co., Ltd.
Leclanché zinc rods.—Locke, Lancaster and W. W. & R. Johnson & Sons, Ltd.

H.M. Office of Works.

Engineering works: Supply of engineering labour (Cardiff district).—Alpha Manufacturing Co. Electric wiring Cornwall House.—A. F. Goodwin & Co.

Maidstone.—Town Council. Accepted:—
Feeder cable (£544).—Union Cable Co.

Manchester.—Tramways Committee. Accepted.
Stores for six months.
Assembled commutator segments.—Dyer & Young; Manchester Armature Repair Co., Ltd.; Met.-Vickers Elecl. Co., Ltd.
Armature coils and equipments.—Manchester Armature Repair Co., Ltd.
Bell presses.—Met.-Vickers Elecl. Co., Ltd.
Phosphor-bronze springs, worm spindles and bushes, two-way connectors, trolley wheel bushes.—Kay & Co.
Tension springs.—British Thomson-Houston Co., Ltd.
Insulation tape, &c.—L. Andrew & Co.; Connolly Bros.
Controller fingers, &c.—Fairless Eng. Supplies Co., Ltd.
Steel conduit tubing, &c.—Perfecta Seamless Steel Tube & Conduit Co., Ltd.
Incandescent lamps.—Drake & Gorham (Wholesale), Ltd.
Switches and sundry lighting material.—General Electric Co., Ltd.
Electric bells, &c.—Mason & Brown.
Cells for bell circuits.—Edison Swan Elec. Co., Ltd.
Mica cones, micanite washers.—R. Whiffen, Ltd.
Insulation cloth, carbon brushes.—Hamnett & Andrew.
Divisions for arc deflectors.—British Thomson-Houston Co., Ltd.; Siluminite Insulator Co., Ltd.
Insulation varnish, &c.—Griffiths Bros. & Co. (London), Ltd.
Soldering fluid and Chatterton compound.—Ward & Goldstone.
Overhead line material.—A. Wiseman, Ltd.
Trolley poles.—Equipment & Engineering Co.
Trolley wheel bushes, &c.—Tramway Supplies, Ltd.
Trolley wheel spindles.—Tramway Supplies, Ltd.; Marshall, Osborn and Co.
Shoes for electro-mechanical brakes, grid resistances.—Electro-Mechanical Brake Co., Ltd.
Magnet coils for E.M. brakes.—P. R. Jackson & Co., Ltd.
Bell crank levers, brackets for E.M. brakes.—J. Mountford & Co., Ltd.
Grids for resistances.—H. Wallwork & Co., Ltd.
Power and lighting cables.—British Insulated & Helsby Cables, Ltd.
Copper cable and strip and steel wire.—F. Smith & Co., Ltd.
Galvanised steel cable.—R. Johnson & Nephew, Ltd.
Celluloid sheets.—Spicers, Ltd.

Education Committee. Accepted:—
Installation of electric lighting at Heald Place Temporary Municipal School.—Ward & Booth.
Electric lamps for schools.—G. H. W. Gasper.

South Africa.—Electrification of the Glencoe-Pietermaritzburg section of the South African Railways. Machinery for sub-stations:—
Twenty-one 2,000-kW motor-generator sets for 3,000-V, d.c. service, with switchgear, automatic control gear, auxiliary transformers, &c., £400,000 (approximately).—British Thomson-Houston Co., Ltd.

Stirlingshire.—Town Council of Denny and Dunipace. Accepted:—
Herbertshire Street extension of the electric cable.—Harland Engineering Co., Ltd.

Watford.—Corporation. Accepted:—
Two water-tube boilers of 30,000 lb. capacity each.—The Spearing Boiler Co., Ltd.

FORTHCOMING EVENTS.

Finsbury Technical College Old Students' Association.—Saturday, November 4th. At the Engineers' Club, London. Annual dinner.

Salford Technical and Engineering Association.—Saturday, November 4th. At the Royal Technical College. At 6.30 p.m. Short papers by members.

Institute of Transport.—Monday, November 6th. At the Institution of Electrical Engineers, Victoria Embankment. At 5.30 p.m. Paper on "British Railway Operating Statistics and Their Lessons," by Sir W. Acworth.

Institution of Electrical Engineers.—Informal meeting. Monday, November 6th. At the Institution, Victoria Embankment. At 7 p.m. Discussion on "The Importance of Commercial Knowledge to the Engineer," to be opened by the President, Mr. F. Gill.

(Western Centre).—Monday, November 6th. At the South Wales Institute of Engineers, Cardiff. At 6 p.m. Paper on "The Interconnection of a.c. Power Stations," by Mr. J. B. Palmer and Mr. L. Romero.

(Liverpool Sub-Centre).—Monday, November 6th. At the Liverpool University. At 7 p.m. Chairman's (Mr. B. Welbourn) address.

(North-Midland Centre).—Tuesday, November 7th. At the Hotel Metropole, Leeds. At 6.45 p.m. Inaugural address by the Chairman, Mr. W. B. Woodhouse, and smoking concert.

(Wireless Section).—Wednesday, November 8th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Effect of Local Conditions on Radio Direction-finding Installations," by Mr. R. L. Smith-Rose and Mr. R. H. Barfield.

Royal Institution of Great Britain.—Monday, November 6th. At Albemarle Street, W. At 5 p.m. General meeting.

Society of Engineers.—Monday, November 6th. At Burlington House, W. At 5.30 p.m. Paper on "The Atlantic Cruise of H.M. Airship R 34" by Mr. E. E. Turner.

Röntgen Society.—Tuesday, November 7th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Presidential address by Sir H. D. Rolleston on "Acute Constitutional Symptoms due to Radiations."

Institution of Civil Engineers.—Tuesday, November 7th. At the Institution, Great George Street, S.W. At 6 p.m. Address by the President, Mr. W. H. Maw, and presentation of medals awarded by the Council.

Electrical Society of Glasgow.—Tuesday, November 7th. At Glasgow. Paper on "Application of Electricity to Domestic Purposes," by Mr. H. L. K. Johnson.

Royal Society of Arts.—Wednesday, November 8th. At John Street, Adelphi, W.C. At 8 p.m. Inaugural address by the Chairman, Lord Askwith, on "The Value of Strikes and Lockouts."

Nottingham Society of Engineers.—Wednesday, November 8th. At the Wellclock Hotel. At 7.30 p.m. Paper on "Spinning Tops and Gyroscopic Motion," by Mr. L. C. Perkin.

Chelmsford Engineering Society.—Thursday, November 9th. At the East Anglian Institute of Agriculture. At 7 p.m. Discussion opened on "Wireless Telephony, by Mr. C. H. Ford.

Optical Society.—Thursday, November 9th. At the Imperial College of Science, South Kensington. At 7.30 p.m. Lecture on "The History of the Photographic Lens," by Dr. R. S. Clay.

Physical Society of London.—Friday, November 10th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, November 10th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "The Development of Ball and Roller Bearings," by Mr. A. Macaulay.

Edinburgh Electrical Society.—Friday, November 10th. At the Philosophical Institute. At 8 p.m. Paper on "Scientific Illumination," by Mr. E. J. Taylor.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:—
Electrical heating apparatus which would light oil-fired furnaces. The lighter would have to be left in the furnace for about five minutes.

NOTES.

British and Best.—In answer to questions, the Dutch Navy Minister has stated that the stipulation that certain parts of a new cable ship must be of British make was inserted because British marine engineering work had proved during many years more reliable than Dutch. British industry owes its thanks for this striking and unsolicited testimonial. We ask for nothing better than the candid admission that best is not only best, but British.—*Evening News.*

The Juvenile in Industry.—Mr. Robert Hyde, the director of the Industrial Welfare Society, read a paper on "The Juvenile in Industry" at a conference held at the Witton works of the General Electric Co. on Saturday last. Mr. Hyde urged that the boy entering industry should be treated as a boy and not as a man; he should not be expected to "pick up" knowledge. Inquiries in which 100,000 boys were involved showed that only in the case of less than 40 per cent. was suitable training being provided. Employers should make sure that no boy was given work for which he was not physically fit, provision for recreation should be made, and the working conditions should be conducive to good health.

The Electrification of German Railways.—Herr Groener, the Minister for the Reich railways, was recently interviewed by a representative of a Stuttgart newspaper on this subject. The Minister is reported to have stated that the State railways, which are dependent upon pit coal for steam locomotion and which require one-tenth of the total consumption of coal in Germany, must not shrink from passing over to other forms of working. In this connection electricity was specially concerned where it could be produced from inferior fuels and water power. In North and Central Germany it was particularly the lignite mines in which electricity could be produced through combustion or gasification; while in South Germany the large hydro-electric works were to be utilised for the purpose. Notwithstanding the difficult financial situation, the Minister stated that he had resolved to promote the transition to electrical working with all energy. The States in the South West—Wurtemberg and Baden—also must introduce electrical working on their main lines as soon as possible, as, for instance, from Basle to Frankfort-on-Main and from Carlsruhe *via* Stuttgart to Ulm. The lines in the Black Forest, of course, would likewise be electrified. In conclusion, the Minister stated that he hoped for the vital participation and support of the Federal States, especially in so far as they possess water power, and he also reckoned on their co-operation in his efforts to render available for the electrification of the Reich railways, the still slumbering water power of the Rhine, the Main, and the Neckar, as well as of the Danube, without having regard to the Federal State frontiers.

Wireless Exhibition.—Correction.—In our description of the exhibits at the above-named show, the word "Automatic" was included in the name of the Telephone Manufacturing Co., Ltd.—an unfortunate slip which we hope has not been the cause of any misunderstanding.

Tramway Authorities and Road Maintenance.—The General Purposes Committee of the L.C.C., in the course of observations upon the second interim report of the Departmental Committee appointed by the Ministry of Transport to investigate certain matters with regard to the taxation of road vehicles, states that "tramway authorities who are compelled to maintain that portion of the road over which the cars travel should be allowed financial assistance from the Road Fund, having regard to the increased wear and tear to which such portion of the road is subjected by the extended use of both heavy and fast moving motor vehicles."

Pulverised Fuel in the United States.—The new Cahokia plant of the Union Electric Light & Power Co. in St. Louis will have its initial installation of eight boilers equipped with pulverised-fuel apparatus.

The reasons given by Messrs. McClellan & Junkersfeld, consulting electrical engineers, for the use of this fuel are:—

1.—An annual coal consumption lower than with the best of a number of stokers tested and investigated is assured.

2.—A net saving is made in operating cost by reason of the relative cost of maintenance, banking and pick-up losses, ash disposal and pay-roll.

3.—Increased operating convenience is gained both for normal load and for quickly added loads.

4.—The fixed charges on pulverised-fuel equipment and buildings are no greater than those on stoker equipment and buildings.

5.—Owing to the location of the plant, there is no question of trouble from stack ash.

6.—Operating reliability of the equipment is unquestionable, while low-grade fuel can be burned and oil can be quickly substituted for coal if desired.

The increased efficiency of combustion with the use of pulverised fuel was the biggest of several factors. Moreover, this plant is about 20 miles from a mining region where low-grade fuel can be obtained at about $2.50 per ton. In the opinion of Mr. P. Junkersfeld, slagging and troubles with pulverised fuel are as preventable as with stokers and have been eliminated to a large extent by careful design.

The decision on the plant fuel equipment was reached only after exhaustive tests and investigations had been made. The new plant will cost about $6,000,000 and will be built on the Illinois side of the Mississippi at St. Louis. At present there are being installed two 30,000-kW turbo-generators, but the ultimate development will consists of eight sets. The two sets are supplied with steam from eight boilers of about 18,000 sq. ft. heating surface with a steam pressure at the throttle of 300 lb. at a temperature of 690 deg. F.

The boilers will be without economisers and will be eighteen or twenty tubes high, with a very deep combustion chamber specially designed to burn puverised fuel having about 17 per cent. ash content. The pulverised-fuel equipment is part of the boiler, takes the same space and is arranged like a stoker installation, as part of the boiler room.

Following a successful experiment in operating a power plant with powdered coal as fuel, the Arkansas Light and Power Co. plans to install a large plant of this type at Russellville, Ark. The powdered-coal plant, which was installed as an experiment, is declared to be a complete success.—*Electrical World*.

First Mercury Boiler and Turbine.—The first commercial mercury boiler and turbine in the world will shortly be shipped from the Schenectady works of the General Electric Co., and will be installed at the Dutch Point generating station of the Hartford (Conn.) Electric Light Co. The mercury turbine is of about 2,000-kVA capacity, and every facility will be provided for analysing its performance. Fuel oil will be burned and will be weighed instead of measured; recording instruments will be installed to enable the energy consumption of auxiliaries to be studied, and feed water and other items will be measured. The equipment will be housed in a 26 ft. by 45 ft. structure. It is hoped to cut down the fuel consumption per kilowatt-hour by approximately 50 per cent. by the use of the mercury turbine and utilisation in steam production of heat given up in the mercury condensation process. The general arrangement of the apparatus is to install a 2,000-kVA mercury turbo-generator on the top of an oil-fired mercury boiler containing about 30,000 lb. of mercury. The mercury vapour at rather low pressure operates the turbine. The exhaust from the turbine produces steam in a modified water boiler which will be introduced into the steam lines of the plant. Mr. W. L. R. Emmet has devoted years to the development of the mercury boiler and turbine.—*South Africa Engineer and Mechanical Review*.

Wireless Manufacturers and Traders' Association of Great Britain.—This recently-formed Association has a Northern and a Southern Section, and is particularly concerned, at present, with the conditions of membership of the British Broadcasting Co. It is endeavouring to associate the "outside" manufacturers and traders in a common effort to secure that the two persons to be elected to the board of the B.B. Co., outside those of the "big six" which have promoted it, shall be truly representatives of the radio apparatus manufacturers and traders of the country. Its objects are (briefly): To protect and further the interests of all engaged *bona fide* in the wireless industry; to prevent the establishment of a monopoly; and to maintain the free and unfettered right of all to trade without hindrance. The Association will also give commercial services, and is to be registered as a limited company (by guarantee). Members will thus be protected from individual liability. The central office of the Association will be situate in London, and membership will be open to all manufacturers of, or traders in, wireless instruments, parts or materials, or persons otherwise engaged in the wireless industry in Great Britain. The annual subscription is £2 2s., or such other amount as shall be, after the first annual subscription, decided upon. The objects of the Association are (*inter alia*):

(i) To protect the interests of manufacturers and traders from onerous or restrictive legislation, and to make recommendations to the competent authorities whenever necessary for this purpose;

(ii) To protect the interests of manufacturers of wireless instruments and component parts, traders in wireless instruments, parts or materials, and other persons engaged in the wireless industry;

(iii) To provide, wherever possible and desired, expert technical advice for members;

(iv) To protect members by the provision of expert legal and technical advice on questions of patents, infringements, and licences;

(v) To establish relations and to co-operate with kindred associations in this and other countries;

(vi) To act as a bureau and a central source of information on all trade, financial and commercial matters, and to provide status reports and such like services.

National Association of Supervising Electricians.—The visit of the Association to the Lots Road power station on October 23rd was a decided success. The party, which included Mr. W. E. Highfield, the president of the Association, numbered over 60, and, under the guidance of Mr. T. D. Grant, of the power station, the party spent the greater part of the afternoon inspecting the plant. The visit was of a most interesting and instructive character, and was fully appreciated by all who took part in it.

Electric Grillers on Liners.—The Cunard liner *Aquitania* contains electric grills capable of dealing with some 400 chops or steaks every hour. On all its vessels, the Cunard Co. has electric toasters. They are in the kitchens and pantries, and amongst many machines deriving their power from electric motors may be mentioned potato peelers, dish-washing machines, which eliminate unnecessary handling and smashing of crockery, mincing, and slicing machines. An apparatus which greatly interests visitors to the kitchens and bakeries on these vessels is the new "human hand" dough-making machine, which is said to reproduce the action of the baker's hand and arm in mixing the dough.

Electric Steel.—The *Iron and Coal Trades Review* recently gave statistics showing the growth of electrically-produced steel. Prior to 1913 steel produced in this way was practically unknown, but in that year a total of 168,673 tons was made—Germany accounting for about half of this, 88,256 tons. Returns from Germany and Austria were not available after the war, but, excluding these countries, the 1920 production had reached 777,633 tons, the principal contributors being the United States (502,152), Italy (100,000), and Great Britain (89,000). In 1921 there was a serious decline, the total being 377,900 tons, of which the United States produced 169,450, Great Britain, 27,100, and Italy, 140,000 tons.

An All-Electric Country.—Some interesting figures showing the extent to which electricity is used in the United States were given in a recent issue of the *National Electragist*, the organ of the American contractor-dealers. Recently-compiled statistics show that more than one-third of the homes in the United States are wired for electricity. Of the 21,145,126 houses, 7,636,409 are wired for electric service, while 5,363,531 are not wired, but could be connected to existing distribution lines. The homes unwired and not yet reached by distribution lines number 8,145,060. There are about 140,000 electric ranges in use in the United States to-day. In 1915 there were 10,000. Last year 30,000 were installed, and it is predicted that this year 100,000 will be sold.

Appointments Vacant.—Shift engineer for the Ipswich Corporation Electricity Supply and Tramway Department; plumber-jointer for the Harrogate Corporation Electricity Department; plumber-jointer for the Nelson Corporation Electricity Department. (See our advertisement pages.)

Educational.—University of London: University College.—The Calendar for the 1922-23 session has been published, giving full particulars of departments, staff, courses, prizes, and scholarships, &c. In addition to this, there are lists of successes in the several faculties, a roll of Fellows, and a mass of other information of a varied character.

South Africa.—A portion of the new Cape Technical College was opened on October 7th, following upon the closing of the Salt River Technical Institute. £10,000 has recently been voted by the Union Government towards equipment, and it is expected that an official opening ceremony will take place next year.

The New President: A Correction.—We regret that in our article on the career of Mr. Frank Gill, President I.E.E., last week an error occurred in respect of his present position, which should be described as "European engineer-in-chief to the International Western Electric Co."

Automatic Train Control.—The case for automatic train control receives further support in Major G. L. Hall's report to the Ministry of Transport upon the accident near Gravesend in August last, in which five men were killed and 17 injured, apart from shock and minor injuries in other cases. Major Hall lays the primary responsibility for the mishap upon the driver of the train which was run into by a light engine, stating that only a perfunctory observation of the signal could have been made. Blame is also attached in a less degree to the fireman, and to a signalman who pulled off the platform starting signal before the second train arrived, the section ahead being still occupied. Major Hall concludes his report as follows:—"The case is a typical example of the class of accident preventable by automatic train control in the form of a definite train stop at the signal concerned; upon obedience to which, governing as it does the admission of a train to the section ahead, the security of the absolute block system largely depends."

Gas on Trains.—Last Saturday an accident occurred on one of the Paris suburban railways, in a tunnel, three coaches being derailed; the gas reservoirs of an overturned coach were ruptured, and the wreck was quickly set ablaze. Fortunately the passengers were able to escape, those who were pinned by broken timbers being rescued before the flames reached them.

Electric Ship Propulsion.—In the course of a paper on the subject of ship propulsion, before the North-Eastern Section of the Junior Institution of Engineers, at Newcastle-on-Tyne, Mr. J. Calderwood said: Electrical methods of speed reduction for turbines are in successful operation. Although it is sometimes strongly advocated, electric drive with internal-combustion engines does not seem to be at all suitable for the propulsion of a ship, except, possibly, for services of a very unusual kind (such, for example, as cable steamers, where the ship has often to run at a speed of from ½ to 2 knots for a considerable length of time). In such a case the adoption of oil engines with electric drive would show great advantages in economy, as a large engine running very slowly is exceedingly inefficient, whereas with electric drive, three generators might be supplied, one of which could alone take the whole load of ship propulsion, an electric cable engine, and electric auxiliaries when laying cables, and when running at full speed all three generators could be in use. Such a system would, of course, require direct-current generators and variable-speed motors. For all ordinary services, the direct-connected oil engine shows great advantages over the electric drive, except possibly in the matter of weight, and in this respect it does not appear that there will be much difference between the two systems of propulsion. The main disadvantage of the electric drive is that, in order to reduce weight, high-speed oil engines are used. The high-speed oil engine, when mounted on a solid concrete base, is a very reliable and good power producer, but when mounted in an exceedingly flexible structure, such as a ship, the case is very different. The vibration from a comparatively small high-speed engine is very unpleasant, and when several such engines of large size are running together—probably, too, at slightly different speeds—the vibration would, it is to be feared, be very bad, and would almost certainly make the engines themselves unreliable and cause defects in the ship's structure.

The turbine electric drive appears to be able to justify itself to a greater extent than can the oil engine electric drive, but even in this case it can show no real advantage over the geared turbine, while the greater complication must increase both first cost and running cost; and its adoption can only be justified in the case of special types of turbine, such as the Ljungström, which are not suitable for a mechanical drive, but which show such high efficiencies as to make their adoption desirable from the point of view of fuel economy. With a turbo-electric drive alternating current must be used, due to the high speed most suitable for the turbines; this makes a variable-speed motor impossible (unless more than one field winding is used, which can give two or more definite speeds) and speed variation must be obtained by variation of the generator speed, which takes from the electric drive one of its main advantages, namely, the possibility of constant-speed generators and control of the ship's speed by alteration of the motor speed.

As a result of troubles with steam deck machinery, electric winches, capstans, &c., are coming into more common use and, though the majority of sea-going engineers seem to have an intense dislike of electrical machinery in the engine-room, there are few who would not be very thankful for the substitution of electricity for steam on deck.

The engine-room auxiliaries vary, of course, with the type of main machinery installed.

The installation of electric auxiliaries is now becoming common, particularly in the case of oil-engined vessels, as with them the presence of a donkey boiler to supply steam to the auxiliaries adds to both weight and cost of the machinery. The generators in such ships are usually oil-engine driven. When electric auxiliaries are used on a steam installation, the generator is driven either by a high-speed steam engine or by a small geared turbine; the latter makes a much neater job, but is often objectionable because of the noise always made by small turbines which run at a very high speed.

It has been usual up to the present to fit direct-current generators and motors, but alternating current would seem to be preferable from many points of view; an induction motor is much more reliable in the hands of engineers not thoroughly conversant with electricity than is a direct-current motor, with its commutator, brushes, &c. Alternating current is also desirable from the point of view of economy in first cost, as both generators and motors are much cheaper than those of the direct-current type. Electric auxiliaries do not, as is generally supposed, make any great saving in steam consumption, their advantage being principally reliability and simplicity of operation. As the driving of reciprocating pumps through gears by an electric motor is not a particularly nice arrangement, the use of centrifugal pumps for all purposes is becoming more common, but there is still much to be known of these pumps before they can be adopted with safety. It is, therefore, usual to supply steam stand-by pumps, in case the electrically-driven centrifugal pumps fail to perform as they should when unfavourable conditions arise.

A Sound Election "Slogan."—"Electric light for every householder!" is one of the election cries of the Labour candidates at the municipal elections in Poplar.—*Evening News.*

A Large Colliery Winder.—Correction.—In our note on this subject, on p. 562 of our issue of October 20th, the motor was referred to as a synchronous induction motor; this type is obviously unsuitable for winding-engine service, and the word "synchronous" should have been omitted.

Correct Industrial Illumination.—The accompanying illustration is a reproduction of an actual unretouched night photograph of a very successful installation of Benjamin reflectors recently completed. It represents the raw materials stores at the new factory at Willesden erected for Messrs. Studebaker, Ltd., the manufacturers of the well-known automobile of that name. The absence of both glare and objectionable shadows will be apparent, the result being practically equivalent to daylight intensity. Messrs. Benjamin Electric, Ltd.'s R.L.M. dispersive reflectors were mainly employed with 300-watt gasfilled lamps, while in the main bay of the shops concentrative reflectors were used with 500-watt gasfilled lamps.



Correct Industrial Illumination.

Miners' Lamps.—The inquiry into the explosion at Haig Pit, Whitehaven, Cumberland, on September 5th, when 39 miners lost their lives, was opened on October 9th. Mr. Alexander Miller, the under-manager, cross-examined by Mr. H. Smith, acting president of the Miners' Federation, agreed that since the accident he had come to the conclusion that it would be a good thing to supply every miner with a flame safety lamp. Mr. Smith quoted the regulation which provides that every workman at the face of the coal shall carefully examine the place before starting work, and asked how the miners could do that if they had no flame safety lamp. A miner could not examine for gas with an electric lamp. Mr. Miller replied that if a miner had any fear of gas he had only to call one of the deputies to examine the place for him. Every miner had an electric lamp. Mr. Smith: You admit, then, that you failed to carry out this clause?—Mr. Miller: The deputy could always have been called. Questioned by Mr. F. A. Macquisten, K.C., M.P., who appeared for the colliery company, Mr. Miller considered that oil lamps were more dangerous than electric lamps.—*Daily Mail.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—East Midland Sub-Centre.—The following are the subjects of the meetings being held during the 1922-23 session:—November 21st, "Some Recent Research in Electrical Engineering," by Prof. W. Cramp, D.Sc.; December 19th, short papers by Students of the Institution; January 9th, 1923, "Starters and Controllers for Electric Motors," by Mr.

O. C. Dinerman, January 30th. "The Transmission of Power by Underground Cables at 100,000 150,000 volts," by Major A. M. Taylor; February 20th, short papers, arranged by Mr. C. Satterly; March 13th, "Automatic Telephones," by Mr. F. A. [illegible] April 10th, "Problems of High-Speed Alternators and [illegible] Section," by Mr. J. Rosen; May 1st, "An Electric Harmonic Analyser," by Prof. Miles Walker, D.Sc.

SOUTH MIDLAND CENTRE.—The annual dinner will be held at the Grand Hotel on November 24th. The following gentlemen have already definitely promised to attend and take part in the proceedings: Mr. F. Gill, O.B.E. (President I.E.E.); the Lord Mayor of Birmingham (Alderman David Davis); the Rt. Hon. Austen Chamberlain, M.P.; the Principal of Birmingham University (Mr. W. Grant Robertson, M.A., C.V.O.); Mr. Neville Chamberlain, M.P.; Mr. Hugo Hirst, and other well-known gentlemen.

The following meetings have been arranged: November 15th, "Equivalent Temperature Tests on the Various Types of Electrical Machinery," by Dr. Kahn; December 13th, "Possibilities of Transmission by Underground Cables at 100,000 150,000 Volts," by Major A. M. Taylor; January 10th, "Technical Research with special reference to Electrical Engineering Development," by Mr. W. Wilson, M.Sc.; January 25th, joint meeting with local branches of the Institution of Civil and Mechanical Engineers; March 14th, "Metering," by Mr. W. Lawson.

Prof. W. Cramp, chairman of the Centre, delivered his presidential address before a large audience at Birmingham on October 26th. To begin with, the chairman paid a sterling tribute to the work of the late Prof. Gisbert Kapp. Turning to the Institution itself, Prof. Cramp said that in the early days the Council consisted of the best of the profession—able men, proved beyond all question. Now, the Council published a list showing what interest each member represented. That, to him, was utterly and fundamentally wrong. It led to a controversy on every important matter, the question invariably being, not what was right and best for the profession as a whole, but which interest could secure the most influence. The result was very apparent. Witness the change from 10 to 5 per cent. in the retention payment under the model conditions. Here was a victory for the manufacturing interest. Or, again, consider the narrow escape from hampering standardisation—almost from world-wide derision—in the proposal pressed forward, and nearly published, to adopt a form of fuse-holder suiting certain "interests," and excluding one at least of the best holders then made. With what joy would the prevailing interests have greeted their victorious representative on the committee, and with what grievous humility must the rest of them have received a decision so dishonourable. Yet, what other phenomenon could they expect if around the neck of every member of the Council they placed a large label denoting the interest he was there to represent, and, presumably, to serve. There was but one way to escape this Tammany disease—namely, to call upon all members in the Council Chamber to forget everything but that they were members of the Chartered Institution, called together for the advancement of engineering science. They must also beware of falling from the lofty objects of the Institution to the position of a trade defence organisation. In conclusion, the chairman advocated the encouragement and extension of the territorial Centres and a much more generous treatment of these financially; co-operation and, if possible, fusion with other engineering institutions ultimately to form one great English-speaking Institute of Engineers.

LIVERPOOL SUB-CENTRE.—The following are the present arrangements for the current session: November 6th, Address by the Chairman, Mr. B. Welbourn; November 13th, "Wireless Broadcasting," by Mr. A. P. M. Fleming, C.B.E.; November 27th, "The Improvement of Power Factor," by the late Dr. Gisbert Kapp (to be read by Prof. Miles Walker, D.Sc.); December 11th, "Domestic Load Building," by Mr. W. A. Gillott; January 15th, 1923, "The Possibilities of Transmission by Underground Cables at 100,000/150,000 Volts," by Major A. M. Taylor; February 7th, "Electrical Propulsion of Ships," by Mr. R. S. Johnson (joint meeting with the Liverpool Engineering Society); February 19th, March 19th, and April 16th, Subjects to be announced later; April [illegible] meeting and smoking concert.

Association of Mining Electrical Engineers.—At the opening meeting of the Midland branch on October 28th, at Nottingham, Mr. A. W. Williams, of Nottingham, was the principal speaker. He expressed the view that those who were [illegible] connected with electricity supply would need in future to pay greater attention to the proper allocation of blame for accidents alleged to have been caused by [illegible] showing those which were [illegible] which were not. He thought the [illegible] had clearly proved that electrical, mechanical and mining engineers must work hand in hand [illegible] the output per man of the mines, because it was [illegible] which seemed to have crept into the industry [illegible] that low efficiency, that retarded progress.

Royal Society of Arts.—The arrangements for the present session, which opens on Wednesday, November 8th, at 8 p.m., with an address by the chairman (Lord Askwith) on "The Value of Strikes and Lockouts," include the following papers:—

November 17th.—"The Development of Water Power in India," by Mr. J. W. Meares.
November 22nd.—"The Economy of Smoke Abatement," by Baillie W. Smith.
November 27th, December 4th and 11.—"Brown Coal and Lignites," by Prof. W. A. Bone, F.R.S.
November 29th.—"The Hot-wire Microphone and its Applications," by Major W. S. Tucker.
April 30th, May 7th and 14th.—"Recent Improvements in Steam Turbines," by Mr. S. S. Cook.

The following papers are to be read after Christmas:—

Mr. C. R. Darling.—"Electrical-resistance Furnaces and Their Uses."
Prof. W. A. Bone, F.R.S.: "Recent Developments in Surface Combustion."
Sir Rudd A. S. Rosmayne.—"The Base Metal Resources of the British Empire."
Mr. R. W. Church, F.R.S.: "Electrification of the Indian Coalfields."

Liverpool Engineering Society.—The first ordinary meeting of the session was held at the Royal Institution on November 1st, when the President (Prof. T. B. Abell) delivered his inaugural address.

Amongst the papers to be read during the session are the following:—

December 15th.—"Water and Water Power," by Mr. D. H. Thomson.
January 24th, 1923.—"Wave Transmission of Power," by Mr. W. Dinwoodie.
January 25th or February 1st.—Annual dinner.
February 7th.—"Electric Propulsion of Ships," by Mr. R. S. Johnson.
February 21st.—"High-ratio and High-speed Transmission Gears," by Mr. J. J. Clark.
March 7th.—"Hardening of Steel," by Prof. C. A. Bannister.
March 21st.—"Standardisation of Ships' Fittings," by Mr. C. Le Maistre.
April 4th.—"The Combustion of Fuel," by Prof. A. E. Nobbs, and "Considerations in Design and Application of Surface Heaters," by Mr. B. Stephenson.
April 18th.—"Rating of Machinery," by Mr. E. W. Pierce.
April 25th.—Annual general meeting.

Wireless Society of London.—At the meeting of the Society, held on October 25th, the announcement was made that H.R.H. the Prince of Wales had consented to become the Patron of the Wireless Society of London and its affiliated societies.

Edinburgh Electrical Society.—At a meeting of the Society, held in the Philosophical Institute, on October 27th, Mr. J. G. Burchell, A.M.I.E.E., read a paper entitled "Electric Lighting Plants for Country Houses." The author outlined the variety of problems met with in fulfilling the requirements of modern detached installations, and described in detail typical plants. He considered the qualities of automatic, semi-automatic, and hand-operated engine and water-power sets. The paper was illustrated by slides and diagrams.

Institution of Civil Engineers.—On October 27th H.R.H. the Duke of Connaught unveiled the Institution's memorial to those of its members (346) who fell in the Great War. The memorial takes the form of a cast bronze figure of St. George flanked by six panels bearing the names of the dead. It looks down from the main staircase into the hall, and the architect of the building, Mr. James Miller, designed it.

The Duke of Connaught mentioned that of a membership of 9,000 a total of 3,000 joined the services. The dedication was pronounced by Bishop Ryle, Dean of Westminster, and a number of R.E. bandsmen played Chopin's *Marche Funèbre*, which was followed by the sounding of the "Last Post" and "Reveille."

Society of Chemical Industry.—A paper on "The De-Watering of Peat by Pressure" will be read by Prof. J. W. Hinchley in the Smoking Room of the Chemical Industry Club, London, S.W.1, on November 10th. Everyone interested, whether a member of the Club or of the Chemical Engineering Group, will be cordially welcome, as the paper deals with a method of reducing the water content of peat by mechanical means, and will be illustrated by quantitative data, diagrams, slides, and samples.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. H. C. APPLEBY, power plant specialist and consulting engineer to the Bradford Dyers' Association of Bradford, is shortly leaving this country to take up a post as power plant specialist and steam efficiency engineer with a large firm in South America. There were over 350 applications for the position.

MR. HARRY RICHARDSON, who was engineer to Dundee Electricity Department for twenty years, has been presented with a gold wristlet watch and other gifts by the Town Council on the occasion of his removal to London. A high tribute was paid by the Lord Provost to Mr. Richardson's abilities. Mr. Richardson, in reply, said the department

could not be in better hands than those of his successor, Mr. Bishop, and its continued success was assured. The staff of the department presented Mr. Richardson with a leather-covered steel attaché case, &c. Replying, he said it was the team work among the men in the department that had assisted him in his advancement.

Mr. E. Harwood, a member of the staff of the Oxford Electric Co., recently received a presentation of a wallet containing Treasury notes upon his retirement after thirty years' service with the company. Sir Henry Mance, the chairman, made the presentation, and the chief engineer, Mr. F. R. Francis, presided.

Mr. Michael Flannery has been appointed manager of the Nenagh (Co. Tipperary) Gas & Electricity Supply Corporation.

Mr. H. H. Casse, who has been connected with the active management of the business of Chas. Bell, Ltd., of Bradford, for fourteen years, has been appointed a director of the company.

Mr. A. G. M. Dickson has been elected a director of the Chile Telephone Co.

New appointments to the Ministry which the King has approved include the following:—Postmaster-General, Mr. Neville Chamberlain; parliamentary secretary, Overseas Trade Department, Sir W. Joynson-Hicks; parliamentary secretary, Board of Trade, Lord Wolmer; and parliamentary secretary, Office of Works and Transport, Col. Wilfrid Ashley. An assistant Postmaster-General has not yet been appointed.

Mr. J. A. Robertson, consulting engineer, who was taken suddenly ill on October 6th at Edinburgh, while on a visit there with a deputation of the Salford Electricity Committee, and has since been laid up in a nursing home, is now progressing favourably, and hopes to be back at business in the course of two to three weeks.

Mr. A. S. Hampton, M.I.E.E., the chairman of the Scottish Centre of the Institution of Electrical Engineers, is electrical

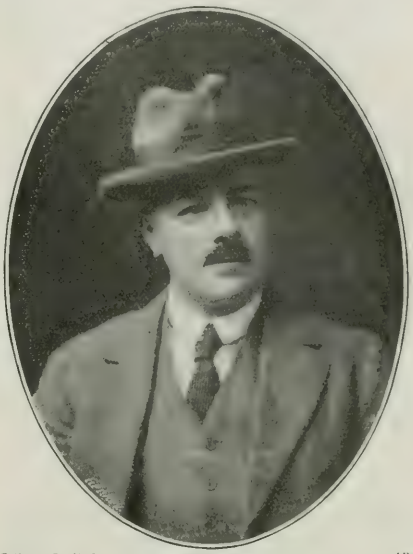


Lafayette *[Glasgow.*

Mr. A. S. Hampton,
Chairman of the Scottish Centre, I.E.E.

engineer and telegraph superintendent to the Caledonian Railway Co., Glasgow. He assumed that position in 1920, having previously held the appointment of assistant to his predecessor in the post for a period of about ten years.

Mr. E. C. H. Handcock, the present chairman of the Irish Centre of the Institution of Electrical Engineers, is an Irishman—a native of Clones, Co. Fermanagh. He received his technical training at the Finsbury Technical College, and upon leaving that institution entered, in 1900, the Meter Department of the British Thomson-Houston Co., London. After gaining experience in the various testing departments of the company, he left this country for the United States, where he entered the service of the Boston Elevated Railway Co., and, later, that of the General Electric Co. In 1905 he returned to the British Thomson-Houston Co. as chief of the turbine testing department, where he superintended the testing of all the company's large machines. He was then appointed as engineer to the Glasgow branch, and in 1912 was requested to open up an office for the company in Dublin, and to take charge of its Irish business. He remained in this position until quite recently, when he secured an interest in the W.M. Engineering Co., a concern which aims



The College Studios] *[Dublin*

Mr. E. C. H. Handcock,
Chairman of the Irish Centre, I.E.E.

at freeing the Irish electrical industry from dependence upon outside sources. Mr. Handcock has been responsible for the electrification of a number of important industrial works in Ireland.

Wills.—Mr. A. E. Marlow, a director of the Northampton Electric Light & Power Co., Ltd., the Rushden & District Electric Supply Co., Ltd., and of the Wellingborough Electric Supply Co., Ltd., left £169,971.

Mr. W. H. Mathias, a director of the Treforest Electrical Consumers' Co., left £514,167.

NEW COMPANIES REGISTERED.

Bower Electric, Ltd. (185,066).—Private company. Registered October 17th. Capital, £30,000 in £1 shares. To carry on the business of electrical engineers, manufacturers, and vendors of, and dealers in electrical apparatus, machines, and accessories, &c. The subscribers (each with one share) are:—J. B. Bower, 17, Church Lane, Merton Park, Wimbledon, S.W.10, engineer; A. A. Henley, "Oak House," The Mount, Sydenham, S.E.26, incorporated accountant. The first directors are: J. B. Bower (managing and permanent director) and others appointed by the subscribers. Qualification of permanent directors, one share; of other directors, 100 ordinary shares. Registered office: 15, Kingston Road, Wimbledon, S.W.

Electrix, Ltd. (185,291).—Private company. Registered October 26th. Capital, £100 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers and contractors, manufacturers of, and dealers in all apparatus and appliances for use in connection with the generation, distribution, supply, accumulation, and employment of electricity, &c. The first directors are: S. B. Henderson, "Roseland," Wivelsfield Green, Haywards Heath, Sussex; P. Fer, Rexine House, 42, Newgate Street, E.C.1. Qualification: 20 shares. Solicitors: E. B. Gee & Co., 15, Copthall Avenue, E.C.2.

Richard Whaley, Ltd. (185,295).—Private company. Registered October 26th. Capital, £1,000 in £1 shares. To acquire the business carried on by R. Whaley at Leyway Engineering Works, New Islington, Manchester, and to carry on the business of manufacturers of, and dealers in wireless apparatus and instruments, &c. The first directors are:—R. Whaley, 14, Park Street, Clayton, Manchester; N. B. Sims, "The Lindens," 53, Linden Road, Levenshulme, Manchester (both permanent, subject to holding 300 shares each). Remuneration as fixed by the company. Secretary: N. B. Sims. Registered office: Leyway Radio Works, New Islington, Manchester.

Waltons (Liverpool), Ltd. (185,226).—Private company. Registered October 24th. Capital, £100 in 2s. shares. To acquire the business of W. H. Walton, carried on at 38, Beau Street, Liverpool, relating to the manufacture and sale of high resistances under P/P.20,506/23 and any improvements thereon, and to carry on the business of motor, electrical, mechanical, wireless, and general engineers, &c. The permanent directors are:—W. H. Walton, 61, Avondale Road, Southport; W. R. Atkinson, Sephton House, Liverpool Road, Great Crosby. Qualification: £10 shares. Secretary: A. D. Dean. Registered office: 28, Exchange Street East, Liverpool.

Runbaken Magneto Co. (Scotland), Ltd. (12,388).—Private company. Registered in Edinburgh, October 11th. Capital, £4,000 in £1 shares. To take over as a going concern the business of electrical ignition specialists and repairers carried on by F. Murray & Co., at 136, West Nile Street, Glasgow. The first directors are:—J. H. Runbaken, "Marvvale," Hill Top, Wilmslow, Cheshire, company director; P. Forrester, "Ballochmyle," Blundellsands, Liverpool, company director; S. H. Flynn, 7, Beatty Road, Southport; F. W. Murray, 34, Bath Street, Glasgow, motor accessory factor. Qualification: 100 shares. Registered office: 134, West Nile Street, Glasgow.

Markes, Ward & Co., Ltd. (185,204).—Private company. Registered October 2[illegible] Capital, £2,000 in £1 shares. To carry on the business of [illegible] ; electrical agents or factors, manufacturers of, and dealers in glass, porcelains, metals, carbons, wire cables, conductors, motor-[illegible] ... machinery, lamps, electrical goods and appliances, &c. The first directors are:—P. D. Morris (chairman), 6, Canonbury Grove, Islington, N.1; A. W. Markes, "Nokomis," Beach Road, Shoreham; J. W. Ward, 18, Sherriff Road, West Hampstead, N.W.6; E. E. Morris, Church Road, Ashtead, Surrey. Qualification: £100. Remuneration (except [illegible] ... fixed by the company. Secretary: H. [illegible] Registered office: 26/30, High Street, Islington, N.1.

Thomas Wood & Co., Ltd. (185,208).—Private company. Registered October 23rd. Capital, £200 in £1 shares. To carry on the business of electrical and general engineers, &c. The first directors are:—T. Wood, 18, High Street, Cheadle, Cheshire; Ada M. Wood, 18, High Street, Cheadle, Cheshire. Remuneration as fixed by the company. Secretary: T. Wood. Registered office: 18, High Street, Cheadle, Cheshire.

Pryco, Ltd. (185,187).—Private company. Registered October 21st. Capital, £2,000 in £1 shares. To acquire the business carried on [illegible] as "Pryce and [illegible] Taylor & Co." and "Wright, Pryce and Co.," at 14a, Chouldham Street, Marylebone, and elsewhere in London, as electrical engineers and dealers in electric lamps, signs, and all kinds of electrical appliances, &c. The subscribers (each with one share) are:—[illegible] Jaeger, 31, Parliament Hill Mansions, N.W.5, general merchant; J. W. Pasham, 76, Holland Road, Harlesden, N.W.10, accountant; O. Bird, 4, Great St. Thomas Apostle, E.C.4, solicitor. The first directors are not named. Secretary: J. W. Basham. Registered office: 4, Great St. Thomas Apostle, E.C.4.

Crieff Electric Supply Co., Ltd. (12,402).—Registered in Edinburgh, October 19th. Capital, £12,000 in £1 shares. To generate and supply electric current for light, power, and any other purpose in or near Crieff. The subscribers (each with one share) are:—W. H. Mungall, "Croftwert," Crieff, retired engineer; A. B. Graham, "Auld House," Crieff, retired merchant; A. M. Wilson, "Roundelwood," Crieff, merchant; W. Watts, "Lincluden," Crieff, chemist; J. Alexander, Comrie Street, Crieff, baker; C. E. Colville, Crieff, solicitor; J. Denwoodie, Union Bank House, Crieff, bank agent. Minimum cash subscriptions: 8,000 shares. The first directors are:—W. H. Mungall, W. Watts, T. Brook, "Avondale," Crieff, retired shipowner; A. N. Rye, 6, Eaton House, Belsize Park Gardens, N.W., electrical engineer; E. J. Williams, 7, Queen Gate, Inverness, electrical engineer. Qualification: 50 shares. Secretary: Charles E. Colville. Registered office: 14, Comrie Street, Crieff.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Marston Billington, Ltd.—Satisfaction in full on June 16th, 1922, of debentures dated May 27th, 1920, securing £20,000.

Egham and Staines Electricity Co., Ltd.—Satisfaction in full on October 5th, 1922, of mortgage debentures, dated October 21st and November 25th, 1912, April 13th and June 26th, 1913, and August 2nd, 1918, securing £17,000.

Dunn & Co. (Cheltenham), Ltd.—First and second mortgage debentures, dated October 13th, 1922, to secure £500 and £200 respectively, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: W. E. Thomson, "Chalfont," The Park, Cheltenham; and C. Lloyd, "Karr's Cottage," Leckhampton Road, Cheltenham.

Cross & Cross, Ltd.—Satisfaction in full on October 11th, 1922, of debentures dated December 11th, 1909, securing £600.

Electric Hose & Rubber Co., Ltd.—Satisfaction in full on August 16th, 1922, of deeds of charge dated November 3rd, 1914, and July 5th, 1921, securing the cash owing by the company to the London County, Westminster & Parr's Bank.

Snowdon Mountain Tramroad & Hotel Co., Ltd.—Satisfaction in full on October 5th, 1922, of debentures dated March 13th, 1897, securing £2,000.

Excelsior Magneto & Ignition Co., Ltd.—Debenture dated October 5th, 1922, to secure £300, charged on the company's property, present and future, including uncalled capital. Holder: A. Reid, 191, North Road, Clayton, Manchester.

Lighting, Heating & Power Installations Co., Ltd.—Debenture dated October 12th, 1922, to secure £100, ranking *pari passu* with previous series, charged on the company's property, present and future, including uncalled capital. Holder: G. A. T. Jesson, "Endsley," Swinton, Manchester.

Minehead Electric Supply Co., Ltd.—Second mortgage debenture dated October 12th, 1922, to secure £4,500, charged on the company's undertaking and property, including uncalled capital. Holder: The Treasury Solicitor.

CITY NOTES.

Drake and Gorham, Ltd.

At the annual meeting, held on October 26th, the chairman, Mr. B. M. Drake, said that, in view of the abnormal conditions which industrial enterprises of all kinds had experienced during the past year, when many electrical companies had had to face heavy losses, it was at any rate satisfactory that they were in a position to recommend a small dividend. The gross profit of £41,380 compared with £65,157 in the previous year, but the expenses had been reduced by £12,338. The item of investments in the balance sheet, £57,047, consisted of securities quoted on the London Stock Exchange, over £50,000 being in British Government Funds. Shares in associated companies, £69,502, referred almost entirely to their wholesale sub-company, which incurred a considerable loss last year, thereby curtailing the dividend which they would otherwise have been in a position to pay. It was a poor consolation, but this had been the common experience of other factors working on similar lines. With an improvement in trade, a return to the profits earned in the past might be anticipated, and in the meantime the directors were reducing the outgoings as far as possible. During the year work had been carried out for the War Office at Seaford Camp and Chelsea Barracks, for the Ministry of Pensions, the Earl of Derby and many other well-known people, companies, banks, &c.

The company has in hand the lighting of two bleach works for Messrs. Deakins, Ltd., the re-modelling of a large lighting equipment at the Birkenhead Depot of the Anglo-American Oil Co.; a complete generating plant and kinema equipment and considerable private installation work for mansions, mills and factories. In the utilisation of water-power they had patented an automatically regulated generator for use with water turbines, which would enable full use to be made of existing water-power without the expense of a governor which, in some cases, cost more than the turbine it controlled. Any current not required for power or lighting was rendered available for heating or other purposes, without the use of an accumulator. The works had executed numerous orders for switchboards and electrical apparatus, and they had commenced to manufacture broadcasting receiving sets; they were developing this new branch of the business as quickly as circumstances permitted. They were also turning their attention to electric furnaces for all purposes, and had made a provisional agreement to represent an important American company which had designed and erected many of the largest and most successful electric furnaces in the States. Although the attitude of labour in the electrical trade had certainly improved, it would take some time to counteract the effects of the disastrous policy adopted in the past, and the position was not helped by the continuance of the payment of doles, which in many cases acted as a premium on laziness. He was pleased to hear from their engineers that the output of their electricians showed a marked improvement. Work made work, and the lower the cost at which installations could be equipped the more men they would be able to employ. No doubt some had been postponing electrical work until prices were stabilised, but in view of the large reductions which had taken place, and the fact that contractors were working at little or no profit in order to find work for their unemployed, he was of opinion that there would be a rise in prices as trade improved. With regard to the future they could only hope that the slight improvement shown in trade might extend, but he was afraid this could not take place to any marked degree until some means was found of reducing the present heavy taxation, which was crushing the life out of industry and restricting outlay on the part of individuals. The directors had carefully examined, from time to time, projects which had been brought to their notice with a view to utilising the additional capital raised by the issue of £50,000 in 10 per cent. seven-year notes, but as it was considered undesirable to lock up this capital in enterprises which might not bear fruit for some years, and the rate of interest payable was high, it had been decided to pay off about half these notes, so as to leave £25,000 outstanding, after taking into account the amount already redeemed.

French Companies.

The Société de Construction Electrique, of Lyons, has just declared a dividend at the rate of 13.50 fr. per share out of net profits of 734,000 fr. in 1921-22.

The accounts of the *Société des Accumulateurs Dinin* are reported to show a credit balance of only 34,000 fr. for 1921-1922, as compared with 301,000 fr. in the previous year.

The report of the *Société Bréguet* states that the net profits in 1921-22 amounted to 1,866,000 fr., or 125,000 fr. more than in the previous year, and the dividend is at the rate of 50 fr. gross per share. The directors state that the results were satisfactory. That was due to the fact that they had had no confidence in the duration of the period of apparent prosperity which followed the armistice, and which was characterised by an exaggeration of prices and a scarcity of materials. By refusing to increase the company's productive capacity in proportion to the orders booked in that period it had been possible to keep the works fully occupied with the execution of orders dated from 1919 and 1920, and these had just been completed. On the other hand, the directors had endeavoured to devote greater attention to the carrying out of mechanical and electrical applications, seeing that there were always new problems to solve. The new workshops at Douai would be able to be brought into operation early in 1923, and the construction of electrical apparatus would be centralised there. At the same time the former would be able to assist the Paris works in the matter of ship turbines.

The report of the year's working of the *Société Bretonne d'Electricité* shows receipts 1,892,948 fr. and expenditure 1,436,662 fr., leaving a balance of 456,285 fr., contrasted with 234,818 fr. in 1920. The net profit, after deduction of sundry charges, totalled 82,571 fr., which was carried forward. The company has completed the enlargement of its central station, whose power now totals 5,500 kW. Progress has been made with the electrification of the city of Lorient and the construction of networks in various communes.

The accounts of the *Gazet Electricité de Valence* for the year 1921 showed a credit balance of 148,609 fr., including 21,973 fr. brought forward. The dividend was fixed at 6.5 per cent. per share, being 13.12 fr. to priority shares, 16.25 fr. to ordinary shares, and 15.50 fr. to bearer shares. Owing to the lower price of coal, a saving of 578,967 fr. was made; but,

on the other hand, a loss of 738,117 fr. had resulted from the lower price obtained for the gas department's output of coke. A more favourable agreement had been signed with the municipal authorities with regard to the tariff for gas and electricity.

Montevideo Telephone Co., Ltd.

For the year ended July 31st the Montevideo Telephone Co. secured a net profit of £28,996 (against £27,555). After transferring £10,000 (the same) to reserve, the directors propose a final dividend of 5 per cent., free of tax, making 8 per cent. for the year (the same), while a balance of £13,782 is carried forward (against £12,157 brought in). The loss in exchange amounted to £7,331 (against £1,007). A resolution was submitted after the general meeting of the company on November 1st sanctioning the *ad referendum* agreement for sale to the Administration of Posts, Telegraphs, and Telephones of Montevideo. The agreement provides for the sale to the Administration for the sum of $700,000 (about £120,000) of the company's rights and privileges, plant, subscriptions, materials, and stores in Uruguay, and of the right of the Administration, for not more than four years, to occupy the company's properties in Montevideo. All money in cash and deposited at bank, and all freehold properties and securities held by the company, will not be included in the sale to the Government.—*The Times.*

Italian Companies.

The report submitted to the shareholders of the *Società Padana di Elettricità* showed a net balance of 179,161 lire, from which a dividend of 10 per cent. on its capital of 1,500,000 lire was sanctioned. The company's operations are limited solely to the distribution of electricity, and it has lately ceded to the Società Elettrica Bresciano its installations to the north of the Po River, while at the same time improving its own network.

The *Società Anonima Trazione Elettrica Lombarda*, of Milan, has decided to increase its capital from 7,000,000 to 8,000,000 lire by the issue of 2,000 500-lire shares.

The *Società. Illuminazione Elettrica*, of Spinazzola, is making an issue of new shares of 1,000 lire each to a total of 60,000.

Amalgamated Wireless (Australasia), Ltd.

At the annual meeting in Sydney on September 7th, the chairman, Mr. C. P. Bartholomew, announced that the Prime Minister, Mr. W. M. Hughes had accepted a seat on the board. The whole of the coastal wireless service was taken over on May 8th, and the New Guinea service on July 1st, and, although only a short time had elapsed, many improvements had been effected. The agreement with the Commonwealth Government ensured that the organisation would be developed upon commercial lines during peace, and in war would be handed over to the Government as a complete working unit.

Herbert Morris, Ltd.—The profit for the year ended July 31st last, after making allowance for taxes, was £57,242 (against £70,878) plus £5,522 dividends from investments, £4 transfer fees, &c., and £20,294 brought in, less directors' fees, preference dividends, ordinary dividend for first half-year, and depreciation, leaving £45,261. A further dividend, making 10 per cent., free of tax, is recommended on the ordinary shares; £10,000 is placed to reserve (against £25,000); and £16,823 is carried forward.

Parramatta Electric Supply Co., Ltd.—The accounts for the year ended June 30th last disclosed a net profit of £3,168, which, together with £1,361 brought forward, gave a total of £4,529. After providing for taxation a sum of £3,202 remained for distribution. A dividend of 8 per cent. was paid on the ordinary capital (£1,940) in shares, and a similar dividend in cash on the cumulative preference shares. £1,000 was placed to income tax reserve and the balance carried forward.

An Austrian Company.—*The Austrian Berliner Co.*—The accounts of the Austrian Telephone Works Co. (late J. Berliner) show net profits of 149.5 millions of crowns for 1921-22, and the dividend is at the rate of 200 crowns (100 per cent.). It is intended to increase the share capital from 50,000,000 to 250,000,000 crowns.

Companies to be Struck off the Register.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Boardman Electrical Patents Co., Ltd.
Immisch Electric Launch Co., Ltd.
London Sherardising Co., Ltd.

Vickers, Ltd.—A petition has been presented to the High Court for the confirmation of the alteration of the provision of the memorandum with respect to the company's objects proposed to be effected, and will be heard by Mr. Justice Laurence, in London, on November 14th.

Calcutta Electric Supply Corporation, Ltd.—Interim dividend on the ordinary shares issued prior to July, 1922, at the rate of 4 per cent. actual for the half-year ended June 30th, 1922.

City of Buenos Aires Tramways Co. (1904), Ltd.—Dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less tax, for three months ended September 30th.

Electrolytic Zinc Co., of Australasia.—At a recent meeting of the company the chairman announced the probability of an early dividend on the ordinary shares, which are chiefly held by the Zinc Corporation, the Amalgamated Zinc, the North Broken Hill and South Broken Hill Companies.—*Financial Times.*

Underfeed Stoker Co., Ltd.—Interim dividend at the rate of 7½ per cent. (free of tax).

STOCKS AND SHARES.

Tuesday Evening.

The prevailing tendency of the House continues to be coloured a good deal by the forthcoming General Election, which has the effect of checking business, and by the weakness of the French franc, which arouses anxiety, not to say alarm, over a wide circle of investors. Prices have considerable difficulty in making any headway; the sharp rise in the price of tin is an example of the fact that even favourable influences fail to make much impression against the dulness in business provoked by the two causes just mentioned.

Home Railway stocks are exciting a little more attention, though in their case it is argued that, with the bare possibility of a Labour majority either in this Parliament or the next, it is skating on somewhat thin ice to buy such securities, though this does not apply, of course, to the prior-charge stocks. Investment money continues to flow steadily into the 4½ per cent. debentures of the three Tube issues recently made, the prices of which remain at about ⅜ discount for the partly-paid, and 92¾ for the fully-paid; 93 being the price of issue. Districts have gone back, and there is a lull in the talk of the Metropolitan Railway being taken over by the Great Western, though, when Great Westerns spurted a few days ago, Metropolitans enjoyed a mild improvement in sympathy. The shares of the Underground Electric Railways are easier. No particular importance is attached to the talk of an immediate announcement regarding a reorganisation of the company's capital.

Power Securities, Ltd., has been making an appeal for capital this week on a somewhat unusual prospectus, which offered half-a-million 7 per cent. participating preference shares at 20s. and 100,000 ordinary shares at 22s. per £1 share. The unusual part of the prospectus lies in the omission of any estimate of profits, which according to the document, will be derived from interest on advances, dividends on investments, underwriting and other commissions. The company is under the auspices of the Armstrong, Babcock & Wilcox, and the British Thomson-Houston Companies, while it has amalgamated with Balfour, Beatty & Co. Speculation is agog to see how the issues will go, though with such names at the back of the company, it may be regarded as tolerably certain that after the allotment, the shares will settle down into permanent hands, and probably command a premium.

The dramatic rise in cable stocks and shares halted at about the levels reached last week. Globe ordinary rose ⅛; Westerns and Eastern Extensions are ⅛ down. People are beginning to ask whether the latest invention of Mr. Marconi, whereby he claims to be able to obtain complete secrecy in messages sent from points a hundred miles distant from each other, is likely to reflect unfavourably upon the profits of the submarine cable companies. These latter have hitherto been regarded as placed in a particularly strong position owing to the secrecy which their messages command, as compared with wireless waves, capable of being tapped by many and sundry. If the Marconi system can compete in secrecy with the cables, it is asked whether the latter can hope to retain the important hold which they possess over the traffic. The answer appears to be, that the experience of the past twenty years has amply demonstrated that there is plenty of room for both systems. That holders of cable stocks are by no means disturbed by the prospect of wireless messages being as secret as those which go underground is manifest by the fact that nobody is attempting to sell cable shares.

The prospectus of the Marconi 6½ per cent. debentures at 99 is expected to be circulated at the end of this week. The debenture will be short-dated and convertible into shares at £3 per share. Underwriters receive 2 per cent. commission. Shareholders in the Marconi company will have the right to apply for half the total amount, and should take care that they exercise this, as there is every probability of an early premium being established on the bonds. Marconi shares are 1/16 down at 2 5/16 on sales by proprietors who intend to take up their proportion of the new issue.

London Electrics have had a sudden rise of 10s. to 3l. on demand from those who expect the company to derive substantial profit from railway electrification schemes. An inquiry came this week, from Glasgow of all places, for Kent Electric ordinary. In these shares there is no market, they can be sold at a modest price, but none are on offer. No

doubt the demand in this case arises from some idea that the Kent company may benefit from the intention to electrify part of the South-Eastern & Chatham Railway. Metropolitans rose 5s. to 6½. The list otherwise shows no change.

Metropolitan-Vickers ordinary are better at 25s. 3d. Iron, steel and armament shares present a firmer appearance all round, on the more cheerful trade reports that come from the provinces. Babcocks hold their good rise at 65s. Armstrongs and Vickers have both advanced. Electricity and cable manufacturing shares are not much altered. General Electric ordinary are lower at 18s. Electric Constructions have gone up 5d. to 25s. 6d.

Brazilian Tractions at 46 are easier, and the preferred have receded to 88. The public are becoming uneasy at the continual shrinkage in the value of the Brazilian milreis, which dropped to a shade below 6d. before it rallied to 6 5/32d. Until Europe's purchasing powers are recuperated, Brazil is bound to feel the effect of the enforced restriction laid upon the customers for her exports; coffee and rubber are, of course, two of the most important. Anglo-Argentine Tramways second preference weakened a trifle: the 5 per cent. debenture stock is 2 points higher. British Columbia preferred has lost two and the only movement amongst Mexican Utilities is a gain of one in the Light & Power common shares. The rubber market exhibits a good deal of animation, although business has fallen away as compared with what it was a fortnight ago. The rush of trade in rubber shares proved sufficient to render it necessary for a good many Stock Exchange offices to work during this week's holiday on November 1st, All Saints' Day.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1920.	Dividend 1921.	Price Oct.31, 1922.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	12	84½	—	£7 1 2
Charing Cross Ordinary	8	9	78	—	5 18 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	—	4 12 4
City of London	14	14	2½	—	6 15 7
do. do. 6 per cent. Pref.	6	6	29/-	—	5 4 4
County of London	8	8	1½	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1½	—	5 4 4
Kensington Ordinary	9	10	7½	—	6 13 4
London Electric	2½	4	3½	+ ½	3 14 9
do. do. 6 per cent. Pref.	6	6	5	—	5 17 1
Metropolitan	7	7	6½	+ ½	5 7 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9½	—	6 11 6
South London	7	7	4	—	7 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 9 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref	5	6	102	+ 1	5 17 6
do. Def.	1½	84/6	23½	— ½	7 6 8
Chile Telephone	6	6	6½	—	4 18 0
Cuba Sub. Ord.	7	7	8⅝xd	—	8 12 4
Eastern Extension	10	10	19⅝	—	5 3 3
Eastern Tel. Ord.	10	10	193½	+ ½	5 3 0
Globe Tel. and T. Ord.	10	10	19½	+ ½	5 2 7
do. Pref.	6	6	11½	—	5 4 4
Great Northern Tel.	24	22	28	—	7 17 2
Indo-European	10	10	35½	—	7 1 0
Marconi	25	16	2⅝	— ⅛	6 9 6
Oriental Telephone Ord.	12	12	27/6	—	*5 4 0
United R. Plate Tel.	5	8	7⅛	—	*5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	15	15	19½	+ ½	*5 2 7

Home Rails.

Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	54½	— ½	4 2 7
do District	Nil	1	40⅜	—1	2 9 5
Underground Electric Ordinary	Nil	Nil	3	— ½	Nil
do. do. "A"	Nil	Nil	7/-	— 6d.	Nil
do. do. Income	2	4	86½	1	*4 12 5

Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5½	12½	88	—	7 11 9
do. do. 2nd Pref.	Nil	5½	8⅜	— ⅛	7 3 6
do. do. 5 per cent. Deb.	5	5	82½	+2	6 2 2
Brazil Tractions	Nil	Nil	46	—1	8 10 2
British Columbia Elec. Rly. Pcs.	5	5	76½	—	6 9 9
do. do. Preferred	5	93/-	66	—2	*7 2 6
do. do. Deferred	3	19/-	71½	—	*8 12 6
do. do. Deb.	4½	4½	78	—	5 16 5
Mexico Trams. 5 per cent. Bonds	Nil	Nil	12½	—	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	42½	—	Nil
Mexican Light Common	Nil	Nil	20½	+1	Nil
do. Pref.	Nil	Nil	40½	—	Nil
do. 1st Bonds	Nil	5	65½	—	7 14 8

Manufacturing Companies

Babcock & Wilcox	15	15	8½	—	4 18 6
British Aluminium Ord.	10	5	17/9	—	5 12 8
British Insulated Ord.	15	15	44/6	—	6 14 10
Callenders	15	15	24	—	6 13 4
do. 6½ Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13
Edison-Swan	10	Nil	8/-	—	Nil
do. do. 5 per cent. Deb	5	5	64	—	7 16 4
Electric Construction	10	10	2½	-9d.	7 17 0
English Electric	8	5	15/9	—	6 7 0
do. do. Pref.	6	6	19/3	—	6 8
Gen. Elec. Pref.	6½	6½	21/8	—	6 2 4
do. Ord.	10	5	18/	—6d.	5 8 1
Henley	15	15	2½	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	14/6	—	—
Met.-Vickers Pref.	8	8	32	—	6 14 9
Siemens Ord.	10	10	35/9	—	*7 15 4
Telegraph Con.	20	20	36½	—	*4 18 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, November 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	7¾d.	...
a Ammoniac, Sal	per ton	£63	...
a Ammonia, Muriate (large crystal)	,,	£48	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£30	...
a Copper Sulphate	,,	£26 10s.	...
a Potash, Chlorate	per lb.	5d. to 5¼d.	...
a ,, Perchlorate	,,	7¾d.	...
a Shellac	per cwt.	£15 15s.	£1 inc.
a Sulphur, Sublimed Flowers	,,	£9	10s. dec.
a ,, Lump	,,	£8 10s.	10s. inc.
a Soda, Chlorate	per lb.	3¾d.	...
a ,, Crystals	per ton	£6	...
a Sodium Bichromate, casks	per lb.	5d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£100	...
b ,, Wire	per lb.	1/9 to 2/6	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£171	£12 inc.
Grade II	,, ,,	£122	£8 inc.
Grade III	,, ,,	£93	£4 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c ,, Tubes (solid drawn)	,,	11½d. to 1/-	...
c ,, Wire, basis	,,	9½d.	...
c Copper Tubes (solid drawn)	,,	1/1½	...
c ,, Bars (best selected)	per ton	£96	...
c ,, Sheet	,,	£96	...
c ,, Rod	,,	£96	...
d ,, (Electrolytic) Bars	,,	£70 15s.	20s. dec.
d ,, ,, Sheets	,,	£145 10s.	...
d ,, ,, Wire Rods	,,	£80 15s.	20s. dec.
d ,, ,, H.C. Wire	per lb.	10½d.	½d. dec.
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	9/-	...
n German Silver Wire	,,	2/6	...
h Gutta-percha, fine	,,	12/6	...
h India-rubber, Para fine	,,	1/1½	1½ inc.
l Iron Pig (Cleveland Warrants)	per ton	92s. 6d. to 95s.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£24	...
g Lead, English Pig	,,	£27 10s.	20/- inc.
g Mercury	per bot.	£12 to £12 5s.	5/- to 10/- inc.
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/1	...
p ,, drawn bars and rods	,,	1/3	...
p ,, rolled strip & sheet	,,	1/2½	...
p ,, wire	,,	1/3½	...
o Platinum	per oz.	£23	£3 dec.
d Silicium Bronze Wire	per lb.	10½d.	¾d. dec.
r Steel, Magnet, in bars	,,	10d.	2d. dec.
n Tin, Block (English)	per ton	£170 10s.	...
n ,, Wire, Nos. 1 to 16	per lb.	3/2	2d. inc.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r. W. F. Dennis & Co.

Freemasonry.—On Friday last, at Mark Masons' Hall, W.-Bro. E. E. Sharp, the retiring Master, installed Bro. P. C. Ebner, A.M.I.E.E. (an engineer on the staff of the Borough of Shoreditch electricity undertaking), in the chair of the Kelvin Lodge. Afterwards a banner presented to the Lodge by one of the founders was unveiled by W.-Bro. Percy Still, M.I.E.E., P.G.S.D., who gave a brief but eloquent address. Amongst the visitors present were Mr. C. F. Quicke, P.G. Supt. Wks., Mr. J. W. Meares, C.I.E., electrical adviser to the Government of India, and Messrs. A. J. Cridge, R. E. Neale, H. P. Guy, A. H. Allen, H. E. Burrows (W.M. Electric Lodge), J. S. Plumtree, and W. Wyld.

Steel Battery Cases.—An interesting announcement was recently made by the National Carbon Co., Inc., U.S.A., manufacturers of dry batteries and carbon products. The most popular type Columbia "Hot Shot" battery, No. 1461—a four cell, 6-volt battery—which has been sold in a fibre container is now being put on the market in a new steel container. This new battery is a very great improvement on the old type which it replaces. Important advantages claimed by the manufacturers for the new steel case include the following:—Superdurable, waterproof, thoroughly insulated, to prevent internal short circuits, unbreakable, portable—a new woven fabric handle for comfort, strength and convenience. The new container is lithographed in colours, thus presenting an attractive appearance. At the same time the nature of the materials used in lithographing the container also serves as an electrical insulation for the outer surface. The price is to be exactly the same as that of the old fibre-container battery. Other standard types of Columbia "Hot Shot" batteries are to be put into steel containers.—*T. & T. Age.*

THE FLEETWOOD AUTOMATIC TELEPHONE EXCHANGE.

THE FIRST PUBLIC RELAY INSTALLATION.

Inventive effort applied to various basic ideas of automatic switching has resulted in the development of several automatic telephone systems, most of which are founded on the principle of successive group selection through the medium of electro-mechanical switching devices controlled by impulses emanating from subscribers' instruments.

In one system, however, all electro-mechanical switching devices, in the accepted sense of the term, have been excluded, and even successive group selection is only utilised to a limited extent. The "Relay" system (which has been described in our pages) is built up entirely with relays; all operations in the exchange, including circuit hunting, connecting, and even ringing, are executed by means of relays, without the intervention of any mechanical gear. The Relay Automatic Telephone Co., Ltd., has evidently been actuated by the resolve to utilise only the simplest apparatus available to attain the object in view, and there is probably no telephone apparatus whose performance and durability under varied climatic conditions are better

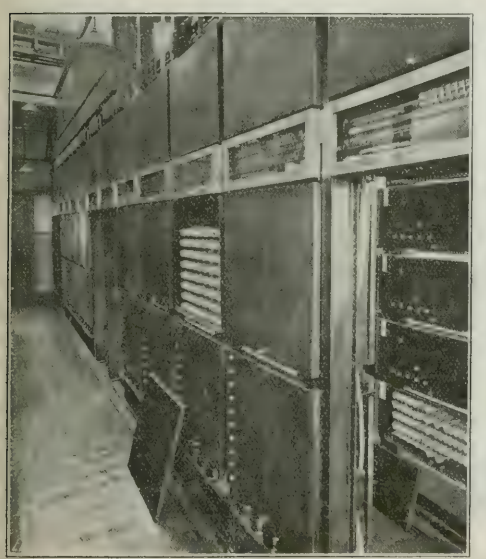


Fig. 1.—Common Apparatus Rack.

known than those of the relay. The early exchanges have proved how extraordinarily reliable such apparatus can be made.

The development of the system in 1914 constituted, in our opinion, a noteworthy advance in automatic telephony, and it is unnecessary to reaffirm our conviction as to its inherent excellence. It will suffice to record that a large number of exchanges have been installed for private service, some of which (*e.g.*, the *Liverpool Courier*, North-Eastern Marine Engineering Co., Ltd., and India Stores Depôt) have connection to the public service, while other similar plant (ranging in size from 20 to 1,200 lines), which will be rented by the Post Office to subscribers, is in hand. The Swedish Co. installed a trial 1,000-line semi-automatic public exchange in Stockholm in 1917 for the Swedish Government, whose official records show that during two years only one exchange fault was reported on an average for every 92,000 calls and only one contact fault for every 195,000 calls, a result which speaks for itself, while the several exchanges supplied by the English Co. to the India Office are fully confirming the confident opinion that the "Relay" system is ideal for tropical use.

The exchange at Fleetwood, which we had the pleasure of inspecting last week, is the first public one to be installed for the Post Office in this country, and was brought into service in July of this year. For several days after the exchange was brought into use, no faults whatever were reported (a most remarkable performance), and during the 3½ months the exchange has been working the number of faults generally has been extremely low.

The exchange was designed to meet the specifications of the Engineer-in-Chief of the British Post Office. During its manufacture each new requirement for automatic exchanges that was standardised by the Post Office and included in its latest automatic exchange specifications was added to the plant, so that when the exchange was brought into use it embodied every improvement to date.

The opening of the Fleetwood exchange marks an era in the development of automatic telephony in this country, for it is the first of its size that is completely automatic (*i.e.*, without local operators for junction and trunk calls and inquiries).

Subscribers are provided with Post Office standard telephones with dial, which are each connected to the exchange by two wires without earth connection. A

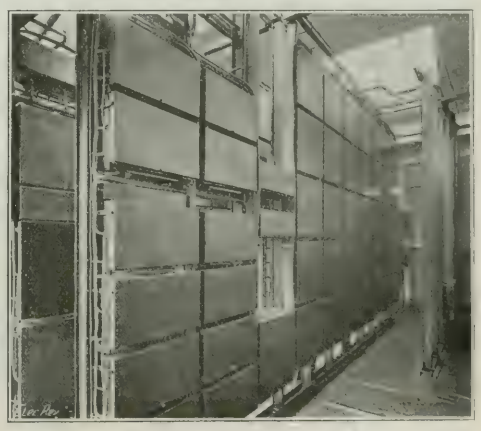


Fig. 2.—Back of Recorder Rack.

Fleetwood subscriber making a local call removes the receiver from the hook and immediately the dialling tone is heard; the dial is then operated the requisite number of times (once for each digit), and if the called number be disengaged, connection is made and the distant bell is ringing within about five seconds. The call is automatically metered against the calling subscriber at the end of the conversation when he replaces his receiver on the hook. If the called subscriber does not answer, or certain special numbers are called, the call is not metered. A unique alarm is provided so that if a subscriber's meter does not operate correctly, a warning signal is given; by this means the meters are kept under continuous observation.

It is the usual practice for a manual board to be located near the automatic board in order that connection can be made by means of junction and trunk lines with the public system. In the case of Fleetwood, however, there is no manual board locally, and junctions (two-wire) run direct from the automatic board to the Blackpool Central manual board (nine miles away).

When a Fleetwood subscriber makes a call for trunks or any exchange other than Fleetwood, he dials 0, and in so doing gets automatically connected to an idle junction to Blackpool, where his call is handled manually; the Fleetwood subscriber, however, gives a clearing signal to the Blackpool operator immediately he hangs up his receiver. Similarly for "inquiries" the subscriber dials 9, and is also automatically connected to Blackpool.

In a like manner calls in the reverse direction are completed by the operators on the manual board at Blackpool Central dialling over two-wire junctions to Fleetwood. In this case also the Fleetwood subscriber lights a clearing lamp in front of the Blackpool operator when he replaces his receiver on the hook. If the Fleetwood subscriber is engaged when dialled by Blackpool, the operator gets the busy-back tone and the clearing lamp flashes intermittently. If it is a trunk call, the operator can, over a special junction obtain connection with the engaged subscriber and offer the trunk call. The operators at Cleveleys (another exchange in the same area) also obtain Fleetwood calls direct by dialling the required number.

It will be appreciated that the entire elimination of the operator at the automatic exchange opens up avenues for effecting economies in the direction of operators' wages, accommodation, and supervision.

The whole of the apparatus is accommodated on one floor. The exchange is planned for an ultimate of 920 lines, about half of which are in use at present, with 40 junctions outgoing to and 40 junctions incoming from Blackpool and other exchanges, and occupies a total floor space of 875 sq. ft., 330 sq. ft. of which are occupied by the power plant, test desk, and batteries.

General views of the Fleetwood equipment are reproduced in the accompanying illustrations: Fig. 1 shows the common apparatus rack, *i.e.*, in junction feeds, ringing groups, AB feeds, trunk connecting groups, fuse and alarm groups; the recorders on the second rack, the back of which is shown in fig. 2, are seen through the first bay (on the right). The third illustration shows the motor generator, main distributing frame, trunk offering bay, intermediate distributing frame, and the meter rack, while fig. 4 shows the battery-charging board and ringing machines.

Although the basis of the design of the relay was a well-known telephone type which had stood the test of practice the company modified the design so that it rarely requires adjusting after it leaves the factory, and continues functioning with a minimum of attention; thus maintenance costs are reduced to the lowest possible figure. The small brass stud usually fitted in a relay armature to prevent it sticking by residual magnetism to the core is replaced by a strip of metal which has a much larger area and does not hammer out and so alter the timing of the relay—a vital point in automatic working. In order to make the relay suitable for tropical conditions, fibre and ebonite are excluded and only micanite and filled insulating materials, such as empire cloth, are used. The contact pressure is not less than $1\frac{1}{4}$ oz. per contact, and is ensured by the employment of a special bronze for the springs, which does not lose its tension with prolonged use. That the results aimed at are being obtained in practice is shown by reports, which prove that exchange faults on "Relay" private automatic exchanges are only occurring at the rate of one exchange fault per working telephone in 7.4 years, while faults on contacts are only occurring at the rate of one fault per working telephone in 40 years.

The total number of relays at Fleetwood is 12,568 for 480 lines, which is an all-in average of 26 per subscriber's line. When the exchange is increased to its ultimate capacity of 920 lines, the relays will total 22,025, or an all-in average of 24 per line. (An exchange of ten times the size, *i.e.*, 10,000 lines, would require approximately 2.5 relays per line additional.)

One of the principal features and facilities provided at Fleetwood is a combined three and four-digit numbering scheme, which illustrates one of the advantages by which the full 1,000 numbers can be employed without an additional trunking stage; the amount of equipment required is practically independent of the number of digits in the numbering scheme. The subscribers are numbered from 200 to 799, and from 8,000 to 8,319; 0 is used for trunk calls, and 9 for inquiries; 1 is not used owing to the liability of a subscriber sending a false impulse when removing his receiver from the switch-hook; if a false impulse be sent it simply resets the recorder without mutilating the call.

Another important advantage is that in searching for an idle junction in a large group, it takes no longer to search and connect the last junction than it does the first, whereas in a mechanical system the moving arm takes an appreciable time to travel over a number of engaged junctions.

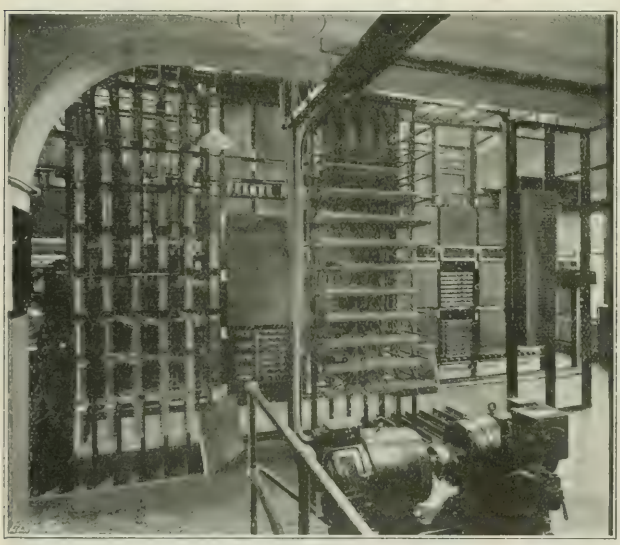


FIG. 3.—DISTRIBUTIVE, TRUNK, AND METER RACKS.

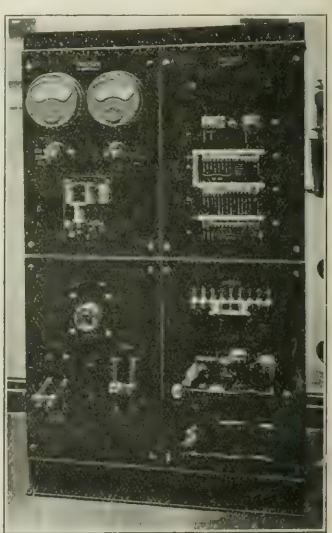


FIG. 4.—BATTERY-CHARGING BOARD.

An intermediate distributing frame for—(*a*) distributing the traffic load on the various subscribers' groups; (*b*) distributing the traffic load on the various A and B feeds and ringing groups is provided, and the auxiliary working of subscribers' lines is effected with non-consecutive numbering and any sized group; night working is done without additional equipment.

The telephonist at the distant manual exchange controls the clear, receives the busy-back lamp-flash, and can meter the call over a two-wire junction, while trunk offering by the telephonist at the distant manual exchange is done over a special junction. Two-party-line working is arranged for.

With regard to call offices, in the case where no dial is provided the caller removes the receiver and is automatically connected over special junctions to Blackpool, where the telephonist answers and deals with the call as if it were from a call office on a manual exchange. In the cases where coin boxes are fitted the caller dials local calls direct, and on hearing the wanted party reply, deposits coins to complete the talking circuit. For calls to other districts, the caller dials 0, and the telephonist completes the connection and asks the caller to deposit the money, &c.

Thermostatic control of common apparatus, to prevent line faults and "receivers left off" from impairing the trunking efficiency of the exchange, is provided, while the delayed back-release is by thermostat.

Dialling, busy-back, number unobtainable, and ringing induction tones are provided and interrupted according to the Post Office standard; the ringing machine starts and stops automatically, and the transmission circuit includes a repeating coil and impedances, which ensure quiet and efficient transmission for long-distance working.

The busy-back is given from the A and B feed, thus reducing the load on the "in trunks." The subscriber's meter energises at the end of a conversation, and an alarm is given if it does not do so correctly; it is therefore under continuous supervision; the recorders deal with 1-, 3-, or 4-digit calls, and are not taken into engagement with a calling line until the first digit is dialled.

Traffic meters are fitted to the various groups so that a continuous record of traffic can be kept, and a recording ammeter can be fitted for speech-minute record purposes. The absence of a subscriber's multiple renders unnecessary the usual allowance of additional equipment for lapsed telephone numbers still in the directory; a subscriber's equipment has no telephone number identity until it is jumpered to the marker.

Calls for dead numbers get the NU (number unobtainable) tone, because the associated marking wires are not jumpered on the IDF, and a "changed number" bar on the latter allows calls for removed subscribers' changed numbers to obtain connection to a manual operator. A system of alarm lamps and signals indicates faults, and a simple power plant is provided, comprising two 32-volt (sixteen-cell) batteries, one charging machine, power board, and two battery driven ringing machines.

ELECTRICAL MARKETS OF SOUTH AMERICA.

An Opening for British-made Meters.

By PERCY F. MARTIN, F.R.G.S.

In view of the wider adoption of electricity both for lighting, power, and heating purposes in the principal States of South America, the demand for electricity meters is pronounced. In these countries, fixed rates are not in favour with supply authorities, so that the provision of house-meters is general. In Argentina, a majority of these meters are intended for direct current and for 220-volt circuits, with a capacity of between two and ten amperes. Whereas in the early days the Edison meter and the Wright meter were largely used, both of these types have now been abandoned, the former surviving only in the Bastian meter, occasionally met with. In Buenos Aires, both German and Italian manufactures are popular, while in the interior cities various types of meters are used, the choice depending largely upon price and suitability.

At one time British-made electricity meters were highly thought of and generally introduced in new installations; but for some reason or other, which it is difficult to explain, these British goods have fallen from second to fourth place in the list of electrical imports, and promise to dwindle still further unless energetic steps are taken by manufacturers at home to supply the undoubted demand which exists. The steady decline in British-made meters may be traced from the early days of the war, but there seems no reason why, now that normal conditions have been restored between the United Kingdom and South America, the once considerable trade carried on in this direction should not be renewed. In comparison with the meters supplied by United States manufacturers, those from the United Kingdom were considered superior; with the revival of European activities it is doubtful whether American meters can sustain the test of quality competition. While quality is naturally greatly esteemed, the selling price is also an important factor, since the electricity suppliers—whose number is estimated at considerably over 350 in Argentina—regard the meter as an expense rather than a productive investment.

Neither is Argentina any longer entirely dependent upon foreign productions, since a local company, La Electro Metálica Argentina, turns out a considerable number of direct-current, ampere-hour meters at a very low cost, and certainly of as good a quality as any imported from Europe or the United States. Another factory, of German origin and managed by German engineers (Siemens-Schückert, Limitada), is manufacturing meters of standard types such as were formerly made in Germany and imported into Argentina by the firm referred to. The claim is put forward that between 15,000 and 20,000 of these meters have been made and sold in Argentina at prices somewhat lower than those quoted by North American or European manufacturers.

Owing, however, to the suspicion entertained against the use of ampere-hour meters on account of possible abuses in over-charging customers, new regulations have been introduced prohibiting their introduction in connection with new installations, and in some instances their removal from existing ones. The present type of electricity meter favoured in Argentina, on account of both construction and price, is the Ferraris single-phase, induction type. All meters have a cyclometer dial or a direct-reading disk dial.

In Brazil, the same objection exists to the fixed or flat-rate system as in Argentina, with the result that the market for watt-hour meters is a wide one. In this Republic also the sizes most in favour include those of a capacity of from two to ten amperes, as in the case of Argentina, while for ordinary household circuits practically all are for single phase, 120 or 220 volts, 60 cycles, which is the standard form of supply from all the larger central stations. On the other hand, there is a certain, but smaller, demand for direct current meters

for 3-phase power meters, and for 50-cycle types. The capacity of the demand may be gauged from the fact that in the capital, Rio de Janeiro, and the next largest city, Sao Paulo, there are about 95,000 meters in use, the annual requirements being normally about 10 per cent. of this number.

European makes have hitherto held the market in competition with those of United States origin. British manufacturers have had a share in the provision of electricity meters for Brazil. It is understood that several types are being shown at the Centenary Exhibition, now in progress at Rio de Janeiro, embracing the special features desired in this tropical country and consisting in general of glass covers and ironclad conduit terminals for entrance wires, with cyclometer or direct-reading dials, the meters being so constructed as to prevent as far as possible the intrusion of tropical insects and vermin.

In Uruguay, the condition of the electricity-meter market is much about the same as in the two other States referred to, except that the purchase of all such apparatus is in the hands of the Government, which controls the generating stations. It may be said that the capital, Montevideo, offers one of the finest markets in South America for all progressive developments connected with the use of electricity, the Government taking particular pride in the character of its own show-rooms, where are displayed many admirable working models of practically every known electrical device for the factory and household.

In Montevideo, there are considerably over 30,000 consumers of the energy supplied by the Government. In view of the wide extension of residential buildings, which has been in progress for several years past, the number of new subscribers is continually being added to. The usual type of meter is for alternating current, including the Ferranti and other patterns. Some old-established installations employ the Aron meter, consisting of two electrically-driven clocks. The Shallenberger and other types are occasionally found. The most common alternating-current meters are for 220-volt, 50-cycle, single-phase circuits, having a capacity of 2½ and 5 amperes. The direct-current meters most used are for 220-volt circuits, of 2, 5, and 10 amperes capacity.

THE PHYSICIST AND THE ELECTRICAL ENGINEERING INDUSTRY.

Mr. C. C. Paterson, chief of the research organisation of the General Electric Co., Ltd., lectured before the Institute of Physics on the above-named subject on October 18th. He said that there were, in the main, three ways in which physicists might be associated with the electrical industry. First, they might work at independent investigations and research at universities with no immediate industrial objects in view; secondly, they might work with a definite industrial object at institutions outside the industry, such, for instance, as the National Physical Laboratory, and be included in this category the various industrial research associations; thirdly, they might engage in research and investigatory work with an individual company and in the employ of that company. It was the last category that he wished to consider most, not because he desired to belittle the importance of the other two categories, but because he thought the need which industry had for the physicist within itself was very insufficiently appreciated.

The electrical industry could never flourish if it relied on merely receiving the results of physical investigations from outside. The outside investigator, however brilliant and however frequent his visits to works, could never have sufficient knowledge of the industry to appreciate fully what were its real needs or what were the real facts of its problems. He wished to convince them of the urgency of the necessity for having physicists of the right sort at the heart of an industrial concern, intimately associated with its manufacturing processes and in the counsels of the management in all matters of policy which might be affected by technical considerations, and the elaboration of this aspect he took as the theme of his lecture.

He would endeavour to give as true a picture as he could of many well-managed manufacturing concerns in the electrical and allied industries. It was of no use to consider the industry as a whole. The industry consisted of a number of manufacturing units, entirely independent and generally in competition; usually the competition was in price as well as quality. Competition in quality always existed, and low manufacturing costs came only second in importance to quality. Sometimes even a compromise between costs and quality had to be admitted. Although it might not always be the case, he would assume that technical processes in the works were in the hands of men whose mental equipment was good. Often they were qualified engineers. Frequently, these men had the main executive responsibility in their departments and had to see to the putting-through of orders and the quality and design of the articles manufactured. Sometimes they were qualified men on the staff of the works chemist, or the works chemist himself was in charge of the processes. On the other hand, in some branches of the industry, a chemist was not considered necessary or was relegated to an inferior position, and the factory processes were in the hands of an engineer to whose shoulders all the production worries were transferred. In other cases, technical responsibility largely rested with the staffs of the drawing and designs office. Whoever was made responsible for factory processes and production was usually given a free hand in the encouragement to make whatever trials and experiments he wished with a view to improving and reducing costs. Most managements prided themselves on the encouragement given to their staffs to make experiments. This had the incidental advantage to the management of affording less ground for excuse on the part of the technical staff should processes go wrong or complaints arise. Alterations in processes or designs sometimes came from inside; often they were the result of pressure from competitors. Information, often incomplete, was received that a competitor was working along some new line, and the technical man responsible for that section was immediately set to work to reproduce the result. If he succeeded up to the point of making the new process or design an improvement over the old, it was adopted in the factory after a fairly thorough trial, and there the matter ended. There was no time for more. Empirical instructions had been given to the factory and, meanwhile, the next worry had been taken up in order of urgency. More often, the attempted improvement was discarded as unworkable for reasons which were never very clearly defined. Either it was beyond the technical skill or knowledge of the man responsible, or there were factors connected with the raw materials which were outside his control. Often improvements which were at first promising had been discarded because the results had proved erratic and uncertain in routine production, and the investigation of the causes by the usual trial-and-error methods was a task of too great a magnitude and was too expensive to face.

To a greater or less extent, this was, or had been until recently, a true picture not of one, but of the majority of the concerns connected with the British electrical engineering industry. It was also a picture of as many foreign ones. From a technical point of view it was a picture of "muddling along," frequently at low efficiency, nearly always in an atmosphere of semi-ignorance as to what it was doing, constantly fearing that the products it was supplying might develop unexpected blemishes the causes of which were shrouded in obscurity. He did not think it compared unfavourably with the average standards existing in many industrial countries throughout the world, but he was comparing it with what it was well within the power of the industry to become.

These uncertainties and mysteries in industry must be explained and for several reasons other than the obvious one. They could only be cleared up by knowing what were the physical laws which underlay its processes and governed the behaviour of its products, and this knowledge must be part and parcel of the factory equipment and must not be regarded as an academic thing, the property of one or two experts. Industry run by engineers was constantly satisfied by merely getting something to work, whether it were a process or a finished product. To do anything more was considered a waste of money. To learn the why and the wherefore was relegated by the management to universities and "places where they think." If the results of this policy were not so disastrous for industry itself, one would have little to say, but it was vital in the interests of industry itself that it should change its outlook and recognise that knowledge was as valuable to it as practical achievement. At present many concerns depended for subsistence on crumbs of knowledge picked from under the tables of the universities, and that was a meagre meal for an industry which ought to be growing. It was sometimes stated by managements that they could rub along all right with their existing technical staffs. If they came up against a problem which they could not manage, and if it was of sufficient importance, they called in outside research assistance, but this outside assistance could never take the place of the physicist at the heart of a concern.

For a works physicist to be a success, however, it was es-

sential that both the physicist and those with whom he must co-operate should learn each other's point of view. Their mentalities were different and must, and should, be different and complementary. Without this understanding there never could be fruitful work, and particularly must the works manager appreciate that the true research worker was originally-minded and therefore found control irksome. Each side must win the confidence of the other and merit the support and appreciation of the other, for the success of physics in industry depended as much upon these matters as on the actual merit of the researches carried out.

The first desideratum for the physicist was to know his works thoroughly. The physicist who entered many branches of the electrical manufacturing industry was surprised to find how empirical everything was. That the industry had been carried on successfully under these conditions was a tribute to the ability and patience of the personnel of the industry. It was a great mistake to assume that other methods could easily and quickly supersede empiricism, but they must gradually do it as principles became surely established. One of the most baffling factors in the process of substituting control by measurement for control by judgment was met with when a factory had not the full control of its raw materials, but had to take what it was able to purchase. Variations in raw materials might completely mask the effect of refinements introduced to improve efficiency. In these circumstances, there was greater need for the physicist or the works chemist, as the case might be, in order to introduce processes for the treatment of raw materials, or to show the suppliers of the raw materials what to do in order to meet requirements. The only way to expect success was to make the research physicists free-lances in the works, free to arrange their own experiments and to set themselves their own problems untrammelled by the prejudices of the existing works personnel. Their only terms of reference should be to investigate the works processes and products with a view to the improvement of efficiency and the development of better ones. They must have a laboratory of their own and workshop facilities under their own control. The number of men would depend upon the size of the concern, but two was an absolute minimum, and their qualifications would naturally depend on the particular branch of electrical engineering in question.

Many industrialists would be inclined to regard with incredulity the wisdom of letting physicists loose in their works with such a roving commission. They might see difficulties of discipline, of jealousy on the part of the works personnel, interference with production and overlapping with the duties and responsibilities of superintendents and others already responsible for experimental work. They might regard it as likely to turn into a new department responsible to none of the existing works managers, with direct access to the managing director himself over the heads of those responsible to him for the works. These were, admittedly grave considerations, but it was nevertheless of the greatest importance to segregate the research men from the existing works influences and control and to get the managers to support and welcome this segregation.

Dealing with the application by the General Electric Co. of the ideas he had propounded, Mr. Paterson said that the company decided four or five years ago to make research one of its definite objectives. Practically the only general fundamental principle the management laid down in connection with this decision was that the research activities were to be kept independent of production activities, *i.e.*, the management must retain complete responsibility for production processes. The research organisation should assist with advice and experiment in a consultative capacity and the problems it tackled and the work it undertook must remain in the discretion of the research organisation itself. On the other hand, the decision to apply or not the results of any piece of work of the research laboratories must rest entirely with the factory concerned with the particular product. With this guiding principle and the financial means to establish laboratories, the movement was launched to work out its destiny, supported by the goodwill of the various managements—to establish its relationship with the different works of the company, and to grow as circumstances should dictate. The arrangement was absolutely flexible. Occasionally, experiments were conducted on the production plant itself—more often, if it could be arranged, the process was installed in the research laboratories where factors could be independently controlled and where production was not interfered with. Moreover, the practice had grown up of holding regular meetings of the works technical staffs with members of the research laboratory staff. Works technical matters were reviewed at these conferences, and the laboratories were able to acquaint themselves with the works policy and their urgent problems and difficulties. The whole personnel of the laboratories now numbered 80, of whom 25 per cent were qualified research men, and of the remainder a good many were operatives who carried on some of the works processes on a small scale in the laboratory, for the purpose of studying them and applying experimental results in a practical way before recommending them to the factory.

Mr. Paterson concluded with a reference to some instances of the manner in which research work in the factory had been productive of practical results in a manner which would not have been possible otherwise. A certain process in the works which had been in use for a long time involved the coating of wires of different diameters with a mate[illegible] hardened after coming out of the bath. The final product was not always uniform in quality, and there was consequent wastage due to outturns, and consequent loss of metal. Investigation showed that there were as many as six variables affecting the final product, several of them interdependent, and concerning processes carried out, and products made, in different departments of the factory. One of these was the quantity and uniformity of the deposit on the wire, which became increasingly variable as the size became smaller. The problem was tackled by making measurements with a view to determining the laws governing the deposition of liquids, with and without suspensions, on long cylinders when suspensions were made. The limiting conditions were found and the lines indicated along which alone it was possible to look for success in the operation. No works technical engineer or manager would, or even could, undertake such a piece of work as this. Again, in the manufacture of a certain composite wire, the drawing process did not always yield 100 per cent. output. A bad patch was frequently met, and at these times the efficiency was very low. Careful micrographic examination of the wire at all stages resulted in the cause and remedy being found, after four or five weeks' work, and the examination revealed a condition of the wire which explained the cause of many troubles which occurred in another department of the works and had been attributed to other causes altogether. The following example was from a lamp works: The final state of evacuation of a lamp depended on the action of a certain amount of red phosphorus introduced into the lamp before sealing-off from the pump system. It was known by the elegant name of "getter." Phosphorus had been employed for this purpose for very many years in the lamp industry. For many years, also, lamp makers had rung the changes upon many different ingredients to add to the phosphorus and also upon the method of its introduction into the lamp. Nevertheless, all the lamps had not always been perfect. Many possible causes had, from time to time, been blamed for failures, including the "getter." The whole problem was clearly one of finding out thefundamental action, not only of the getter, but of every other agency in a lamp—and there proved to be several—which affected the quantity of free gas in the bulb at different periods of the life of the lamp. The whole of the phenomena were investigated and correlated in about two years and reduced to proper physical terms. The complication of the whole problem thus revealed in its full magnitude, showed the utter hopelessness of attempting to carry on manufacture intelligently by the process of groping and guessing among empiricisms.

In the design of thermionic valves, there had been the great advantage that the modern physicist was fairly early in the field and had got his principles generally clear before manufacture took place on a large scale, and it was, in this case, possible in some measure to avoid empiricism from the beginning. The same, however, did not apply to acoustics, for in spite of the fact that the telephone was one of the oldest instruments, the principles and practice underlying the faithful magnification of sounds were virtually unknown. Electrical engineers throughout the world were suddenly confronted with the necessity of supplying loud speakers in connection with the magnification and reproduction of speech and music by wire and wireless, and they had little but empiricism to go upon. The industry could only hope that the public would have patience with it until the problem had been properly explored by physicists and the results of their work translated into practice.

He could imagine few things, concluded the lecturer, more beneficial to a factory or more helpful to a progressive works staff, whether glass works, cable works, machinery works, lamp works, or any other kind of works, than an invitation from its management to a band of men, physicists and chemists, to devote themselves to its welfare and improvement, in the manner he had indicated. At the same time, he could imagine few things more disturbing than this to a works technical staff which had allowed itself to crystallise and had no real desire to depart from the methods of tradition and empiricism.

At the conclusion of the lecture, a number of lantern slides were exhibited showing the various departments of the research organisations of the Metropolitan-Vickers Co., Ltd., and the General Electric Co., Ltd. It may be mentioned that the following are included in the list of problems which the former company has allocated to its research physicists: the use of tides for power generation; critical speeds and vibration in rotating machinery; electrical and thermal characteristics of dielectrics; heat transmission and radiation of various appliances and materials used in electrical engineering; study of circuit-breaking gear by measurement of rapidly transient phenomena; and the study of stresses in gearing for power transmission.

A Large Cable.—A large cable is reported to have been constructed by the Halsingborg Electrical Works for the South Swedish Power Co. The cable, which is to be laid to the latter's transformer station in Halsingborg, is of the 50,000-V three-phase type; it has a diameter of 110 mm., and weighs about 30 kilogrammes per metre.

A MANITOBA HYDRO-ELECTRIC SCHEME.

The infinite possibilities of Canada become more and more apparent as progress is made in methods of development. The advent of electricity, employed on a scale never before known, has rendered possible the fullest exploitation of the country's vast resources which so far have been scarcely touched. Apart from this, electricity is making life easier for Canada's small population; electrical energy has received full recognition as a labour-saver, and as a clean and cheap agent for performing all kinds of duties. Canada is far ahead of the Mother Country in this respect. The principal reason of this superiority is, of course, the existence of illimitable water-power resources which are steadily being harnessed and put to work in all parts of the Dominion. We have previously said a great deal about the wonderful hydro-electric system of Ontario, but the other provinces are also carrying out schemes of equal magnitude. Already Manitoba has made several important developments, those of the Manitoba Power Co. in particular being comparable with any other hydro-electric undertaking. The province is rich in timber, coal, and copper, in addition to its fisheries and furs. In the northern part of the province copper is mined, but transport costs for the ore make the resultant price high. Timber for paper-making is also abundant, but pulping facilities are lacking, and transport costs again intervene to enhance the price of the finished product.

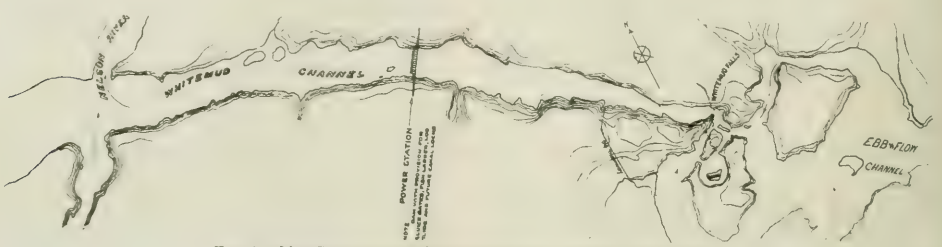


Fig. 1.—Map Showing the District which is being Developed.

With a view to developing the area and to enable copper and paper to be produced in an economical manner, a company has been formed under the title of Menzies-Smart, Ltd. This company proposes, by means of electricity produced by the power of the Nelson River, a view of which appears in fig. 2, to operate pulp and paper mills and copper smelting and refining plant, in addition to supplying energy for purposes which will follow the initial developments. As far back as 1910, the potentialities of the Nelson River were the subject of a reconnaissance survey made on behalf of the Department of the Interior. The river joins Lake Winnipeg with Hudson Bay and forms the main artery for carrying the discharge of an area of 450,000 square miles to the sea, and it runs parallel to the Hudson Bay Railway which passes within 30 miles of the power site. It flows through the central portion of North Manitoba for a distance of 430 miles, and it has a fall of over 700 ft. in this distance. The point at which the Menzies-Smart company intends to erect its station is seen on the accompanying map (fig. 1). It is proposed to utilise Cross Lake, part of the discharge of which passes over the Whitemud Falls, as a storage reservoir. The lake is not shown on the map, being over three miles distant. The company will erect a dam at a point 1½ miles below the Whitemud Falls where the width of the river is about 1,800 ft. The available head at this point is 40 ft., and the average potential power is 182,000 h.p., with a turbine efficiency of 80 per cent., corresponding to a maximum demand of 236,000 h.p., with a load factor of 60 per cent. The available maximum is 291,000 h.p. This can be augmented by means of the facilities afforded by Lake Winnipeg, which has an area of 9,414 square miles, but it is considered that this storage would not be required for many years to come. The civil engineering work to be executed will include a concrete non-overflow dam, spillways, and sluiceways at both ends of the power house, with provision for sluice gates, a fish ladder, log slides, and lockage facilities for navigation. At a point approximately three miles up-stream, at a site known as Eve's Falls, will be placed a rock-fill diversion dam of the free spillway type to cut off the flow through a waterway known as Eve's Channel, thus providing an automatic spillway 2,000 ft. in length. It is stated that no unusual engineering difficulties will be encountered in carrying out the hydraulic work.

At each end of the power house will be placed six sluices, each 20 ft. wide, separated by 6-ft. piers, and a sill provided with stop logs or gates to control the flow of the river. From the end of the sluice-way will extend a free spillway, with a total length of 316 ft. At the extreme end of each spillway a non-overflow dam will be built to restrict "flood waters." The entire structure will be of solid cyclopean concrete, reinforced where necessary.

In the generator room of the power house, the generators, turbine governors, and exciters will be installed. The turbines which it is proposed to employ are of the vertical shaft, single runner, high-speed Francis type, made by Messrs. Vickers, Ltd. The weight of the rotating parts will be borne by a Michell suspension bearing mounted on the top of the generator. The runners, movable gates, fixed guides and other exposed parts will be of extra heavy construction to guard them against the effects of block ice which may float in if the racks are raised for any purpose, and will be fitted with the latest devices for combating frazil ice. The speed of the turbine will be controlled by an automatic oil pressure governor. Each governor will be supplied with oil from valveless pumps, the pressure system being in duplicate. There will be a central supply for all governors, and an individual, independent, supply for each, with compressed air accumulators. The governors will have all adjustments readily accessible, and the speed will be controlled from the switchboard. An excess speed cut-out which will close the turbine gates immediately and automatically will be fitted. The turbine gates will be fitted with both hand and motor-driven closing gear. Each turbine operating under a 40-ft. head will be capable of giving a maximum output of 23,000 h.p. The generators will be 3-phase, 60-cycle machines delivering current at 12,000 V. Each will be provided with an exciter directly-connected to its shaft. The normal rating will be 15,000 kW and the machines will be capable of sustaining a continuous overload of 25 per cent. The transformers for long-distance transmission will be single-phase, each of 5,000 kVA normal rated capacity and designed to withstand safely 50 per cent. continuous overload. These will step-up the pressure to 110,000 volts, but provision will be made to tap off energy at



Fig. 2.—The Nelson River.

lower pressures. These transformers will not be required in the initial stage as the energy will be transmitted direct to the mills at the generated voltage. A double-circuit three-phase transmission line, arranged for 110,000 volts, will be erected. For the initial installation, however, it will be operated at 12,000 volts.

The total cost of the initial portion of the scheme, giving 48,000 h.p., is put at $4,028,500; the final development of 291,000 h.p. will cost a further $6,600,000.

At the same time as the first stage of the power scheme is being put through copper smelters will be erected. These will take the whole of the power generated. Later a 43-mile electric railway will be constructed to link up with the Hudson Bay Railway, and pulp and paper mills will be erected.

Previous experience has shown that such schemes in Canada have formed the nucleus of large townships, and the same is anticipated in connection with this development.

NON-MAGNETIC CAST IRON.

A Dawson-Ferranti Patent.

The necessity for a metal having similar magnetic properties to brass and gunmetal, but in price more nearly approaching that of cast-iron, has long been felt by manufacturers of electrical plant and apparatus. Such a product is now on the market under the name of "No-Mag," an alloy which possesses not only the features of gunmetal, which are so essential in the design and construction of electrical machinery, but also has a higher specific resistance than ordinary cast-iron. "No-Mag," therefore, combines at once the essential non-magnetic properties of gunmetal and the high-resistance properties of cast-iron, and its use permits enormous advantages to be gained when magnetic hysteresis is removed and loss due to eddy-currents is reduced to a minimum, benefits which are not jointly obtainable with any other metal or alloy in use. This combination is readily observed on reference to the following figures:—

	Magnetic Permeability. Maximum	Specific Resistance. Microhms per cm. cube.
Cast-iron	330.00	95.0
"No-Mag" ...	1.03	140.0
Brass	1.00	7.5

This invention was prompted by a close consideration of the incompleteness of existing materials in this respect, especially with reference to cases wherever there is present an alternating or rotating flux. By its use in the construction of an alternator the hysteresis and eddy losses in the stator and plates are reduced to a minimum, and magnetic leakage

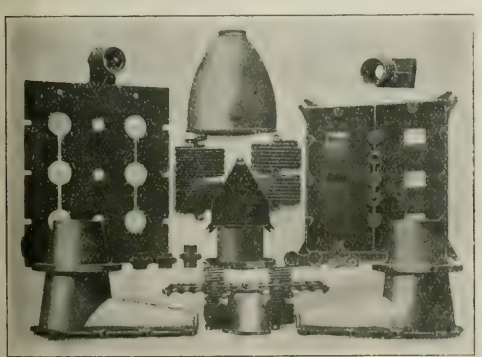


Fig. 1.—"No-Mag" Castings.

is largely removed; the same applies to the covers over the end connections. In the case of armatures or rotors of direct and alternating generators or motors if non-magnetic iron end plates are used the total flux is kept particularly confined to the armature core and magnetic leakage is again reduced to a minimum, the latter being important from the point of view of the reduction in the amount of copper which may be used.

The main characteristics of non-magnetic cast-iron are, as seen from the table already given, as follows:—

(1) *Low Magnetic Permeability.*—The figure is approximately the same as that for air, namely, unity. Repeated tests show a permeability for this material of 1.03, which, it will be observed, is practically the same as for brass, which is 1.00.

(2) *Temperature Effect on Permeability.*—"No-Mag" is slightly less permeable with increasing temperatures, as shown by the following figures actually obtained on test: At 17 deg. C., permeability 1.025, at 100 deg. C., permeability 1.020. This property of low permeability enables "No-Mag" to be used in place of brass, especially where there is danger of induced eddy currents, and its uses in this direction cover a large field.

(3) *Specific Resistance.*—"No-Mag" has a much higher specific resistance than ordinary cast-iron. Its resistance of 140 microhms per centimetre cube, as compared with 95 for ordinary cast-iron, shows an increase of 50 per cent., and suggests the use of this material in cases where increased resistance with smaller volume of metal, or similar resistance with extra metal for strength, would be an advantage, such as in resistance grids.

(4) *Resistance Temperature Coefficient.*—Between 0°C. and 100°C. this is 0.0009 per 1°C., as compared with approximately 0.0019 per 1°C. for ordinary cast-iron, the respective formulæ being: "No-Mag" iron $R_2 = R_1 (1 \times 0.0009\ t°C.)$; ordinary iron $R_2 = R_1 (1 + 0.0019\ t°C.)$.

Manufacture.—"No-Mag" can be cast with the same facilities as ordinary cast-iron, brass, and aluminium, and has the same appearance as the former, with which it also compares equally as regards strength and machining properties. In tensile and transverse strength it follows the usual cast-iron figures, but has the advantage of increased toughness and malleability, which is observed both in the transverse deflection and in its resistance to shock. This property will commend itself as being especially useful in the case of resistance grids.

The increased toughness of the new metal as compared with ordinary cast-iron is also shown by the Izod test, figures for which are as follows (compared with the same figures for two samples of ordinary cast-iron): For this purpose the test was developed on a larger bar than usual, in order to show up more clearly the differences between various grades of cast iron:—

		A.	B.
Cast-Iron	Carbon ... ... =	3.36	3.38
	Silicon ... =	1.81	1.99
	Phosphorus ... ... =	0.46	0.79
	Tensile Strength (tons per square inch) =	14.90	14.10
	Izod (foot-lb.) ... =	14.00	11.00
"*No-Mag*"	Izod (foot-lb.) ... ... =	29.00	

The Izod test bar was 20 mm. x 20 mm. x 75 mm.

The cost of "No-Mag" depends somewhat, as does that of ordinary cast-iron, on the type of casting into which it is put, but can be taken as being between 20 and 50 per cent. higher than that of grey iron. When compared in price with gunmetal, however, its use as a substitute for that material becomes obvious, its cost being about half.

To point out only a few of its fields of usefulness we might mention oil-switch covers, busbar clamps, brackets, cable boxes, sealing bells, bearing covers, separating pieces, transformer covers, &c., resistance grids for tramway or other electric vehicles, and in all cases where such grids are used, allowing either for an increased resistance to be obtained for the same weight of metal employed, or lower temperature rises for the same current-carrying capacity on account of the increase in metal which can be employed without impairing the resistance value. The new product, which is made by Messrs. Ferranti, Ltd., under a Dawson-Ferranti patent (application No. 33,290/20; U.S. patent No. 517,777/21), is also made in the form of "pig" metal, which is ready to charge directly into the cupola or other melting furnace.

THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.

Annual Dinner.

On Saturday last the fourth annual dinner of the Southern Division of the Electrical Power Engineers' Association to the members of the National Executive Council was held at the Hotel Cecil. The chairman was Mr. W. J. Oswald, A.M.I.E.E., senior vice-president, and there were present about 180 members and guests, including ladies.

After the loyal toast had been honoured, Mr. Frank Gill, president of the Institution of Electrical Engineers, speaking for the first time in that capacity, proposed the toast of "The Association." He said he had strong reasons for believing that the Association was doing very fine work. By adhering to the Whitley scheme and working on constitutional method it was benefiting the electricity supply industry, which above all was a key industry. It was also carrying on an educational campaign and was evolving a scheme of training for newcomers into the industry. He advocated discretion in appraising the qualifications of a candidate for membership—Faraday and Stephenson were not qualified engineers, and they must be careful not to exclude desirable men. In connection with training, ideals were important—the things that made character; they needed men of reliability, based on a sense of duty and a spirit of self-sacrifice.

Mr. T. A. G. Margary, junior vice-president of the Association, proposed "Kindred Associations" in a humorous speech, referring to the discovery of the Association that it had

kinship with hundreds of trade unions, including the professional associations.

Mr. J. R. B[illegible], vice-chairman, proposed "The Ladies," whom he thanked for the help they had given to the Association in its work, and the sacrifices they made on its behalf.

Mr. W. J. [illegible], chairman, proposed the toast of "The Visitors," claiming that the presence of so many distinguished guests was a striking testimony to the position that had been attained by the Association. Amongst those present were Mr. Page (one of the Electricity Commissioners), Mr. Gill (president I.E.E.), Mr. W. C. Ullman (president Associated Municipal Electrical Engineers), and Mr. Latham (president of the National Federation of Professional, Technical, Administrative and Supervisory Workers). He expressed deep appreciation of the work done and time given by the provincial members of the National Executive Council, and thanked the Electricity Commissioners for their assistance and support; they also could help the Commissioners and would stand by the industry in times of political strife. The Association, he said, was really in earnest with regard to the education and training of engineers, and he appealed for the support of the chief engineers to further that end. The full significance of the Federation of Professional Workers had not been fully realised; it would become a potent force in the social and industrial work of the country, and would exercise influence for the protection of professional men. The continued existence of the National Joint Board was more necessary to the employers than to the E.P.E.A.—if the Association concerned itself with selfish aims it would let the Board go. He appealed to employers to support the Board; to withdraw from it was a suicidal policy, and would lead to a struggle which would not benefit the industry at the present, though it would make for its ultimate good. The Association owed much to the technical Press for its kindly help and friendly criticism, which was accepted as well-meant even if they did not agree with it. Mr. Oswald also thanked the lecturers who had assisted them, and declared that the members were proud of their profession, of their work, and of their Association. On the proposal of Mr. Heavyside, the health of the chairman was drunk, with musical honours, and briefly acknowledged. Mr. W. J. Jeffery then, on behalf of the members, invited Mr. Heslop to accept a present comprising a silver tea set, a canteen of cutlery, fish servers, fruit knives, &c., and a special gift of jewellery for Mrs. Heslop (who was not present), in recognition of the great work which he had accomplished during his year of office as president—although living at Barrow, he had to travel [illegible] miles to the Council meetings, and covered [illegible] miles last year on E.P.E.A. business. Mr. Heslop had reorganised the finances of the Association and rekindled enthusiasm, and had initiated a sound policy of agreement and co-operation with the manual workers' unions, two achievements which stamped his year of office as a most notable one; and Mrs. Heslop had loyally supported him in the work in spite of his frequent absences and the resulting disorganisation of home life.

Mr. Heslop briefly responded, expressing his thanks for the presentation and for the terms in which it had been made.

Replying to the first toast, Mr. Jeffery said that the Association had found that organisation for self-protection brought with it new responsibilities—(1) To the public in general and the electricity supply industry in particular; the E.P.E.A. had been the bulwark which enabled supply to be maintained without interruption for some years. (2) To the employers; the Association meant to see that the status of engineers was raised, and this meant raising the standard of training of new men. (3) To themselves; engineers did not fully realise [illegible] in the country—the profession was of such value to the nation as that of electrical engineer. The Royal Charter obtained by the I.E.E. was a most important step towards public recognition. (4) To the [illegible] they must educate them to a proper appreciation of [illegible] to the world at large. "Ca'Canny" was the result of ignorance, and the staff unions could remedy that condition.

Major F. H. Masters (editor *The Electrician*) responded on behalf of the visitors, suggesting that if the Press was the fourth estate of the realm, electricity supply was the fifth, and that it was the duty of the Press and of the Association to urge on the utilisation of electricity by every possible means.

Mr. R. R. Telford (of the National Executive Council) expressed the N.E.C.'s appreciation of the honour done to them, but held that it was really the dinner of the Association, not merely of the Southern Division.

Mrs. Oswald, replying for the ladies, expressed the view that there were not enough social functions in connection with the Association; such occasions would arouse the interest of the ladies, who had to spend much time alone owing to the calls of the Association's work.

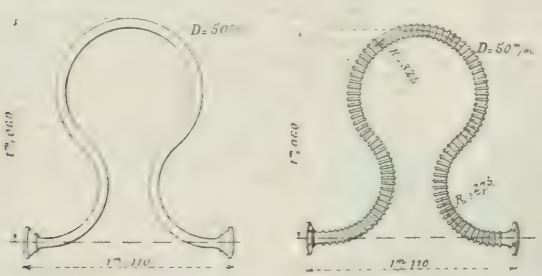
Mr. G. Latham (president Federation of Professional Workers) replying on behalf of the kindred associations, said the aim of the Federation was to advance the interests of the great body of "black-coated workers," and commended the courage and ability shown by the E.P.E.A. in pursuing its policy.

Finally, the chairman expressed deep indebtedness of the gathering to the Dinner Committee for the excellent arrangements that had been made, with special reference to the work of Mr. P. G. Hieatt, hon. secretary of the Southern Division.

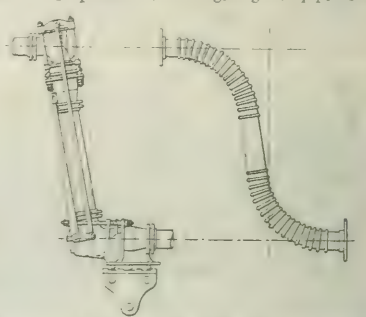
A musical programme was interspersed with the toasts, and the function was in every respect successful and thoroughly enjoyable.

CORRUGATED STEEL PIPES AND TUBES FOR FLUIDS AT HIGH PRESSURES.

For some time past corrugated steel tubes have been largely used instead of expansion joints for protecting pipe-lines, not only from expansion and contraction, but also from vibration. The corrugated pipe differs from the ordinary pipe of uniform cross section, as shown in figs. 1 and 2. The corrugations or waves occur at regular intervals, varying according to the diameter of the pipe, its thickness, and the use to which it is put. The inner side of the corrugations is tangential to an ideal cylinder of the same diameter as that of the original tube. The pipes are manufactured by taking an extra-mild steel smooth pipe and making the corrugations with the metal in the hot state. The operation of corrugating the pipe forms,



Figs. 1 and 2.—Smooth and Corrugated Expansion Bends.



Figs. 3 and 4.—Expansion Joint and Corrugated Coupling Pipe.

at the same time, a selective test for the smooth pipe, since a pipe of inferior quality could not stand the work of deformation necessary.

Among the advantages of these corrugated pipes may be mentioned: (*a*) greater elasticity in the longitudinal direction; (*b*) greater resistance to internal or external pressures; (*c*) the ease with which the pipes may be bent through any angle.

Corrugated pipes can be used for obtaining a flexible joint in steam and high-pressure gas lines subjected to alternating stresses of tension and compression, due to temperature variations or other causes; and as shock or vibration absorbers.

According to the *Génie Civil*, from which these particulars are derived, in the method of manufacture adopted by a large French firm, any diminution in wall-thickness of the pipe is automatically excluded. To bend the pipes they are first of all raised to red heat without filling with sand, &c., after which the portion beyond the bend is sprayed with a fine jet of water to make it undeformable. The pipe is then bent by compression on a mandrel. Corrugated pipes may be bent and re-bent in the cold state through a small radius without cracking the metal.

Figs. 3 and 4 show the application of a corrugated tube to the compensation of a steam pipe-line, the left-hand illustration showing the old form of compensator with stuffing box and

hinges, and the right-hand figure the simple S-bend of corrugated piping which takes its place. The trouble with the previous forms of compensator was that they were liable to stick, due to expansion, and were easily scored by grains of sand or other foreign substances, thus giving rise to leaks. In the corrugated pipe compensator all fatiguing of the metal is reduced to a minimum, and accidents are practically excluded. Where used as water and flame tubes in boilers, corrugated tubes take up the variations in contraction and expansion, and thus save fatigue in the tube-plates.

E. S. H.

LEGAL.

Charge of Abstracting Electricity from Main.

At Burnley, on October 25th, George Gregson, a tradesman of Berkeley Street, pleaded not guilty to abstracting electricity from a main. He was allowed a supply for power purposes, but not for lighting. On the meter being examined it was found that a piece of wire had been connected between the fuse-box and an electric light in the shop. Defendant said he thought the current was being registered. Fined £5 and costs.

An Electricity Supply Company and an Agreement.

Counsel were heard in the Court of Session, Edinburgh, last week in an application by Duncan's Electricity Supply Co., Ltd., 1, Golden Square, Aberdeen, in accordance with Section I. (1) (a) of the Courts (Emergency Powers) Act of 1919. The company had entered into an annual agreement with the Provost, Magistrates, and Councillors of the Burgh of Ballater for the supply of electricity, and this agreement it was now sought to suspend or annul, owing to the alteration of trade conditions due to the war.

The applicants, a private company, with capital of £25,000 in £1 shares, became undertakers under the Ballater Electric Lighting Order of 1914, which was secured in agreement with the respondents by Mr. James Duncan, of Tillycorthie. The company commenced to generate electricity in 1914, but during the period from 1914 to 1917 the work was retarded owing to the war conditions of lighting restriction and the high cost of production. Similar conditions prevailed the following year, and in October, 1918, the company told the Town Clerk that it proposed to increase the lighting rate from 6d. to 8d. a unit and the power rate from 2d. to 3d. The Town Council acquiesced in the increases and these rates still remained. It was explained that the works, although economically managed and efficient, had not allowed the company ever to pay a dividend, to set aside a sum to meet depreciation, or to pay a salary to its manager or its supervising engineer. It had a debt for repairs for £1,016. At the present rates charged the expenditure on the undertaking would, in any normal year, exceed the revenue by £477. This excess was entirely due to the alteration of trade conditions through the war. In these circumstances the company in 1922 applied to the Ministry of Transport for an Order to increase the maximum prices allowed by the existing Order to 1s. for lighting and 5d. for power. The annual revenue would then have exceeded the expenditure by only £54. The application was opposed by the Town Council, who contended that the minute of agreement had not expired, that they believed that Mr. Duncan did not intend to make a profit from the undertaking, and that they were paying rates which met the increased cost of production. The company asked the division to suspend or annul the agreement.

The division held that the application was relevant, and ordered an inquiry before one of the judges. The question of expenses was reserved.

Charges Arising out of a Scottish Colliery Explosion.

As a sequel of the explosion at Viewpark Colliery, Uddingston, on April 11th last, when two men were killed, and the subsequent inquiry under the Fatal Accidents Act, the Crown instituted proceedings against Thomas Weir, Bothwell, and Andrew Crowe, Bothwell, the manager and under manager respectively of No. 1 pit, Viewpark Colliery, and George Thom, Uddingston, the chief electrician at the colliery. The manager and under manager were charged with five offences under the Coal Mines Act, 1911—allegations being made that they failed to observe certain regulations concerning ventilation and the use of electricity under conditions which rendered it dangerous. The electrician was charged with having failed to have the electrical apparatus in the splint coal seam constructed, installed, protected, worked, and maintained so as to prevent danger so far as reasonably practicable, in that he failed to have in position three stud bolts for holding down securely a coal-cutting machine cover and seven stud bolts in a switch casing. The three accused were defended by Mr. Graham Robertson, K.C., while Mr. Wm. Thomson, Procurator-Fiscal, had charge of the case for the Crown.

The case against George Thom was called first.

Joseph Lynch, Bridgeton, Glasgow, stated that on the night of April 10th-11th he was in charge of a coal-cutting machine along with Bernard Finnigan. They had three electric lamps. He was familiar with the machine, and on that night it worked perfectly. [illegible] the switch cover of the machine [illegible] down by four bolts, but these were missing. There were holes in the covers for studs, one of which was out, and though the hole the stud should be [illegible]. He had complained to the machine on April 7th, and it was repaired by the electrical staff. Witness [illegible] the machine on April 9th, [illegible] heated up, and it was again reported for repair. The defect was remedied, and on the 10th it worked well until the explosion next morning at 7.30. [illegible] neighbour turned on the switch for the last time.

In cross-examination, witness [illegible] rule that all machinemen must carry oil safety lamps, and no instructions came to him in January to that effect. He never saw a machineman with an oil safety lamp during all his time at the pit. He could not definitely say that all the four holding-bolts of the cover were missing. He denied that when the machine was repaired the bolts were in position, and that he or Finnigan, or both of them, removed the bolts in order to lift the cover.

Bernard Finnigan corroborated the previous witness. He said that two bolts were missing, and through a hole caused by the absence of a stud he could sometimes see a flash when the switch was turned on. He, too, admitted that he had never asked for oil safety lamps.

Asked by counsel if the accident which occurred on the morning of April 11th was not just an ignition rather than an explosion, the witness replied that he was thrown back by the force of it but not knocked down. He denied having interfered with the bolts of the machine during the night.

George Chalmers, assistant electrician, Bothwell, spoke to having carried out repairs on the machine with a fellow electrician on each occasion complained of by the witness Lynch. Mr. Thom had the matter reported to him, and on the day previous to the accident he accompanied witness to the machine and saw the defect put right. He was positive that all the bolts and studs of the switch cover were replaced before the machine left their hands. There might have been a few bolts missing from the oil-box cover, but that was immaterial. On April 10th, when Mr. Thom was at the machine, he took a spanner from witness in order to tighten the switch cover bolts. After the accident three of these bolts were missing, and also some of the studs.

In cross-examination, the witness said it was his opinion that the bolts and studs could not have come out owing to the vibration of the machine. They must have been interfered with, and there were several reasons for taking off the cover. The operators might have wished to clean the switch fingers for instance.

Wm. M'Laughlin, assistant electrician, who partnered Chalmers in repairing the machine, gave corroborative evidence

The accused in the witness-box maintained that the machine was fully provided with all the necessary studs and bolts.

His Lordship, without calling upon counsel for the defence, said he was prepared to give his decision at once. He thought it was quite proper to bring such a case because matters of that sort should be fully investigated in the interests of the safety of the miners. He had, however, simply to decide between two sets of witnesses—the two men who were in charge of the machine and the three electricians. Neither set was disinterested. Both had an interest in acquitting themselves of any responsibility for the explosion, and it occurred to him while he was hearing the evidence that the machinemen might as well have been in the dock as the present accused. Taking the evidence as between the two sets of men, he was bound to say that he preferred that of the electricians. He was very favourably impressed with the way they gave their evidence. There was no attempt to suggest that everything was perfect, as there was an admission that bolts were wanting in places where they were unessential. He thought the men, as practical electricians, had devoted all their attention to seeing that the essential parts were kept in repair. His view of the evidence was that the accused was entitled to a verdict of "Not guilty" and not merely one of "Not proven."

The trial of the manager and under manager was thereafter adjourned till November 8th.

British Thomson-Houston Co., Ltd., v. B.T.T. Electric Lamp & Accessories Co.

In the Chancery Division, on Tuesday, the B.T.-H. Co., Ltd., were plaintiffs in a motion for judgment in default of defence against Blanche Clara Taylor, William Taylor, and the B.T.T. Electric Lamp & Accessories Co., of Crutched Friars, for an injunction restraining infringements of letters patent for improvements in evacuated vitreous containers.

Mr. Trevor Watson (for the plaintiffs) said the defendant firm had entered an appearance, and had pleaded that the only partner was Mrs. Taylor, but the plaintiffs desired separate judgments against the firm in the ordinary form. There had been separate infringements, and there should be separate judgments.

Mr. Justice Romer: Yes, as to damages, but [illegible] fringement.

Mr. Watson said they wanted to take action against separate members of the firm, if there were any.

His Lordship said he would give judgment for the plaintiffs by consent against Mr. Taylor, but he would give no relief as against Mrs. Taylor.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 288, High Holborn, London, W.C.1.

27,318. "Spring contacts for electric switches, fuse-holders, &c." A. C. Smith. October 14th.

27,328. "Wireless receiving sets." C. B. Kersting. October 14th.

27,351. "Alternating current electromotors." L. Segal. October 14th.

27,961. "Vacuum tubes." E. Y. Robinson. October 16th.

27,962. "Thermionic devices." E. Y. Robinson. October 16th.

27,977. "Crystal detectors for wireless telegraphy." A. Adams, W. G. Hopkins, & H. L. Jackson. October 16th.

27,985. "Electric radiators." A. L. W. Maseyk. October 16th.

28,002. "Intervalve couplings for wireless installations." R. Heather, N. Miles, and Wireless Instrument Manufacturing Co. October 16th.

28,010. "Electric signs." P. Freedman. October 16th.

28,014. "Radio-telephonic receivers." A. E. Alexander (Cory & Son, Inc.). October 16th.

28,025. "Electrolytic rectifiers." M. A. Codd. October 16th.

28,037. "Electric lighting devices." J. P. Haworth. October 16th.

28,042. "Electric switches and plug couplings." G. Marr. October 16th

28,054. "Electric impulse distributing systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). October 16th.

28,062. "Fittings for electric lamps." J. H. Collings and M. J. Railing. October 16th.

28,077. "Telautography." H. G. Bartholomew and M. L. D. McFarlane. October 16th.

28,078. "Telautography." H. G. Bartholomew and M. L. D. McFarlane. October 16th.

28,083. "Recorder relay." W. P. D. Van der Knapp. October 16th. (Holland, December 16th, 1921.)

28,086. "Head attachment gear for telephone receivers." British Thomson-Houston Co., Ltd. October 16th.

28,092. "Electric light globe attachments." E. W. Hutchings. October 16th. (New Zealand, October 18th, 1921.)

28,098. "Electric snap-action switches." Ward Leonard Electric Co. October 16th. (United States, July 29th, 1921.)

28,099. "Controlers for electric circuits." Ward Leonard Electric Co. October 16th. (United States, July 29th, 1921.)

28,100. "Photo-electric device." T. W. Case. October 16th.

28,109. "Electrically-heated cooking devices." W. J. Mellersh-Jackson & J. F. Newsam. October 16th.

28,115. "Relays." A. L. Rawlings. October 16th.

28,124. "Synchronisation of clocks by wireless waves." A. E. J. Ball and I. H. Parsons. October 17th.

28,152. "Electric heating device for incubators, &c." G. W. Phipps. October 17th.

28,154. "Fitting for use with electric light terminal to produce a light of low candle power." J. Bradley. October 17th.

28,155. "Electric switchgear." Brook, Hirst & Co., Ltd., and J. A. Hirst. October 17th.

28,165. "Electric advertisement sign." R. Osborne. October 17th.

28,169. "Sparking plugs." H. C. Brown. October 17th.

28,189. "Apparatus for production of changeable electro-luminous effects." L. C. Pla. October 17th.

28,190. "Electric interrupters." A. B. Pales. October 17th. (Spain, June 13th.)

28,193. "Electric riveting." G. B. Ellis (T. E. Murray). October 17th.

28,209. "Controllers for electric control systems." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. October 17th.

28,223. "Electric lamps." A. Smith and T. G. Thomson. October 17th.

28,232. "Burglar alarms." A. O. Ward. October 17th.

28,235. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). October 17th.

28,238. "Electric plug socket." H. Baron (F. Allendorff). October 17th.

28,242. "Apparatus for electrolysis of metals." A. Cremer. October 17th. (Belgium, October 18th, 1921.)

28,252. "Devices for protection of windings of high-voltage telephonic apparatus." W. J. Rickets. October 18th.

28,277. "Electrically-operated lock for doors, windows, &c." W. J. H. Walter. October 18th.

28,281. "Earthing of electrical apparatus." F. W. Rowley and A. W. Williams. October 18th.

28,286. "Electric conductors." E. L. Lilev. October 18th.

28,322. "Vacuum tubes, &c." E. Y. Robinson. October 18th.

28,323. "Thermionic devices." E. Y. Robinson. October 18th.

28,324. "Antenna systems for wireless communications." E. Y. Robinson. October 18th.

28,325. "Thermionic devices." E. Y. Robinson. October 18th.

28,326. "Thermionic devices." E. Y. Robinson. October 18th.

28,336. "Electrolytic anti-corrosion systems." A. S. Gush. October 18th.

28,343. "Wireless current rectifier." L. Lochner. October 18th.

28,350. "Electric incandescent lamps." General Electric Co., Ltd., and C. J. Smithells. October 18th.

28,351. "Electric incandescent lamps." General Electric Co., Ltd. October 18th. (Germany, October 19th, 1921.)

28,367. "Variometers." United Manufacturers & Agency, Ltd. October 18th.

28,380. "Electric plug and socket unions for lamps." A. L. Davis. October 18th.

28,389. "Aircraft lamps." A. Davis. October 18th.

28,393. "Relays for reproduction of sound, &c." F. W. Baynes. October 19th.

28,407. "Sparking plugs." T. Foster and G. Thomlinson. October 19th.

28,422. "Electric kettle." C. de C. Matulich. October 19th.

28,423. "Crystal rectifiers for wireless telegraphy." L. B. Miller. October 19th.

28,432. "Control device for wireless telegraphy, &c." A. J. Bull. October 19th.

28,444. "Radio telephonic, &c., systems." A. J. Hurst and H. J. Lucas. October 19th.

28,449. "Steam turbines." English Electric Co., Ltd. October 19th.

28,451. "Apparatus for electrical transmission of power." K. R. D. Shaw. October 19th.

28,473. "Electric ignition, &c., apparatus for internal-combustion engines." G. Unterberg. October 19th. (Germany, January 12th.)

28,474. "Pressure regulator for ignition apparatus." G. Unterberg. October 19th. (Germany, December 19th, 1921.)

28,488. "Electric control systems." British Thomson-Houston Co., Ltd., R. D. Given, and E. G. James. October 19th.

28,493. "Electric relays." W. H. Anthorpe and Cambridge & Paul Instrument Co. Ltd. October 19th.

28,497. "Electric switches." Akt. Ges. Brown, Boveri et Cie. October 19th. (Switzerland, November 3rd, 1921.)

28,499. "Electromagnetic separation or concentration of minerals." W. M. Mordey. October 19th.

28,504. "Telephone system." Automatic Telephone Manufacturing Co., Ltd. October 19th. (United States, February 4th.)

28,515. "Commutators for motor vehicles." E. L. Oatars. October 20th.

28,520. "Luminous signs." A. Amos and W. Stephen. October 20th.

28,521. "Apparatus for testing coil ignition systems of internal-combustion engines." H. E. Coston and E. A. Miller. October 20th.

28,533. "Means for controlling electrically-operated mechanisms, &c." F. Whipp and Whipp & Bourne, Ltd. October 20th.

28,553. "Grooved tramway rails, &c." J. P. Barker. October 20th.

28,556. "Gas and electricity meters, &c." P. F. E. Major, G. H. Miles, and C. Coates-Smith. October 20th.

28,572. "Magneto ignition for internal-combustion engines." D. Dunnett, Research Association of British Motor and Allied Manufacturers, and H. S. Rowell. October 20th.

28,574. "Circuit breaker for electric installations." L. Jublin. October 20th. (France, November 8th, 1921.)

28,590. "Diaphragm for telephone receivers, &c." H. J. Bailey. October 20th.

28,592. "Measurement of X-radiations." C. E. S. Phillips. October 20th.

28,604. "Manufacture of telephone cables." Johnson & Phillips, Ltd., and C. F. Street. October 20th.

28,624. "Alternating-current commutator machines and methods of starting them." F. Creedy. October 21st.

28,663. "Electric conductor." H. A. O'Neil. October 21st.

28,669. "Electric cut-out." W. H. Illingworth. October 21st.

28,670. "Apparatus involving the use of a number of electric cutouts." W. H. Illingworth. October 21st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

9,536. "Control systems for direct-current electric motors." J. A. M. De l'Orvelet. March 31st, 1921. (186,640.)

15,310. "Electrical means for transmitting and reproducing sound." A. F. Sykes. June 2nd, 1921. (Addition to 160,223.) (186,698.)

16,294. "Device for testing high-tension sparking plugs, magnetos, and coils." J. Jennison and F. Greenhalgh. September 26th, 1921. (186,664.)

17,106. "Photographic recording and electric signals." J. Hettinger and C. A. Vandervell & Co., Ltd. June 22nd, 1921. (186,665.)

17,361. "Means for preparing, transmitting, and recording messages, particularly applicable to telegraphy." A. C. Baronio. June 24th, 1921. (186,670.)

17,323. "Diaphragms for sound-recording and sound-reproducing instruments." W. E. Clifton and Cliftophone, Ltd. June 27th, 1921. (Cognate application, 24,324/21.) (186,672.)

17,324. "Diaphragms for sound-recording and sound-reproducing instruments." W. E. Clifton and Cliftophone, Ltd. June 27th, 1921. (Cognate application, 28,347/21.) (186,673.)

17,536. "Electric heaters." L. M. Waterhouse and F. F. D. Davidson. June 28th, 1921. (186,675.)

17,708. "Electrical distributing apparatus for explosive motors." V. Paquit. August 17th, 1920.) (168,041.)

17,748. "Electric apparatus for sending out the time." M. P. Favre-Bulle. June 29th, 1921. (186,681.)

17,752. "Method of and apparatus for producing optical signals of a definite colour." Siemens & Halske Akt. Ges. September 18th, 1920. (169,430.)

17,820. "Dynamo-electric machines." A. H. Midgley. June 30th, 1921. (186,684.)

17,895. "Ironclad electrical switches." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. July 1st, 1921. (186,689.)

17,959. "Telephone switch-banks." Creed & Co., Ltd., and T. Lenaghan. July 1st, 1921. (186,694.)

18,032. "Electrically-heated clothing." A. Negromanti. December 18th, 1920. (173,205.)

18,082. "Electrical protective apparatus." A. H. Railing, C. C. Garrard, and W. Wilson. July 4th, 1921. (186,699.)

18,108. "Electric supply services for dwelling-houses." E. S. Russell. July 4th, 1921. (186,703.)

18,122. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 3rd, 1920. (186,796.)

18,156. "Changeable advertising device." G. J. Motter. July 5th, 1921. (186,706.)

18,295. "Telephone circuits." Siemens Bros. & Co., Ltd., and D. A. Christian. July 6th, 1921. (186,713.)

18,964. "Electric switchgear." W. A. Coates, G. E. Gittins, D. R. Davies, and Metropolitan-Vickers Electrical Co., Ltd. July 13th, 1921. (186,733.)

18,961. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 11th, 1921. (174,035.)

20,384. "Telephone systems." Western Electric Co., Ltd. September 25th, 1920. (169,684.)

20,545. "Electrically-operated warning horns." R. W. Maudsley and Standard Motor Co., Ltd. August 2nd, 1921. (186,738.)

21,114. "Link boxes for electrical mains." F. Thursfield and G. P. Cosway. August 9th, 1921. (186,768.)

21,663. "Electric motors." T. Yamamoto and M. Kawarada. December 7th, 1920. (172,603.)

22,026. "Miners' electric lamps." H. Wade (Concordia Elektrizitäts Akt. Ges.). August 19th, 1921. (186,781.)

22,559. "Electric burglar-alarm circuits." H. Eisler. August 25th, 1921. (186,787.)

22,680. "Electro-motor controller." W. Fairweather (Singer Manufacturing Co.). August 26th, 1921. (186,789.)

22,704. "Hand electric battery lamp." F. A. Jennings. August 26th, 1921. (186,790.)

23,144. "Electric-current limiting devices." British Thomson-Houston Co., Ltd. (General Electric Co.). August 31st, 1921. (186,797.)

23,320. "Electric sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (186,798.)

23,419. "Telephonic systems." E. A. Graham. September 2nd, 1921. (Addition to 7,331/14.) (186,802.)

23,518. "Terminal blocks for electric conductors." A. Kirk and R. C. Milliken. September 3rd, 1921. (186,807.)

24,847. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 1st, 1920. (169,698.)

25,428. "Electrical connectors." Credenda Conduits Co., Ltd., and F. F. D. Davidson. September 26th, 1921. (186,826.)

26,561. "Incandescent electric lamps and fans." H. H. Berry. October 7th, 1921. (186,835.)

27,057. "Casings for transformers and other electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). October 12th, 1921. (186,839.)

28,568. "Impulsive driving mechanisms for ignition magnetos." E. A. Watson and M.L. Magneto Syndicate, Ltd. October 27th, 1921. (186,848.)

29,752. "Electric fuse carriers and the like." W. T. Henley's Telegraph Works Co., Ltd., and E. Moor. November 8th, 1921. (186,852.)

30,159. "Electrically-heated coffee-making machine." H. Graetz and F. Graetz. November 11th, 1921. (186,853.)

31,517. "Electric incandescent lamps." K. Krausser. December 20th, 1920. (173,218.)

1922.

1,792. "Electron-discharge devices." British Thomson-Houston Co., Ltd. August 29th, 1921. (185,384.)

4,119. "Electrical ignition gear, particularly, though not solely, suited to two-stroke cycle engines." L. H. Hounsfield. February 13th, 1922. (186,870.)

17,033. "Telephone systems." Siemens & Halske Akt. Ges. January 21st, 1921. (Divided application on 174,805.) (186,916.)

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THE PRESIDENTIAL ADDRESS.

THE Institution is to be congratulated on the remarkable address with which Mr. Frank Gill opened the new session. It was in the main a masterly review of the art of electrical communication, with special reference to long-distance telephony, as practised in the United States, and as it might conceivably be practised in Europe. The figures which he quoted regarding the actual development of telephony in America were startling to people accustomed only to our modest statistics; with one telephone to every 7.7 persons, 10,000 companies at work, over 14,000,000 telephone stations installed, and the invested capital of the Bell-owned companies alone some £346,000,000, it would appear as though the saturation point were not far off in the United States. Yet in Los Angeles, Mr. B. Welbourn said last Monday, there is one telephone to every four people!

A large part of Mr. Gill's address was devoted to the highly technical aspect of long-distance telephony, explaining the effect of recent developments upon long-distance communication, and will, we think, be regarded as a classic exposition in simple language of what must be admitted to be a somewhat abstruse subject. How great a debt the telephone community owes to Mr. Oliver Heaviside was clearly indicated; as long ago as 1887 Mr. Heaviside showed that "loading" a telephone line with inductance, contrary to the prevailing view, would have a beneficial effect on the transmission of speech, and to that discovery is due the possibility of holding converse over such a distance as that between New York and San Francisco—2,800 miles—or through submarine telephone cables from Great Britain to various Continental countries. This was rightly regarded as a great step in advance, before the war; but one of the results of the war of intellect and research which accompanied the war of blood and fire was the extraordinary development of the thermionic valve, and its application to the solution of telephonic problems, first to that of enormously amplifying infinitesimal variations of current in radio-telephony, and later to that of relaying telephonic currents in cables and overhead lines. Telephone repeaters had been known for many years, but their efficiency bore no comparison to that of the thermionic repeater, which is effecting a revolution in telephony by wire over long distances. It is a most remarkable property of the thermionic repeater that it retransmits voice currents without appreciable distortion or loss of intelligibility—as Mr. Gill remarked, no fewer than 23 repeaters have been used in tandem on regular service. So highly have these devices been perfected, that their characteristics are as well-defined as those of incandescent lamps, and the performance of one is identical with that of another of the same type. One result of the advances that have been made in this direction is that long overhead lines need not now be loaded in order to reduce attenuation—it suffices to insert repeaters at suitable intervals.

Remarkable results, too, have been attained in the use of the "carrier" system of telephony. This depends upon the principle of resonance. Several high-frequency currents are sent along the same circuit, each modulated by voice currents independently of the rest, and at the receiving end the various frequencies are sorted out and the carrier currents eliminated. By such means four wires between Chicago and Omaha (450 miles) carry 27 effective circuits. In the United States already there are over 15,000 miles of "carrier" routes and 95,000 miles of "carrier" channel

But all these refinements are subject to one essential condition—that the lines to which they are applied shall be suitable in all respects and at all times for the application of the repeating and multiplying devices above mentioned; and that involves as an imperative necessity *unity of control*. This, in fact, is the keynote of Mr. Gill's address. After explaining how the indispensable unity of control obtains in the United States, in spite of the existence of 10,000 telephone companies, he shows that in Europe the conditions are at present fundamentally different—the very antithesis of unity. Nevertheless facility of intercommunication between town and town throughout the European area is of immense importance. No fewer than 4,000,000 long-distance calls are originated at New York per ahnum; the United States has found the telephone indispensable to the speedy transaction of commercial affairs—and Mr. Gill asks: Why should not Europe share that convenience?

Thus he arrives at the climax of his thesis—the astounding proposition that Europe should, in effect, be treated as one country for telephonic purposes; that either a single company should handle all the long-distance traffic, or the various Governments should form a Commission for the same purpose. He is even ready to submit a plan for the consideration of the authorities concerned, by which the desired result could be brought about.

Seldom has so bold a proposition been put forward; whatever the outcome, the idea is certainly one which reflects credit on the author, and is well worthy of enunciation from the presidential chair of the Institution. We trust that Mr. Gill's additional suggestion—that a conference be held of all the European telephone authorities—will be carried into effect. Such a conference would find ample material for consideration within the four corners of the presidential address alone; and even if the existing conditions are unfavourable to the immediate realisation of the scheme of unification, at least it will be possible to prepare the ground for such a scheme to be carried out when circumstances are more propitious. As Mr. Gill suggests, there is no better way of increasing goodwill amongst nations than by increasing the facilities for intercommunication between them; and goodwill amongst nations is necessary to "peace on earth."

Canvassers and Canvassing.

At a recent Salesmanship Conference a supply engineer indicated that he would welcome some advice as to how to *train* salesmen. His thought, or at least the root of the thought, has probably been in the mind of a good many engineers and managers of supply undertakings. We do not think we are far wrong in saying that the canvassing staffs of electricity supply undertakings are as a whole somewhat disappointing. This may be less their own fault than that of those who engage them and allocate their duties. This side of an undertaking's energies seems curiously to have received a minimum of attention—despite the obvious fact that it is just this department that forms the main channel for incoming business. The individual status of canvassers is often placed quite low. So, although "training" is a factor, and an important factor, there is another point to be thought of first, namely, what position such a representative is to hold in the undertaking, and by position we mean status and pay. Unless he holds a dignified status and has good pay, how can it be expected that he can impress the public, how can he even get a proper hearing? He must have education, he must be able to live well, dress well, feed well. He must be in manners and appearance someone with whom anyone would be pleased to talk. All this is obvious. But you cannot get it for a starvation wage. The post must be one worth having, and worth stretching every sinew to keep. Only this way can you attract the right material and keep it. And only in this way can you hope anything to respond properly to training. Of course, in some undertakings this is realised—but not by all. We all know that

> "The man who whispers down a well
> About the goods he has to sell,
> Will never gain the golden dollars
> Like him who climbs a tree and hollers."

—but to "climb" and "holler" need confidence, dash, gusto and good feeding, which involve in the last resort good salary.

But it is not only the status of the canvasser that requires consideration, the whole canvassing system of some electricity undertakings seems to us to call for a complete overhaul. There are undertakings which are praised for the modern spirit of enterprise that characterises their latter-day operations which never seem to dream of approaching potential consumers until they have received some form of communication or application from them. This is not only bad business, but it is actually playing the gas company's game, for the consumer adds this, that and the other new facility that the gas authority is not slow in bringing to his attention; he thus becomes more confirmed in his use of gas and less likely to turn over to electricity, when the electricity authority overcomes its bashfulness or want of enterprise and asks him to become a consumer. Posters, electricity notices on rate forms, exhibitions, &c., are all very good, but the value of the personal intelligent canvass and follow-up method is inestimable.

Not very long ago two electrical men interested in pushing development in a certain district were offering explanations to each other concerning their failure to utilise electricity in their private residences. One said: "I want it and can't get it because the mains are not laid down my thoroughfare, and the authority has never shown any desire to have me as a consumer"; the other excused himself on the ground of cost, as shown by high installation estimates received during the high-cost period. The cheap unit is of paramount importance, but a progressive mains laying and canvassing policy and low installation costs will be equally effective in adding to the number of consumers. Of what avail is it to offer an electric stove or any other article of the domestic class on easy payment terms if the supply itself is not available?

Electrical Apparatus for Electrical Men.

The restaurant proprietor is said to take his meals at any establishment but his own, and it has long been a matter of regret that many electrical men have had this principle forcibly applied to their own circumstances. Nothing, surely, can be more humiliating or detrimental to an electrical salesman, and the industry he represents, than a confession that he himself has no personal acquaintance with the appliances he is endeavouring to sell. That this frequently happens, however, is evident from the number of exhortations recently made to electrical salesmen to use electrical appliances in their own homes, and in this way gain valuable experience and "selling points." The salesmen employed by the gas industry may at times be inexact in their statements regarding electricity, but it is safe to assume that they all possess the one virtue of an intimate, personal acquaintance with their cookers, fires, and other appliances. Thus should it be with electricity, and thus it would be were it not for a number of really serious obstacles.

As in one of the previously-mentioned cases, salesmen are often compelled by force of circumstances to occupy houses far from an electricity main, and connection can be secured only at enormous expense, making it an impracticable "proposition." Cables are far more costly than gas pipes, and this expense cannot always be borne wholly by the supply undertaking. Then, again, salesmen's employers would probably regard with disfavour any suggestion that *they* should defray the cost of installation. The question of electricity tariffs next arises. It cannot be denied that in many districts the price charged for energy precludes any thought of electrical cooking; but in such districts efforts should be directed

to the reduction of charges rather than the sale of large electrical appliances.

A third important factor affecting the question adversely is the present level of prices of large appliances. As we have pointed out before, a reduction cannot be expected until sales have increased to a very large extent. Incidentally, a reduction in the price of energy would naturally follow.

Thus we return to our original point—that salesmen must possess everything necessary to further the business.

A step in the right direction has been made by the Hotpoint and Falkirk Companies in offering to salesmen and others heating and cooking appliances at a specially low price, with the option of spreading the payment over a year.

We hope that success will attend the scheme; indeed, we think success certain, for everybody connected with the electrical industry knows the value of electricity.

Large Electric Cookers and Heaters.

Whilst Mr. Howell's lecture before the Electrical Development Association on November 3rd in relation to the selling of large electric cookers and heaters was probably the best, from the salesmanship point of view, of the series so far, the discussion was somewhat disappointing. Several speakers imagined, apparently, that the subject was domestic cooking and heating, and one gentleman gave some quite interesting information on the subject of domestic hot water supply. It was all valuable in the right place, and Mr. Gillott was quite justified in his mild complaint that the discussion had wandered too far away from the subject. On the whole, however, the lecture and discussion should go a long way in the education of those who have the selling of large apparatus in their hands. There was an atmosphere of real salesmanship about it all, apart from the two or three instances mentioned, and specially interesting were the remarks of Mr. Robinson, of Hackney, who is going to follow the example of another undertaking and carry the electric cooking campaign to the point of hitching all the coffee stalls in Hackney to lamp-posts to give them a supply of current for their cooking operations. Undoubtedly the large cooking and heating apparatus offers a different problem from that of the domestic, and in a sense it should be a somewhat easier proposition, for commercial results can be shown. The inherent conservatism of the chef, in this case, appears to be a quite substantial stumbling block, and the points brought out in this connection in the discussion merit close attention. They bear on the importance of studying the psychology of the customer, which has been already mentioned, but in this case it comes to a study of the psychology of the operator. So far as these lectures and discussions have gone, however, there has been a lack of information of actual results. That there are abundant figures on the subject we know, and although the contractors and their salesmen can go to the E.D.A. or the manufacturers and get data, that is not quite the same thing as making public sufficient in the way of actual results to attract the attention of prospective users who will have no other opportunity of getting this information than through the medium of the reports of the lectures. There is little doubt that the general public is not kept sufficiently in touch with either the possibilities or the actualities, and we repeat what we have said on previous occasions that the supply authorities will have to take a much more active hand in the game than is the case in many parts at present. A correspondent who lives in an area where electricity is available, informs us that he has never yet received one piece of literature as to any class of apparatus, either lighting or otherwise, from the supply authority. That, we fear, is an attitude adopted in too many cases, and it is a phase of commercial development which the E.D.A. might well take in hand.

The closing paragraph above reminds us that even electrical salesmen themselves are prevented from gaining the benefits of electricity for the reasons given, and other considerations.

Commercial Arbitration.

We have recently raised the question of arbitration in international commercial disputes of a private nature, with special reference to the position assumed in the matter in important circles in the United States, and to the constitution of such a court of arbitration in connection with the International Chamber of Commerce in Paris. No doubt individual action of this kind can do much to promote the friendly settlement of contract disagreements between subjects of different countries, but a general scheme supported by Governments would be likely to bring about a considerably improved state of affairs in this important commercial direction. This particular aim has engaged the attention of the Economic Committee of the Council of the League of Nations, who recently presented a report on the matter to the Council, which we find discussed in the *Board of Trade Journal* of October 26th.

The Economic Committee has proposed that State members of the League should adopt measures to promote the use and secure the practical efficiency of clauses in private commercial contracts providing for arbitration. Having regard to the juridical difficulties which stand in the way of a general recognition of the arbitration clause, the Committee has found it necessary to consult legal and commercial experts before arriving at any definite proposals for dealing with the problem. These experts, who represented various countries, met in London in July, and their recommendations have been endorsed by the Economic Committee. These recommendations are:—

"If two parties of different nationalities agree to refer disputes that may arise between them in a named country, an action brought by either party in any country other than that agreed upon as the place for arbitration ought to be stayed by the court of the country in which it is brought, provided that (*a*) the court is satisfied that the other party is and has been ready and willing to do all things necessary to carry out the arbitration agreed upon, and (*b*) that the same court is satisfied, either by a certificate of the court of the country in which it has been agreed to arbitrate, or by diplomatic methods, that the law of the latter country recognises and will make effective the arbitration agreement."

The Economic Committee in its report expresses the opinion that the steps indicated in the recommendations should be taken with a view to ensure that traders of different nationalities who have voluntarily agreed to an arbitration clause in their contracts should so far as possible be made to respect and comply with it. As this would render necessary the removal of any obstacles in the law of the various countries which may "assist or justify" traders evading the terms of their contract, the Committee considers it desirable that the State members of the League whose legislation or legal practice is still adverse to arbitration agreements, should endeavour to introduce as soon as possible measures necessary to give effect to the experts' recommendations.

As to the enforcement in one country of an award made in another, the Committee finds that this question cannot be separated from that of the enforcement of legal judgments. Very great difficulties exist at present in the way of the reciprocal enforcement in one country of legal judgments delivered in another, and as a natural consequence the difficulties in securing the enforcement of arbitration awards would be still greater. Under these circumstances the Economic Committee expresses the opinion that both questions of awards and legal judgments should be referred to competent legal experts for further examination.

The report also deals with the problems of unfair competition, Customs formalities, and the desirability of stabilising Customs tariffs so that the latter may remain applicable to substantial periods of time and that changes in rates and classification should be made as seldom as possible.

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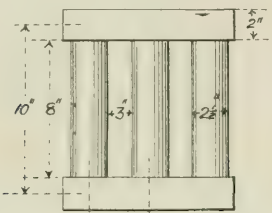
INSTRUMENT TRANSFORMERS.

By "S. M."

The purpose of this article is to give a general idea of the considerations covering the design, manufacture, and use of instrument transformers.

These devices are looked upon as a necessary evil, and as they are generally hidden away, and, when once installed, need very little attention, the average man only has a vague idea as to their existence. In the average text-book they receive little more than passing mention.

Instrument transformers are essential in a.c. practice. Safety demands that no instruments shall be connected to high-pressure conductors. They are necessary for convenience in measuring electrical quantities. The instruments with which they are used need only be at a low pressure above earth potential. The size of the instruments is kept down by the reduction of the



Potential transformer, 1 per cent. regulation, 3 ph., 3,300/110 volts, 25 cycles.

Fig. 1.—Dimensions of Cores and Yokes.

secondary current (current transformers). But what is more important in both cases is that the secondary current (current transformers) and the secondary voltage (potential transformers) is standardised, thus making it possible to standardise the instruments, which, when used in conjunction with a suitable ratio transformer, can have their scales marked to indicate primary quantities. Instrument transformers can be divided into two classes—current and potential—and it is proposed to consider each separately.

Current transformers are used in conjunction with instruments and protective devices which depend on current for operation (*e.g.*, ammeter, power factor meter, relay, trip coil). The primary of the transformer is connected in series with the main conductors. The secondary full-load current is generally 5 amps.; for special protective work it is sometimes 2.89 or 8.66 amps. The ratio is given in terms of the currents, *e.g.*, 200/5. The secondary circuit has a low impedance; the current element of an induction wattmeter will have a resistance of 0.2 ohm. The secondary voltage, on closed circuit, is about two volts. On open circuit the transformer acts as a choking coil, and a voltage is induced in ratio to turns, and thus a dangerously high voltage may be induced in the secondary. Because of this a current transformer should never be left on open circuit, and before an instrument is disconnected the secondary should be short-circuited.

Ampere turns, not volt turns, are the basis of the design of these transformers, which are of various sizes and shapes, according to the work required and the position in which they are fixed. Those for iron-clad switchgear will be placed in iron cases and run in solid with compound. For cellular, cubicle, or truck gear, wall mounting, floor fixing, or slipping over cables other shapes are necessary. The volume of iron required for the core is fixed by the work to be done, though one core can be used over a large range. The shape of the core is conventional unless required for special protection (*e.g.*, self-balance). The above factors allow standardisation of designs for cores, with a standard magnetising loss (*e.g.*, 10 amp.-turns—working on straight portion of B.H. curve). The core is built up of thin iron stampings (*e.g.*, Lohys iron, .018 in., Stalloy, .03 in. thick) pressed together and bound with linen tape. Moving-iron instruments take about 1 volt-amp., and, in combination with relay and time-lag fuse, 15 volt-amps. Six hundred amp.-turns is a common number for the primary winding. From this deduct the magnetising amp.-turns, and divide by the secondary current; the result will give the number of secondary turns required. The next stage in the making of the transformer is the winding of the secondary; No. 14 S.W.G. (preferably d.c.c.) is suitable for 5 amps. If there are many secondary turns a layer of tape should be wound between each layer or double layer of the secondary. The polarity of the ends is marked. The insulation between the primary and secondary must now be wound, using some type of prepared linen Empire cloth 15 mils thick.

Volts.	Radial depth.
600	⅛ in.
3,000	3/16 in.
6,000	5/16 in.
12,000	13/32 in.
20,000	¾ in.

It often happens, and indeed is desirable, that only one primary amp.-turn is necessary. This makes what is termed a "straight-through" transformer. This results in cheaper production, easier installation, and no chance of breakdown between turns. A transformer suitable for certain protective and metering devices can be made by slipping a core, wound with secondary, over an insulated cable. The area of the primary is calculated from the 1,000 amps. per sq. in. rule.

A solid winding is not used with wound transformers; the winding consists of a number of wires (No. 16

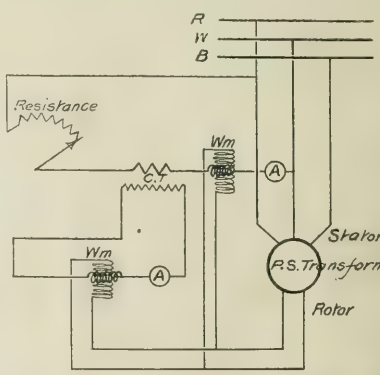


Fig. 2.—Diagram of Connections for Testing Phase-angle of Current Transformers.

S.W.G., bare) stranded and insulated with Empire cloth. If a potential transformer is installed in the switchgear it is fed from a tapping on the primary of the current transformer.

Load Taken by Instruments.

	Volt-amps.		Volt-amps.
Moving-iron ammeter ...	1	Induction ammeter ...	6
Power-factor indicator ...	1	Overload relay ...	12
Indicating wattmeter ...	1	,, coils ...	40
Integrating ,, ...	1	Recording instruments	6

Transformers for split-conductor protection have two primaries wound in opposition, and the ratio is stated in terms of turns, 1-1/40. Three separate primary windings are required for core and self-balance protection. For e.m.f. balance, Merz-Price and Beard-Hunter protection, cores which have an adjustable air gap must be used. Twin transformers, that is, those

with two secondaries, are manufactured. One secondary is used for indicating instruments and protective devices, and the other for integrating instruments.

The general tests of current transformers are for pressure, ratio, and direction. Special tests of new types or those for balance protection are for phase-angle and balance. The insulation between primary and secondary is usually tested at three times working pressure. Working pressure is applied between splits on a split-conductor transformer. A brush discharge will be noticeable at voltages over 20,000; this is not harmful, but vicious flashing over should be avoided. Pressure tests are repeated after assembly if the transformer is encased. For general purposes the ratio of a transformer should be within 2 per cent. of standard, but for integrating instruments it should be accurate to within ½ per cent. from 1/5th to full load. The ratio is checked by comparing the secondary current with that of a standard transformer. When testing transformers used for power measurement a resistance equivalent to that of the wattmeter must be inserted in the secondary circuit.

When connected for ratio testing, another pressure test is given. A test between turns can be applied by open-circuiting the secondary winding and passing full-load current through the primary. All pressure tests should be of one minute duration. A repetition of the ratio test will reveal any short circuits. If the transformer has a high turn ratio, there will be a dangerous difference of potential across the secondary terminals.

It is usual when winding to mark the start and finish of the secondary, and as this marking is all-important to the outside erector, it should be checked. By connecting a cell in series with the primary, and a central zero galvanometer across the secondary, and noting the direction of the swing of the pointer, the direction of the flow of secondary current can be checked. There is a phase difference of nearly 180° between primary and secondary currents. When testing split-conductor transformers, connect the halves of the primary separately. The direction of one is opposite to that of the other.

In an ideal transformer the phase difference between the primary and secondary currents would be 180°, but in practice this is not so, because of the magnetising amp.-turns. The primary load amp.-turns equal those of the secondary. The total primary amp.-turns are the resultant of the load and magnetising amp.-turns. The latter are in quadrature, and so the primary and secondary currents differ by less than 180°. In practice this phase difference should be within 2° of 180. Obviously the smaller the number of magnetising turns the less this phase angle. By using good and sufficient iron this angle can easily be made 30 minutes. Fig. 2 shows the connections for a phase-angle test. Suitable current readings can be obtained by using a variable resistance. To find the phase angle, turn the phase-shifter until the wattmeter in the primary side reads zero, and read the angle from the scale of the phase-shifting transformer. Care should be taken to make the leads non-inductive and not to have any outside interference.

Potential transformers are small power transformers. They are necessary in any circuit which has a potential difference of more than 600 volts, and operate all indicating and integrating instruments and certain protective devices (*e.g.*, no-volt release) which possess pressure elements. The transformers are generally connected by a high-pressure fuse to a tapping from the end of the primary of a current transformer. They may be either of the "core" or "shell" type, but the former is usual. For single-phase working the windings are divided between two limbs, but for three-phase working each phase is wound on a separate limb.

The cores and yokes are built up of stampings of "Stalloy," .03 in. thick; the core and yoke junctions being sandwiched. The yoke is of greater cross-section than the core. It is usual to work with a density of 12,000 lines per sq. cm. Several standard cores are designed, each one to fit a certain class of gear, and careful tests are made for iron losses. It is found in practice that only two standards are required for frequency, one for 25 cycles and the other for 40 cycles, which will serve up to 80 cycles, without any great error.

It is usual to assume that a potential transformer works at unity power factor and that no leakage takes place.

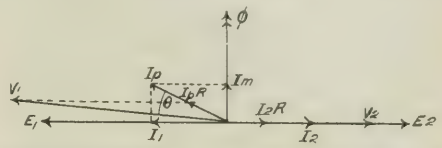
The following data are required before proceeding with the design of a transformer, *viz.*, kW, regulation, voltage ratio, frequency, and the number of phases.

Let us sketch out the plan of design. The current on both sides will be determined from the ratio power/voltage. The number of turns can be calculated from the formula:—

Turns = Volts × 10⁸/*4.44 × frequency × flux density × core area.

The permissible voltage drop can be obtained from the regulation per cent., which is taken as half up and half down.

The resistance of the winding is the ratio of voltage to current. The probable depth of the high-pressure winding must be assumed, but from experience this can be determined to within 1/16 in. The h.p. winding is generally wound next to the core. The core area and the diameter of the limb are known. The winding is



Φ, flux; V1, primary applied voltage; V2, secondary terminal voltage; E1, primary induced voltage; E2, secondary induced voltage; I1, primary "load" current; I2, secondary "load" current; Im, magnetising "load" current; Ip, resultant primary current; IpR, primary "resistance" drop; I2R, secondary "resistance" drop; θ, angle of lag.

Fig. 3.—Vector Diagram for Potential Transformer on Load.

wound on a former made of specially impregnated cardboard, and the insulation, Empire tape, is wound on at right angles to the winding, covering it to a specified radial depth. To obviate serious breakdown it is usual to divide the h.p. winding into sections, the number depending on the voltage. By adding the diameter of the core, and the thickness of insulation and former, the diameter of the latter will be obtained. Calculations now fall very simply. The mean length of a turn, the length of winding, the resistance per yard allowable, and the gauge of wire, which is s.c.c., are easily obtained from the previous quantities. The length of winding space available is known, and so now the depth of winding can be calculated, and by working backwards the actual length, resistance and regulation can be determined.

From the per cent. of regulation left the allowable resistance of the l.p. winding will be known. Assume a certain depth of winding and proceed as before to obtain the various quantities.

The transformers are generally star-connected. The secondary winding is assumed to have no losses, and so all such must be compensated from the primary. To do this the ratio of transformation is reduced by about 0.5 per cent. The losses are calculated at half load. Turn the secondary potential drop into equivalent primary drop. To determine the total in-phase primary current, only add the core loss to the load; other losses may be neglected. From this current the equivalent primary drop and the exact turns ratio will be obtained. The core loss per limb will be about 30 watts.

If a neutral lead is required on the h.p. side, it is specified. Four terminals are brought out on the l.p. side and one of them is earthed. It is usual to earth the start of a coil, as instruments are generally connected across the line.

In a single-phase transformer one of the h.p. leads is often earthed. Potential transformers are connected

* Assume sine wave form

to the main circuit through fuses. If the fuses are too heavy and refuse to blow under abnormal conditions, the winding will probably break down. If the fuses do blow, then any protective devices operated by the transformer are useless. This is a serious objection against installing these methods of protection.

Transformers are generally enclosed in oil, of a special quality—specific gravity 0.86, and flash point above 160° C. The oil must be thoroughly dried before use, and be cleaned at intervals to remove sludge.

Mechanical stresses are very real in the event of a primary short-circuit, and to resist these the yoke plates are firmly clamped together, and vertical tie rods connect the upper and lower plates.

Sometimes these transformers are used to supply power; collieries use them for underground lighting. For this purpose the regulation is 2½ per cent.; 1 per cent. up and 1½ per cent. down. When used for these purposes, an earth shield is often specified. This is a sheet of thin copper, earthed through the yoke, and placed between the two windings.

Sometimes in designing, the calculations will show that a wire of No. 42 gauge may be used for the primary winding, but owing to mechanical weakness no gauge under No. 40 is used.

The normal rating for single-phase transformers is 50 watts (unity p.f.) and for three-phase 100 watts.

Load Required for Certain Instruments.

Name.	Volt-amps.
Voltmeter, moving-iron	1
Voltmeter and indicating wattmeter ...	14
Wattmeter and synchroscope	13
Reverse relay	12
No-volt coil	30
Wattmeter, indicating	20
Wattmeter, integrating	14

Testing Potential Transformers.

The usual tests are for pressure, ratio, direction, magnetising current and resistance.

The pressure tests are at three times working pressure and of one minute duration. The first one is between the primary and the secondary, which is earthed. The next one is a test between turns; it is here that any weakness is shown. Either the secondary or the primary can be connected to the supply terminals, but for voltages over 10,000, the latter way is preferable. The transformer is connected to a supply at three times normal pressure, and as one winding is closed, in order to prevent overload, the frequency of supply must also be three times the normal.

If there is a breakdown, it is generally at the point where the h.p. lead is brought out.

The last pressure test is to raise the secondary winding to a potential of 1,000 volts above earth.

The ratio test is merely a comparison of the two voltages, taking each phase separately. As the transformer will not be on load, the secondary voltage will be about 1 per cent. higher than that specified.

It is necessary to check the connections of the coils, and a direction test similar to that made on the current transformers will do this. It would not do to have two starts and one finish starred.

In order to check the quantity and the quality of the iron and the construction, the current required to magnetise the core is compared with the figure given by the D.O. The secondary is connected to a supply at normal voltage, and the current taken. The primary is on open circuit.

The resistance of the winding of each phase is compared with D.O. figures. The simplest way of doing this is to use a P.O. box. Usually there is no neutral point available on the h.p. winding, and so two coils must be taken.

After manufacture current and potential transformers are dried out and impregnated. They are again tested with their instruments with the completed gear *in situ*.

THE "ELECTRICAL REVIEW" FRENCH TOUR.

(*Concluded from p.* 617.)

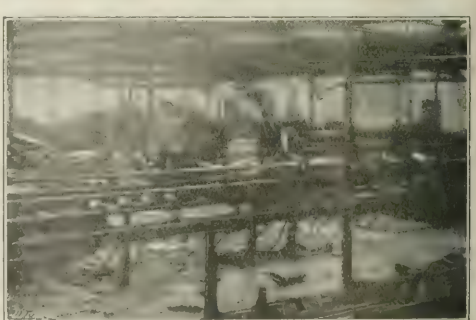
From Beuvry the party proceeded by way of La Bassée and Hulluch to Pont-à-Vendin, where a new generating station erected by the Société des Mines de Lens was visited. This station is still in course of equipment, but presents many interesting features. Reinforced concrete figures largely in its construction, the building having a handsome appearance; the two stacks are of the same type as those at Beuvry, and the coal bunkers are also of concrete, as well as the new headgear of the adjacent pit-shaft. Coal for the station is thus obtained "on the premises," being carried by an underground belt conveyor to the hoppers of a double bucket elevator which takes it up to the bunkers. The water is hard, and has to be treated in softening plant before use. Eight cooling towers are provided.

The boiler house contains two rows of Babcock and Wilcox boilers, with "dutch-oven" furnaces and chain-grate stokers. Ashes are removed in trucks. Forced draught is provided by seven pairs of fans in the basement. Green economisers are used. The working pressure is 200 lb.; the steam pipes are in duplicate, and are neatly arranged, with large steam separators on the pipes entering the engine room.

Space is provided for six 10,000-kW turbo-generators, but a 6,000-kW set is temporarily installed; all the sets are of the Société Alsacienne's manufacture, and run at 3,000 r.p.m., generating three-phase current at 3,000 V, 50 cycles. A 50-ton crane serves the engine-room, and runs over a spur line from the railway at one end of the room. Only one of the 10,000-kW sets is in place as yet, but others are being erected; each alternator is directly connected to a transformer, the secondary pressure of which is 15,000 volts.

The feed and circulating pumps are mounted in a sunk gallery alongside the engine-room, the circulating pumps being driven by motors with steam drive as a stand-by.

A feature which marks this station in common with those previously described is the speed with which it has



The Cotton Mill of Messrs. Dufour at Armentières.
From a photograph taken in 1918 after the Germans had shelled, plundered, and burnt the mill.

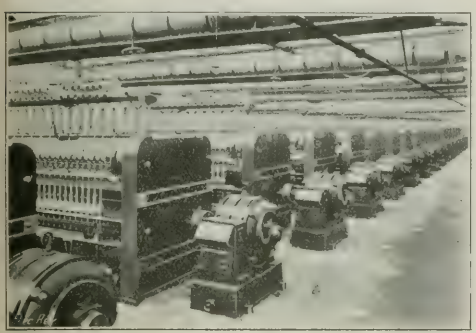
been erected; to illustrate this it may be mentioned that the concrete bed of one of the sets now being installed was cast in a mould, to fit into the foundation blocks, because the condenser was not ready in time to be installed first; on the arrival and erection of the condenser the foot is lowered into place and the erection of

the turbine can proceed without delay. This device has not been necessary in the case of the other sets.

A temporary switchboard for the 15,000-V circuits has been installed at one side of the engine-room. The system supplied by this power station is self-contained.

Near the power station there was a 45,000-V sub-station of the Compagnie du Nord, which the party was permitted to visit; time, however, did not allow of more than a few of the party entering it, and the journey was resumed to Lille, which was reached after a long drive in the dark.

On Tuesday morning, October 10th, an early start was made for Armentières, where an electrically-driven



Messrs. Dufour's Mill as it is To-day.

cotton mill owned by Messrs. Dufour Frères, and equipped by the Société Alsacienne, was visited; on the way the remnants of the Hindenburg line, including a number of concrete block-houses, were passed.

The cotton mill is of special interest in that it was formerly driven by steam, but was reduced to ruins by the Boche; on rebuilding, half of it was driven by steam and half by electricity, but the economy of the electric drive, amounting to 25 per cent., decided the owners to adopt electricity throughout—a total of 1,500 h.p. A three-phase transformer sub-station and switchgear, supplied by the Société Alsacienne de Constructions Mécaniques, is installed at the mill; the mains are taken along a subway directly under the mill, and tappings are taken off them to the spinning machines on the floor above, which are driven by individual motors at 200 V, 50 cycles. The cotton machinery was also made by the Société Alsacienne. The card room is driven by shafting from motors fixed outside the room.

This concluded the technical programme, and the party, crossing the frontier into Belgium, proceeded to Ypres—once the pride of Flanders, with a population of 200,000 persons, which fell to a tenth of that number when it had ceased to be the centre of the linen trade. Its world-famous Cloth Hall and Cathedral Church, both dating from the 13th century, bore witness to its by-gone glories, until the war came and the Huns wantonly destroyed those wonderful buildings.

The ruins, still majestic and eloquent of their former beauty, were examined with great interest by the visitors, who deplored the loss of these irreplaceable triumphs of architecture; the ruins are to remain as an everlasting monument to Prussian ruthlessness, for which purpose they are being carefully strengthened and made weatherproof.

The party took luncheon at Ypres, and after the meal, Mr. George Wilkinson, of Harrogate, proposed the health of the proprietors of the Electrical Review, who, he said, had had the foresight and enterprise to offer them a tour of the greatest interest. Referring to the distressing scenes that they had passed through during the last two days, he said their sorrow was blended with admiration for the wonderful powers of recuperation manifested by the people—he hoped that no race would ever again have to go through such an ordeal, and was glad to think that the English had done something to help the sufferers. They had seen works that opened their eyes and gave them examples to copy—and to avoid. He hoped the large undertakings they had seen would prove to have been founded on a sound commercial basis.

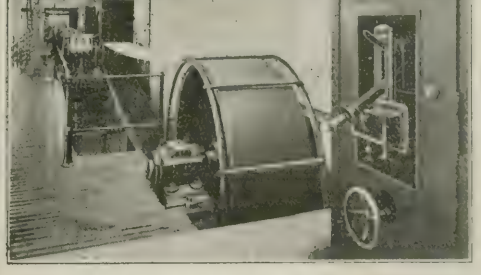
Mr. J. P. Gregory supported the toast in the warmest terms, remarking that the tour had been full of interest and instruction, and he hoped it would be the precursor of many others.

Mr. E. A. Gatehouse, responding, said that in the preliminary negotiations he had always met with the greatest courtesy and assistance from the French authorities concerned.

Compliments were also paid to Major T. Rich, who rendered invaluable assistance on numerous occasions, and to Captain Harvey, the courier who accompanied the party. Afterwards the journey was resumed, by motor-car to Hazebrouck and thence by train to Calais; a quick passage to Dover in calm weather and a comfortable run to London brought the tour to a close in happy circumstances.

In concluding this brief record, we desire to express our sincere appreciation of the courtesy and goodwill invariably received from every one of our French confrères—the directors and engineers of the important undertakings that were visited—who spared no pains to ensure the success of the arrangements, threw open every part of their works for inspection, and did their utmost to afford the fullest information regarding them. In particular we would refer to Col. Mercier, managing director of the Union d'Electricité; Commandant Jullien, officer in charge of the Eiffel Tower station; M. Pécheur, chief engineer of the Compagnie Parisienne de Distribution d'Electricité; M. Carrière, chief engineer of the Société Electrique du Nord-Ouest; M. Barthelemy, man-





Main Switchboards and Motor Drives, at Messrs. Dufour's Cotton Mill.

aging director of the Compagnie des Mines de Nœux; M. Cuvelette, chief engineer of the Société des Mines de Lens; and Messrs. Dufour Frères, owners of the cotton mill—to all of whom we tender thanks on behalf of the party. We also wish to record our gratitude for the patience and good humour shown by every member of the party throughout the tour; fortunately there was not a single mishap of any moment, but minor discomforts, delays, and disappointments cannot be wholly avoided in conducting so large a number over an itinerary hundreds of miles in length—if such occurred, they were borne in silence, for we have not heard of them. Our special thanks are due to Major Rich, whose intimate acquaintance with the whole of the region traversed—acquired in sterner times—was of the utmost value in planning the tour, while his fluent interpretations threw a flood of light upon the technical details of the installations, and his ready wit enlivened the proceedings on every occasion.

There is no doubt that during the last four years the patience of the French people has at times been sorely tried, but if the great kindness with which the party was received everywhere is anything to judge by, then the "Entente Cordiale" is likely to be a factor in European affairs for many years to come. The difficulties which had to be got over in the North of France after the Armistice appeared at one time to be almost insurmountable, but things that were seen during the Northern visit showed that "where there's a will there's a way."

Time prevented any visits to reconstructed collieries and steelworks, and when the programme of the trip was under consideration, the difficulty was to choose between the numerous places of interest which would have been thrown open to us.

Apart from the general plan of the tour, the whole of the financial and other arrangements were placed in the expert hands of Messrs. Thos. Cook & Son, and were most efficiently carried out; the courier who accompanied the party—Captain Harvey—was on active service in the north of France during the war, and knew every foot of the ground.

But above all we have to thank the Clerk of the Weather, without whose aid the success of the tour could not have been complete.



The Ruins of the Cloth Hall and Cathedral at Ypres.



Homeward Bound: A Halt at the Frontier.

LARGE ELECTRIC FIRES AND COOKERS.

The above was the subject of the E.D.A. salesmanship lecture on November 3rd. The lecturer was Mr. F. H. Howell (Hotpoint and Falkirk Companies), and the chairman was Mr. A. N. Rye, of Edmundson's Electricity Corporation.

In opening the proceedings, the Chairman reiterated the necessity for keeping clear of technicalities in these lectures and then referred to the question of the price of electricity. There were some small undertakings which could not generate electricity and sell it at a price which would attract the electric cooking load. They were started as lighting undertakings and were not in a position to take on a large cooking and heating load. From their point of view, therefore, it could not serve any useful purpose to argue about the high price of energy. Personally, he thought it was better for these undertakings to stand aside in this matter and not spoil the market for those who could deal with the heating and cooking load. Any endeavour to develop a heating and cooking load under conditions of high prices of electricity could only lead to dissatisfaction on the part of the people in particular areas, and that was not good for the general development in other areas where the conditions were really favourable. There were numerous supply authorities which were supporting an attractive tariff, and the salesmen should know their business sufficiently well not to waste time in those districts where the tariff was not sufficiently attractive.

Mr. Howell said that the question of selling large electrical cooking and heating apparatus could be best dealt with under four heads: first of all it was necessary to consider the type of salesman; secondly, the field he had to exploit; thirdly, how he was going to get into that field; and finally, having got into the field, how he was going to sow his seed to the best advantage in order to reap the richest possible harvest. Few salesmen were made; the majority, like poets, were born. It had often been said, that the salesman must have personality and tact; in addition, he must have patience, a thick skin, cheerful optimism, and a tidy personal appearance.

The field available was enormous. Even now the number of large cooking and heating outfits in use was astonishing to anybody who did not realise the steps that were being made and the results of the patient work of the past few years. Every little teashop, and every small restaurant had room for a grill, a cooker, an urn, or some piece of apparatus for cooking—and why not electrical? The majority of these people did not know the possibilities of the electrical cooker. Moreover, they were cramped for kitchen space and the electric cooker certainly scored there. The number of hotels and public houses which served an ordinary lunch was increasing daily, and all of them had to extend their cooking arrangements. Then in the industrial world, every factory had room for an electric heater for some purpose. As an example, and here he was speaking of what had been accomplished to the satisfaction of all concerned—a cigarette-making machine had an output of 300 cigarettes per minute. But the machine had continually to be stopped to scrape away the flake of gum in the channel. An efficient electrical heater was installed and the output was increased to 500 cigarettes per minute because the gum was always kept at the right temperature. In the printer's shop, the metal for the lino machines was kept at a certain temperature most effectively by electric heating, and in certain two-colour printing machines copper cylinders were used, sometimes as large as 45 cu. ft., which had to be kept at a certain temperature to dry the paper as it went through the printing press. Some of these electrically-heated cylinders had been working for three years.

It was astonishing, too, the number of industries that required a furnace for some of their processes; the jeweller, at one end, who wanted a muffle measuring less than a cu. in., to the big furnaces for baking bricks. In the hosiery

trade, three-ton presses could be adapted for electric heating; timber drying ovens were in successful operation electrically; and he entirely disagreed with the view that in the larger heating apparatus, electricity must give way to other methods. He had recently had experience of the heating of a large hall in which window heaters were fitted, amounting to a total of 64 kW in one room. The air inlets operated from inside the wall panelling and 36,000 cu. ft. of fresh air was brought through these heaters every hour. Another example which came to his mind, was that of a 600-gal. water cylinder required to be kept between 130 and 150 deg. F. This was done by means of 44-kW circulators. There was a kitchen not 500 yd. from the building they were meeting in, which was dealing with 3,000 meals, and such were the results obtained, that in another kitchen belonging to the same firm, the electrical equipment was duplicated after a year's experience of the first one, and that kitchen was not run by a crank or an electrical enthusiast, but by the cold-blooded chief of a commercial firm. Again, how many fried fish shops were there? Had electrical engineers tried to tackle them? He agreed with some of the speakers at previous conferences, that postcards and circulars were excellent for getting into touch with potential customers for some apparatus, but he did not think they were much use in the case of large cooking and heating apparatus. The salesmen had to be continually on the job. The number of gas and coal oven renewals that went on in the large hotels almost every day was astonishing, and information concerning these must be sought for and the business pursued on the same lines as the lighting business, in which jobs were got, installed, and paid for before anybody else had hardly heard of them.

The last and most important thing for the salesman to have was knowledge. It was impossible for the salesman to have a complete knowledge of every possible branch of engineering, domestic cooking, large cooking, and power work, but he should not be misled by the old-fashioned motto that "a little knowledge is a dangerous thing." As long as the salesman had some knowledge, so that he could talk intelligently to, and interest the customer, that was sufficient, because he could then drop a card to the manufacturer to come and look over the kitchen and give an estimate. It was no harder to sell, or approach prospects for the sale of, large cookers and heaters, than it was to sell lamps and fittings. With electricity at 1d. or 1½d., they could compete with any other method, but even if the charges for energy were high, the job should not be turned down without the fullest inquiry, because it was quite possible that the high rate for electricity might be more than compensated for by the high costs of other methods, and the salesman should always remember that he was selling something more than so many pieces of iron and so many elements put together to form a cooker. Civilisation to-day demanded an ever increasing scale of comfort and cleanliness, and the abolition of dirty work, and civilisation was willing to pay for that.

Mr. L. L. Robinson (Chief Electrical Engineer, Hackney), who opened the discussion, said that he had got one cooker in a small cookshop, the owner of which they would hardly think could afford a stove at all. After seeing him in connection with it, he found that business was very flourishing and that the man was taking custom away from other similar shops which had not electric cooking. He (Mr. Robinson), consequently took the opportunity of interviewing the owners of other cookshops with some success. In another case he had been to see a customer about lighting and noticed that gas heating was being used for drying thousands of baby's teats, and the result here was the installation of a 32-kW heater. In yet another case, he had seen a large draper and pointed out means for reducing the lighting bill by 25 per cent., but at the same time he got in cooking apparatus for 50 people. There was one undertaking in London which was putting in electric cooking apparatus at a rate which was not appreciated by others. Nothing was being said about it, and perhaps this particular undertaking was saving it all up as a sort of bombshell. Even the coffee stalls in this district hitched up to the nearest lamp-post and used electricity, and all the coffee stalls in Hackney were, as a consequence, going to have a free trial next month.

Mr. G. Nobbs said that he had come to the conclusion that the most lucrative source of revenue would be that of domestic hot-water supply by thermal storage. As an old hot-water engineer he believed that the demand for hot water would, under average conditions, be equal to that of combined lighting, heating and cooking consumption and, what was most important of all, without their attendant "peak" disadvantages. Water heating apparatus that took an even load off peak, for 22 hours daily, surely merited a rate of at least half that for apparatus having a 25 per cent. load factor, such as cooking or power. He did not think cooking or warming by thermal storage would find favour in this country, but the demand for hot water was comparatively a constant quantity all the year round. The cost of maintenance of a well-designed hot water storage system with immersion heaters was practically nil.

Mr. W. E. Warrilow suggested a scheme of advertising in the newspaper Press in which cooking and heating apparatus would be dealt with, and the names of the manufacturers who contributed to the E.D.A.'s funds mentioned. This would assist the salesman considerably. As business grew, he did not think there was the slightest doubt that the question of maintenance would have to be dealt with by the supply authority.

Mr. A. W. Bonell said that one supply authority had put water heaters at 25 per quarter, including electricity.

Mr. Gibson (North Metropolitan Electric Power Supply Co.) asked for experiences as to bread-baking by electricity.

Mr. W. A. Gillott thought the discussion had gone too much on the domestic side. From the large cooking point of view, the requirements were good cooking, quick service, and reasonable cost, and it was the duty of the salesman to show how these three essentials could be obtained by electricity. The best way was to show hotel and restaurant proprietors actual installations at work. During the war, some canteens were able to deliver 1,500 meals in ten minutes, that was so far as service went. Again, information as to costs was available and should be given to hotel proprietors. The general consumption was from 0.15 to 0.5 kWh per meal according to the class of service, and an average of 0.3 kWh per meal was a safe figure. Again, the saving of floor space in the kitchen should be made a strong point and also the elimination of risk of fire and explosion. There was no coal heap or ash dump, and generally 20 per cent. could be saved in floor space. Finally, he suggested that these discussions would be all the better if the E.D.A. selected certain speakers to deal with one particular point in relation to the subject of the evening, rather than to have too many general remarks, interesting though they were.

Mr. A. F. Berry urged the importance of tackling the chef in large kitchens.

Mr. Hurry (Jackson Electric Stove Co.) thought a great deal of good would be done if the supply authorities advertised the advantages of electric cooking more than they did. Manufacturers did not make an enormous profit out of cookers, and if there were a little more pushfulness on the part of the supply authorities it would help considerably. The business from the supply point of view was very lucrative, and if the supply authorities appreciated this and did their best to reduce charges there would be more business all round.

Mr. Scott suggested a good field in the heating of drying-rooms in paint and varnish factories.

Mr. G. Leevers (British Thomson-Houston Co.) did not think enough was being made of the advantages of electric cooking in factories. He had not found many electric cookers in the factories he had visited during the last two years and yet there was electric driving in all of them.

Mr. Howell briefly replied, and said that a national advertising campaign meant a great deal of expense and he did not think the manufacturers had got the money for it. They were at the moment relying upon exhibitions and local work. The Swansea master-bakers did a lot of bread-baking at the Swansea exhibition and he hoped to get figures from them. As to the chefs, there were several reasons why they should be tackled. Electrically-heated drying-rooms in paint and varnish factories were a practical "proposition." A similar case was the use of hot cupboards for drying secondary batteries for submarines. These were 30 ft. long, divided into seven chambers, and the seventh one was used for baking armatures. There were not so many canteens being fitted now, owing to the fact that the large number that went in during the war were installed out of excess profits.

NOTES FROM CANADA.

(From our Special Correspondent.)

Sir Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, has recently, according to the daily Press, given information relating to the operation of railless trolley cars as compared with gasoline (petrol) motor 'buses.

Tabulated, the information is as follows:

	Railless trolley 'bus.	Gasoline motor 'bus.
Operation costs, cents per mile	18	24
Life in miles	750,000 to 1,000,000	100,000 to 200,000
Maintenance, relative per cent.	100	150 to 200

Several railless trolley lines are now in operation in various "hydro" municipalities in Ontario, so that actual experience of their operation is available. Where the frequency of service is greater than one hour the gasoline 'bus can be more cheaply operated than the railless trolley 'bus, but for intervals of ten or twenty minutes up to one hour the latter is the more satisfactory.

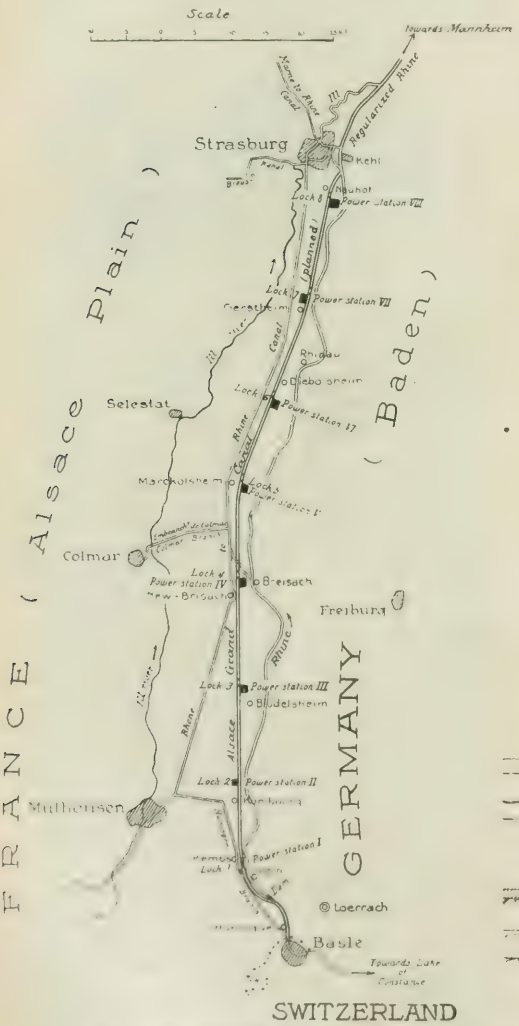
According to information published recently by the *Industrial Digest* the annual production of Canadian industries now amounts to about $400 per capita, while the country's exports are worth $150 per capita which, the paper states, is the highest in the world. During the first six months of the present year new companies have been formed in Canada whose combined capitalisation amounts to about $20,000,000 per week. At the end of 1921 it was estimated that there were about 800 branches of United States industries in Canada and about 250 English branches. This paper expresses the opinion that many more British owned indus-

THE RHINE BETWEEN BASLE AND STRASBURG.

Proposed Hydro-Electrical Development.

At a recent meeting of the British section of the Société des Ingénieurs Civils de France, M. A. Antoine, Ingénieur des Ponts et Chaussées, Inspecteur de la Navigation du Rhin, read a paper on the proposed improvement of the river Rhine between Basle and Strasburg, which subject is a technical and economic problem interesting not France only, but also the neighbouring States, and indeed the whole of Europe, for the navigation of the Rhine has been placed under an International Control Committee.

The utilisation of the energy of the river between Basle and Strasburg should make it possible to develop over 700,000 h.p. Neither France nor Europe has a right to let such a natural force go begging, especially in the present economic circumstances. Moreover, it is a fact that only the possibility



[illegible] RHINE LATERAL CANAL.

of developing the [illegible] justify the execution of the enormous work [illegible] to the improvement of the upper Rhine to the [illegible] of navigation.

The main features of the waterway planned by France are:—A canal lateral to the Rhine to originate in the river near Huningue and [illegible] Strasburg. The reaches would not be more than eight in number, the fall at the end of the reaches being [illegible] as allowed by present technical means.

To water the canal, a weir would be constructed across the Rhine at Huningue, an especially favourable point. This canal would be a veritable artificial river, its width being no less than 120 metres, on the average, at the top and its average depth 6.5 metres, with high embankments to limit it on either side. The stream in the canal should be far slower than that in the Rhine, the velocity not exceeding about 1.20 metres per second. The slope of the canal bed would be one-tenth only that of the river bed. The volume of the stream, instead of increasing in flood time, would decrease, since the whole of the excess water of the Rhine would find its way into the river bed by means of the Rhine weir that would act as an enormous safety valve. At each step of the "stairway," an important station would be installed with, close to the station, a lock in smooth water with a basin allowing easy passage from one reach to the other. Therefore, navigation on this artificial waterway would be at once easy, safe and cheap.

Eight locks only instead of thirteen or fourteen for the canalised Rhine would have to be passed by the barges; the cost of building and upkeep of the canal would be much lighter (one weir only being established across the Rhine); and the lateral canal would be made watertight.

Finally, from the power viewpoint, the lateral canal has the advantage of being a simple solution, providing for the

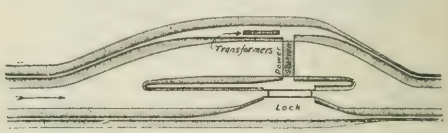


Fig. 2.—Hydro-Electric Station and Lock on the Grand Canal d'Alsace.

development, at minimum cost, of the maximum of permanent power. The great point is indeed to make sure of that permanent power to ensure the economic utilisation of the energy available. (Figs. 2 and 3.)

In May, 1922, the Central Committee gave consent to the execution of the Kembs scheme, reserving a few technical modifications and France is actively carrying out the technical, economic, and financial studies in connection therewith. (About twenty engineers are now busy tracing the complete layout of the canal between Basle and

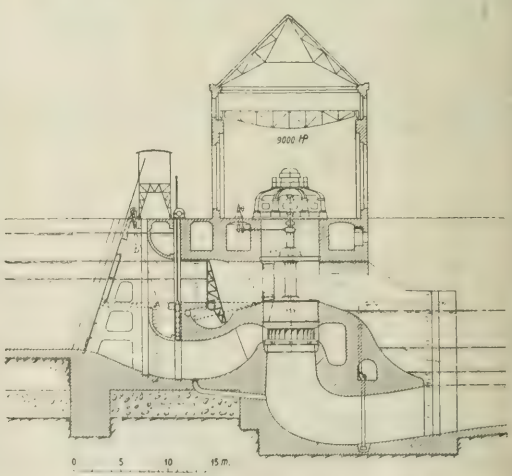


Fig. 3.—Hydro-Electric Station (Kembs Project).

Strasburg.) In addition to studies made by the State, an important society, grouping all the interests concerned, has been recently constituted, and will study the problem in its entirety.

It remains obvious, however, that, considering the importance of the works (the temporary estimate, about a year ago, amounted to one milliard francs) it will be necessary to proceed by stages and the building of the canal will certainly take no less than twenty years.

Discussion.

In the course of the discussion that followed the reading of the paper it was pointed out that there were no figures in the paper to enable any judgment to be formed how the cost of the new canal would compare with the cost of canalising the river. It seemed that only by making the canal the primary consideration and treating the power as a by-product was there any likelihood of the power being offered at such a price as would provide a market for so considerable an output.

Monsieur René Koechlin explained that, as regarded the expenditure necessary for construction, comparison would not be made between the canal and the regulation schemes for the following reason:—The expenditure involved in the construction of the canal would be recouped by the revenue accruing from the supply of hydro-electric power to industrial and other undertakings, whereas the cost of regulation would be entirely borne by the riparian States, without any possibility of recoupment, for no navigation tolls or taxes were allowed to be collected on the Rhine.

The regulation of the river would cost more than 100 million francs (Swiss) and the riparian States would not see a penny back. Then, while the regulation of the river would result in an increase of the period of navigability, owing to the deepening of the channel, it could not lessen the greatest obstacle to navigation, namely, the great speed of the current.

When the speaker put forward his first scheme some 20 years ago, it was estimated that a 10,000-h.p. station would be sufficient. At the present time the electricity undertakings of Strasburg and Mulhouse alone would be able to absorb the 100,000 h.p. which the Kembs station would furnish. But the Rhine power stations would be able to transmit their power far from Alsace, throughout Eastern France.

Mr. W. J. E. Binnie, M.A., M.Inst.C.E., remarked that the International Commission had been formed under the Treaty of Versailles, the idea being that all rivers which were navigable through more than one country should now be internationalised. The yearly average flow amounted to about 19,300 million gallons per diem. It was not subject to very great fluctuations; 950 million gallons per diem must pass down the river for sanitary reasons. The canal would take all the other water except when the flow reached a certain amount, 15,485 million gallons per diem being the maximum taken into the canal. The surplus flow would go down the Rhine channel. That was what fixed the enormous size of the canal which, strictly speaking, would not be a canal at all, as the flow in it would be about fourteen times that of the Thames.

The author, replying briefly, said the lateral canal would be more economical than the canalisation of the River Rhine because canalisation would necessitate the construction across the river-bed of from 13 to 14 great weirs, and that through every one of them it would be requisite to provide for the passage of enormous volumes of water in case of floods. The weir foundations would be very costly and difficult. On the other hand, in the case of the canal, only one weir across the river was required, and it would be possible to select the position. Besides, it was very costly to utilise the power of low falls, and the efficiency of power stations on canalised rivers decreased considerably, sometimes by as much as 50 per cent., when the volume of water increased, and particularly in times of flood. The averaged power derived from the utilisation of the canalised river would be, therefore, considerably smaller than that which the canal would yield, and it was necessary that the amount of power produced should be as regular and permanent as possible. It was for the purpose of combining hydro-electric power and navigation that so large a section had been adopted, which would not be justified were the size of the river craft the only consideration.

One must not forget that great opposition, principally of a political nature, was encountered, which would have rendered it impossible to obtain sanction for a truly logical scheme from a purely technical point of view.

Manchester Electro-Harmonic Society.—The second concer of the season will be held on Friday, November 17th, at 7.15 p.m., in the Marble Hall, Albion Hotel, Piccadilly, Manchester. The chair will be taken by Mr. A. J. Hutchinson, and the following are the artistes: Soprano, Miss Pansy Moore; violinist, Mr. Harold Jones; entertainers, Messrs. Wilks and Simmonds: solo pianist and accompanist, Mr. Granville Hill. The Society again extends a hearty invitation to any electrical friends. On the occasion of the last concert the Society showed its appreciation of the excellent services rendered by the late hon. secretary, Mr. J. Hill, by presenting him with a suitably inscribed gold fountain pen. This was handed to him by Mr. W. J. Smith, the hon. musical director, who made a few appropriate remarks, which Mr. Hill suitably acknowledged.

THE BREWERS' EXHIBITION.

This year's Brewers' Exhibition, the 36th, at the Agricultural Hall was, on the whole, very similar to the last show. If anything, the amount of electrically-driven machinery was greater, but this may be said of any industrial exhibition nowadays.

The official title of the exhibition was again an insufficient indication of its scope, for many firms with only a remote connection with the industry were able to display their products. However, the fixing of a definite border line between what is and what is not connected with an industry is a matter of difficulty and dispute.

One of the most prominent electrical stands was that of Messrs. Berry's Electric, Ltd. Here a large variety of large and small appliances was on view. The principal exhibit was a "Touchbutton" electric dish-washer, suitable for employment in a hotel or canteen. It was claimed for this machine that it could deal with 1,500 or 2,000 pieces of crockery per hour. Another feature of the stand was an "A.B.C." "laundress" and ironing-machine. For the rest, the display consisted of "Ortosafe" electric irons, "Magicoal" fires, kettles, and other small appliances.

Messrs. L. G. Hawkins & Co., Ltd., showed a large variety of "Universal" apparatus—coffee mills, meat choppers, kettles, teapots, irons, washing machines, and cookers. The "Moto-Maid," a general utility kitchen machine was also exhibited, as well as "Vio-Ray" high-frequency apparatus.

Messrs. Frank Feesey & Co. demonstrated their

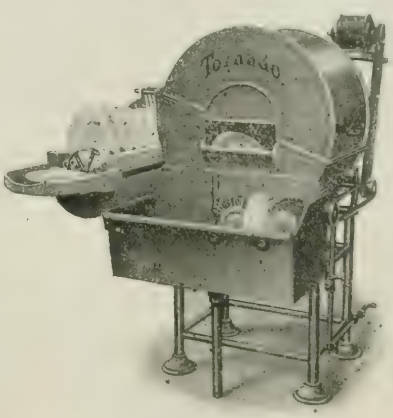


Fig. 1.—The "Tornado" Dish-Washer.

"Cascade" ironer and washing machine. The latter is provided with a rotary oscillating cylinder and a wringer driven by a geared shaft.

Ozonair Ltd., had a range of deodorising and ventilating plant on its stand, including several portable machines for use in offices, restaurants, &c.

Messrs. Richard Crittall & Co., Ltd., exhibited examples of refrigerators of Swiss manufacture. "Autofrigor" automatic cooling and icemaking machines were included in the display. The "Autofrigor" consists of an electrically-driven compressor, a condenser, and an evaporator, contained in one casing. The vertical-spindle motor projects above the main body of the machine, facilitating connection. A similar appliance to the "Autofrigor," consisting of the essentials of the latter machine mounted on a column, can be used for cooling rooms, &c. Another device shown was the "Tornado" dish-washer. This machine is motor-driven, but the water is boiled by gas. It consists of a trough in which is placed the crockery to be washed, and two rotary brushes remove surplus fat, &c. The body of the machine contains a spiral rack which carries the dishes through the boiling water and discharges them, at the rear of the machine, on to another spiral path which ends in a tray from which the clean dishes are removed by hand. The "Tornado" is illustrated in fig. 1.

Mr. George S. Clayton exhibited the "Colebrook" electric water heater, a compact device for instantaneously raising water to a high temperature during its passage through the heater.

Messrs. J. W. Flower & Co., in addition to an "Eclipse" electro-hydraulic stacking crane (previously described in the Electrical Review) showed an electrically-driven machine for fixing capsules on bottles, and a rotary pump with a wide delivery range—from 1,000 to 10,000 gal. per hour.

Messrs. Negretti and Zambra included, in a large variety of scientific instruments, examples of electrical thermometers for registering temperatures at a distance from the source of heat.

Messrs. Smart and Clark supplemented the rather inadequate heating arrangements of the hall with a few "Fireflies" and "Vesta" fires.

Messrs. H. J. West & Co., exhibited a full-sized cold storage room suitable for a butcher's shop; a refrigerator and ice-making machine designed for hotels and similar institutions, and a number of ammonia compressors, including a large machine directly-coupled to a 92-120-b.h.p. motor by Messrs. W. H. Allen & Sons.

Messrs. Thomas Broadbent & Sons, Ltd., exhibited a centrifugal separator of which the motor formed an integral part. Similar machines were described in our columns some time ago (Elec. Rev., December 3rd, 1920).

Mr. H. C. Slingsby showed a large collection of trucks of various sizes, including electric tractor and lifting trucks.

The exhibition provided yet another reminder to electrical manufacturers of the opportunities which every modern exhibition affords.

THE NEW ELECTRIC STEEL FURNACES AT THE FIAT WORKS, TURIN.

The Fiat Motor-car Works at Turin have recently designed, constructed, and taken into operation a number of electric furnaces of new design for the purpose of producing economically all kinds of steel required in their work.

The endeavours of the designers were to get a furnace showing the following advantages: (1) The possibility of securing and maintaining an absolutely neutral space in the hearth during the entire duration of the "heat." (2) The possibility of using a continuous electrode, by adding portions of new electrode to replace those consumed, and so obviating the necessity of frequently dismantling the electrodes and their gear. (3) The obtaining of a theoretical maximum period of 2½ hours for the melting and refining of the cold charge. (4) A reduction in the consumption of

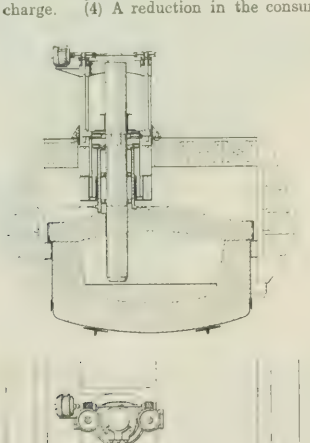


Fig. 1.—Cross-section and Plan of the Fiat Steel Furnace.

electrical energy and electrodes as compared with other furnaces. (5) Increased life of lining and arch. (6) Maximum ease of erection and dismantling, for the purpose of rapidly replacing the arches or removing the electrodes with their gear, without the necessity of interrupting operations.

Fig. 1 shows an elevation and plan of one of the Fiat furnaces at the Demag Works, at Duisburg (Germany). Of the three-phase type, it consists essentially of a cylindrical metal casing, well stiffened, with a domed bottom, to which are fixed two segment-shaped supports of cast steel which enable the furnace to be tilted in both directions. Whereas some of the Fiat furnaces used in the Fiat works are tilted by hydraulic pressure, those at the Demag works are tilted electrically, for purposes of economy in the use of water-power. There are only two openings in the furnace chamber and its refractory lining; a larger one in front for charging the furnace and removing the slag, and a smaller hole at the opposite side for tapping the molten steel.

Ease of removing the slag is a point of great importance in steel-making. By slightly tilting the furnace forward, the slag flows from the furnace into a tank below floor-level, whence it flows through gutters to the outside. The opening for the charging door has a water-cooled lagging.

The structure of the electrodes of this new type of furnace is specially noteworthy. The three graphite electrodes, 350 mm. (15 in.) in diameter are supported, together with their gear, on a special bridge. They are arranged in the usual way perpendicular to the bath. The entire electrode, together with its fittings and the whole of the control gear, including the motor, is detachable, and can be replaced by a new one, while operations are proceeding, within a space of half an hour. The whole of the supporting bridge carrying the gear for all three electrodes can also be raised easily.

After removing the bridge, the cover ring and the arch can be removed, thus making it an easy matter to replace the arch or reline the furnace.

The great advantage of this new type of furnace consists in the very careful way in which the electrodes are lagged and cooled. On the arch of the roof is a double-walled cylinder traversed by cold water. This cylinder surrounds the electrode (see fig. 1). To the electrode terminal, the movements of which are automatically controlled by motor-driven gear, a second cylinder is fixed which slides, with the electrode, telescopically over the first cylinder. The electrodes, being entirely shut off from the air, do not oxidise, with the result that their life is increased. Fig. 2 shows the consumption of electrodes of the older types of furnace as compared with the type now described.

The energy passed into the furnace is used exclusively

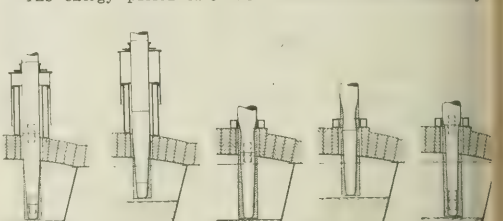


Fig. 2.—Consumption of Electrodes of Fiat Design Compared with Old Methods.

for the melting of the charge, and not for heating up large quantities of air which simply pass through the furnace. Hence the low energy consumption of this furnace. The electrode consumption in the Fiat furnace has been reduced to 2.8 kilogrammes per metric ton of steel melted, whereas in the older types of furnace it fluctuates between 8 and 15 kilogrammes.

The following points concerning the operation of the furnace are interesting: As a rule two voltages are used for working, a higher voltage of 130 V and a lower of 75 V. In the first and more protracted period during the melting of the cold charge, the voltage used is 130 V. In the second, or refining, period, the lower voltage is employed so as to raise the temperature at pouring to about 1,750 deg. C.

The oil transformer used has the primary circuit connected in delta for an output of 2,000 kVA. If, however, the primary is connected in star, the output drops to 1,150 kVA: The secondary being transformed to 130 or 75 V respectively. The secondary is connected in star, and for each electrode 12 flexible cables with a total cross-sectional area of 4,800 mm². are used. The neutral point of the star is in the immediate vicinity of the furnace and is connected by a flexible cable with the shell of the furnace.

To give an idea of the energy consumption of this new type of furnace, it may be mentioned that, for a total of 1,341,160 kilogrammes of steel made in one month, the meter consumption was 937,000 kWh, *i.e.*, an average of 0.70 kWh per kilogramme of steel.—*Elektrotechnische Zeitschrift.*

E. S. H.

REVIEWS.

Principles of Electrical Engineering. By William H. Timbie and Vannevar Bush. Pp. viii+513; figs. 244. New York and London: Wiley, Chapman & Hall, Ltd., Price 20s. net.

In view of the large number of works dealing with the principles of electrical engineering a new one must be of outstanding merit to receive any attention at all. The authors of the present work evidently understand that something novel is necessary before the publication of such a book can be justified. The reasons they give for producing their book are that they dealt specially with the magnetic circuit, modern electron theory, thermionic emission and dielectrics, while a large number of special practical examples have been used to illustrate the principles.

The first chapter of the book deals with the necessity for knowing the fundamental principles, and is in the traditional style of university introductory lectures. Even this chapter is illustrated by examples of a common-sense practical nature.

Chapters two to four deal with the electric circuit, power, energy, resistance. The special feature here is the inclusion of the star-delta transformations, which even yet are not nearly so widely known as they deserve to be. These are followed by a short discussion on electrolytic conduction.

The magnetic circuit, magnetic field, the properties of iron and steel, induced and generated voltages, and forces on conductors, take up chapters six to eleven. These are notworthy specially for the systematic use of the magnetic units "Maxwell, "Gilbert," and "Oersted," so that magnetic calculations are made—so far as the physical properties of the materials allow—exactly in the same way as electrical calculations. The benefit to the student will be obvious.

A feature not previously noted in students' text books is the inclusion of Froelich's equation for magnetic curves. The value of these in practical engineering may be questionable, but they are certainly of value to the student analysing the properties of materials.

The book concludes with a chapter on conduction through gases, and one on dielectrics. The work on thermionic conduction is necessarily rather limited in its scope, but what is included is extremely interesting and readable. The outstanding feature of the concluding chapter is the quantitative treatment of electrostatic voltmeters. This subject, in addition to being of great value in illustrating electrostatic principles, must commend itself to all engineers who have to deal with high-voltage testing.

A useful feature of the arrangement of the book is the inclusion of summaries of all the chapters. These are, however, sometimes insufficiently explicit to be of much value apart from the extended treatment in the chapters themselves. This reduces their value for rapid revisal.

The examples included are far more varied and practical than in any other book which has come before the notice of the reviewer. The only criticism that might be levelled against them is that some are so difficult that they could hardly be solved at all by a student. The examples, although of a thoroughly practical nature, never depart from their real purposes, *viz.*, to illustrate fundamental principles. The reviewer is of the opinion that answers to the examples should have been included, instead of being issued separately.

Apart from occasional vague passages, the style of the book is exceptionally clear. The only mistake noted was "stes" for "sets," page 45. It is also doubtful whether Faraday's law of electro-magnetic induction should be included as part of Lenz's law.

The general conclusion drawn by the reviewer is that if the direct instruction given by Messrs. Timbie and Bush is as good as their written book the students of Massachusetts Institute of Technology are in a very enviable position.

The work of the publishers is perfectly satisfactory.

Science in the Service of Man: Electricity. By S. G. Starling, A.R.C.Sc., B.Sc. Pp. 245; figs. 127. London: Longmans, Green & Co. Price 10s. 6d. net.

It is not the easiest of tasks to provide an entirely non-mathematical treatment of electricity for the general reader, for, since the development of the electromagnetic theory much of the progress of the science has been mathematical in character. At the same time, however, it must be said that the growth of electrical knowledge and the progress of its application to practice is a truly fascinating romance, and one well worth the telling. And because he has entered so wholeheartedly into the spirit of the subject Mr. Starling has produced a very delightful book.

It is only necessary to picture for a moment the daily life of a century ago and contrast it with the life of to-day to realise the revolution accomplished by electricity in the service of man. In this connection it must be remembered that practically all the truly great advances have been made by physicists working with no thought of immediate return, and the author does well to emphasise the interdependence of theoretical electricity and electrical engineering. He writes: "The development of knowledge for its own sake is one of the highest services that can be rendered to man, and no branch of science is richer in intellectual achievement than electricity. The subject, therefore, exhibits in a particular degree that reaction between pure and applied science which is vital to the life of both."

After a brief historical sketch, in which the great work of Volta, Oersted, Faraday, Maxwell and Kelvin is mentioned, the industrial applications are dealt with. These include the electromagnet as represented in some of its most important forms, such as lifting magnets, electromagnetic brakes, bells and magnetic separators, the dynamo, electromotors, including motor meters, alternating current generators, motors and transformers, electric lighting, the electric telegraph and telephone, and the various practical applications of electrolysis.

A long and interesting chapter on the electromagnetic theory introduces the subject of wireless telegraphy and telephony, and even includes such modern developments as Rankine's method of transmitting sounds by means of a beam of light.

Gases and X-rays form the subject of another chapter. Here the author has surpassed himself in his capacity for clear and accurate descriptions of some of the most intricate of experimental researches. The earlier work of Sir J. J. Thomson is described, together with the cloud experiments of Wilson and the recent work of Aston on Isotopes. A reference to Röntgen's discovery of X-rays leads to a brief description of modern applications of radiography in both the medical and industrial spheres, and concludes with a short but illuminating paragraph on Sir Wm. Bragg's work on X-rays and crystal structure.

A final chapter on Radioactivity deals with a less popular subject in a clear and interesting manner and concludes with a short treatment of atomic energy. A very useful and complete glossary of electrical terms in general use is given at the end of the book—an idea which might profitably be applied to many other semi-popular scientific works.

Mr. Starling is to be congratulated on this very attractive treatment of a very interesting but none the less difficult subject.

P.H.S.K.

OUR JUBILEE ISSUE.

Our issue of Friday next, November 17th, will be a special one celebrating the completion of Fifty Years' publication of the Electrical Review.

It will be very much larger than the usual weekly number, and for that reason all parts of the paper will have to be closed down at least one day in advance of the normal time.

Matter of interest and value continues to pour in from all directions, although much of the issue has already been printed. We therefore request our contributors, correspondents, and advertisers to take note of these facts, and forward anything intended for insertion in the issue immediately after reading this announcement.

All general advertising space has been disposed of for some time past, but it will be possible to accept small advertisements and official notices up to 5 p.m. on Tuesday, November 14th.

BUSINESS NOTES.

Bankruptcy Proceedings.—Vulco Magneto Co. (Herbert Rothwell, Stanley James Watson, and Frank Cecil Jinks), late of 11, Long Acre, W.C.—The firm failed in August, 1921, and on Tuesday last week the bankrupt Jinks applied to Mr. Registrar Mellor at the London Bankruptcy Court for an order of discharge. Mr. W. Boyle, Official Receiver, reported that the public examination of the bankrupt Watson stood adjourned till November 7th, but that fact need not interfere with the present application. The joint liabilities of the firm amounted to about £2,800, and although no assets were disclosed, a sum of £21 had been received by the trustee. The applicant, an electrical engineer, served with distinction during the war, and in May, 1919, purchased from the other bankrupts for £800 a one-third share in the business of electrical engineers carried on in Long Acre under the style of the "Vulco Magneto Co." The applicant took no part in the business, and in November, 1920, having expressed a desire to withdraw from the firm, he retired, and had since been dependent upon his Army pension. A balance-sheet then prepared showed the firm's liabilities £2,500 and assets valued at £3,581. The failure was attributed to lack of capital, to the omission of a contractor to deliver essential parts, and consequent claims for damages and legal costs. After hearing Mr. E. W. Hansell, in support of the application, the learned Registrar granted a discharge, subject to a suspension of three months.

John Bakewell, 63, Waterside Road, Barton-on-Humber, electric light and power engineer.—The receiving order in this matter was made on October 17th on debtor's own petition. The statement of affairs shows liabilities of £713, and there is a deficiency of £613. The first meeting of the creditors was held on November 1st at the Official Receiver's office, St.

Mary's Chambers, Great Grimsby, when the case, being a summary one, was left with the Official Receiver as trustee. The following are creditors:—

	£		£
Beadle, T., & Co., Ltd.	20	Electric Suction Cleaner Co.	11
Bakewell, Wm.	106	General Electric Co., Ltd.	28
Bruce & Sons	2	Bankers	317
Dickinson, A.	26	Leach & Co., Ltd.	27
Lemon Screw Lamp Co., Ltd.	53	Rackwell, L.	14

FRANK PORTER, electrical engineer, 17, Goldhawk Road, Shepherds Bush.—The public examination of this debtor was held on November 7th, before Mr. Registrar Mellor, at the London Bankruptcy Court, the accounts showing liabilities £766, and assets valued at £226. Replying to Mr. Armstrong, Assistant Official Receiver, the debtor said that for many years prior to August, 1921, he was employed by various firms as an electrical engineer. In that month he and a partner, who provided the only capital of £40, commenced business at the above address under the style of "Porter & Simpson." The partnership was dissolved in the following October, and witness continued the business alone until, owing to pressure by creditors, he filed his own petition on July 28th. He attributed his failure and insolvency to lack of capital and business experience. The examination was concluded.

W. FORD (Redditch Electrical Accessories Co.), electrician, Central Chambers, Unicorn Hill, Redditch.—Receiving order made on October 31st on creditor's petition.

W. SHAW THE YOUNGER, electrical engineer, 26, Westcliffe Road, Shipley, Yorks.—First meeting, November 13th, at the Official Receiver's office, 12, Duke Street, Bradford. Public examination, December 13th, at the Court House, Bradford.

F. W. CHAMIER, mining and electrical engineer, late of 59, Fleet Street, E.C.—Last day for proofs for dividend, November 30th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

Company Liquidations.—SAITAX MANUFACTURING CO., LTD.—A meeting of members has been called for December 4th at 81, Albany Street, N.W., to hear an account of the winding-up from the liquidator, Mr. W. Adams.

PORTABLE ELECTRIC MOTORS (1919), LTD.—The Senior Official Receiver and Liquidator is applying for his release. In his statement he says:—"The receiver for the debenture holders reports that he has sold the assets of the company for £11,600, which sum is insufficient to meet the claims of the debenture holders and pay the costs, charges, and expenses of the receivership. In these circumstances there is no prospect whatever of funds becoming available for distribution amongst the unsecured creditors and shareholders."

COMPARRI WIRELESS CONTROL SYNDICATE, LTD.—Winding up voluntarily. Liquidator: Mr. H. Harwood, 73-75, Albion Street, Leeds. Meeting of creditors, November 14th, at the Midland Grand Hotel, St. Pancras, N.W.

BELL BATTERY CO., LTD.—Winding up voluntarily. Liquidator: Mr. F. Wilcock, 1, Great Winchester Street, E.C. Meeting of creditors, November 21st.

CORONA LAMPWORKS (NORTHERN), LTD., renamed the James Brown Lamp Manufacturing Association, Ltd.—Meeting of creditors is called for November 14th, at the office of the liquidator, Post Office House, Leeds. Liquidator, Mr. A. Dobson.

Dissolution of Partnership.—E. E. ANDERSON & Co., electrical engineers, 116, Snow Hill, Birmingham.—Mr. E. E. Anderson and Mr. H. N. Moses have dissolved partnership.

Trade Announcements.—MESSRS. R. FERGUSON and F. STONE have entered into partnership as Ferguson & Stone, electrical and wireless engineers, 178, King Street, Hammersmith, London, W.6, and they desire to receive catalogues and lists.

MESSRS. E. A. INGOLD, LTD., have removed from Shipley to 19, Booth Street, Bradford.

MESSRS. R. MACKENZIE & SONS, electrical engineers, of Dingwall, have opened a branch business at Alness, under the management of Mr. William T. Mackenzie.

MESSRS. HALL BROS., electricians, have opened new showroom premises at 5, The Promenade, Malvern.

MR. D. S. PAXTON, electrical and mechanical engineer, has removed to 312, Deansgate, Manchester.

MESSRS. A. C. ALEXANDRA & Co., LTD., 86, Pilgrim Street, Newcastle-on-Tyne, have ceased to trade under that style, and their registered name is now The Northumbria Engineering Agencies, Ltd.

MR. S. D. SCHOFIELD, M.I.Mech.E., M.Inst.E.E., engineer representative for Holophane, Ltd., is moving his headquarters from Sheffield to Penistone on the 11th inst. His address will be: Holophane, Ltd., Penistone, Yorks.

MESSRS. G. H. T. PETERSEN (ENGINEERS' MERCHANTS), LTD., have removed to 82, Victoria Street, London, S.W.1.

Catalogues and Lists.—THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C.4.—Three illustrated pamphlets:—No. L.251, giving reduced prices of various types of "Mazda" lamps; L.248, dealing with the "Posterlite" flood-lighting fitting; and L.256, describing the Langmuir condensation pump.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—A pamphlet dealing with the "Marconiphone" V.2 [illegible].

MESSRS. HORACE GREEN & Co., Station Works, Cononley, Yorks.—Lists Nos. 221 and 222, giving specifications, dimensions, prices, and other details of d.c. and a.c. motors.

WESTINGHOUSE INTERNATIONAL ELECTRIC CO., New York, U.S.A.—An illustrated circular (No. 7,376), advertising self-starting synchronous motors for driving ammonia compressors. Views of installations are given.

THE ELECTRICAL ALLOY CO., Gray's Inn Road, W.C.1.—Two pamphlets dealing with metals for electrical work, including resistance wires, contact pieces, electrodes, &c.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—November stock list of motors and dynamos.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A series of 16 small pamphlets, arranged for overprinting, advertising irons, hot-water radiators, kettles, pedestal heaters, and other electrical appliances. Illustrated and priced.

ENGINEERING & LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts.—Two illustrated leaflets dealing with cast-iron lighting fittings (priced), and "anti-vibration" disks.

MESSRS. A. EMANUEL & SONS, LTD., 7-13, George Street, Manchester Square, W.1. — A well-produced catalogue (52 pp.) of lighting fittings of many types—bowls, pendants, lanterns, &c.—and accessories. Fully priced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—An illustrated pamphlet advertising the "A.B.C." electric "laundress."

Price Reductions.—MESSRS. C. A. VANDERVELL & Co., LTD., announce that substantial reductions have been made in the prices of all their products as from November 6th. A new catalogue is in course of preparation.

The Policy of the Electrical Contractors' Association.—We reproduce the following from the November issue of the *Electrical Contractor*:—"POLICY.—*Appointment of Special Committee.*—A step of great importance an done which promises the most far-reaching results was taken by the October Council at the suggestion of the Trading Committee, when a special committee, the most weighty perhaps, which has ever been called together by the Association, was appointed to define the policy of the Association in its relations with other groups of traders within the electrical industry and incidentally with the various classes of contractors and electrical retailers.

"The Special Committee so appointed will consist of the president, the chairman of the Trading Committee, and five past-presidents selected upon account of their special qualifications for this important work. The Association is fortunate inasmuch as each of the gentlemen concerned has consented to act, although in some cases at least at no inconsiderable personal inconvenience and sacrifice.

"The problems before the special committee are no light ones. The quantities with which it has to deal are as yet undefined and confused, the interests overlapping and often opposing. Nevertheless, it will be immediately admitted that the object in view—the laying down of a foundation for our whole future trading policy—is worthy of the labour, and of the importance attached to it by the Council."

Concert.—The 14th annual concert of the Halifax Corporation Tramways Employés' Club, in aid of local charities and the employés' benevolent fund, was held on November 2nd at the Victoria Hall, when a mixed programme of operatic features and general "popular" items was presented to a very large audience. The Tramways Glee Party, under the conductorship of Mr. Edwin Holroyd, rendered an excellent programme of their own.

Applications for British Trade Marks.—Below is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Villiers. No. 425,661. Class 6.—Magnetos, being parts of internal-combustion engines. Villiers Engineering Co., Ltd., Blakenhall, Wolverhampton. November 1st, 1922.

Teleola. No. 428,635. Class 8.—Instruments for wireless communications, and gramophones. Dale, Forty & Co., Ltd., 106, Great Portland Street, London, W. November 1st, 1922.

Boiler Contracts.—Recent orders received by the Stirling Boiler Co., Ltd., comprise two 25,000-lb. units, with complete boiler-house plant, for the borough of Torquay; three 35,000-lb. units, with boiler-house plant, for the West Gloucester Power Co.'s new station at Lydney, Forest of Dean, ordered through the Foundation Co., Ltd.; three orders for sugar refineries at home and abroad; and others for municipal colliery, and industrial authorities. Twenty boilers are included in the above, having a total heating surface of 108,039 sq. ft.

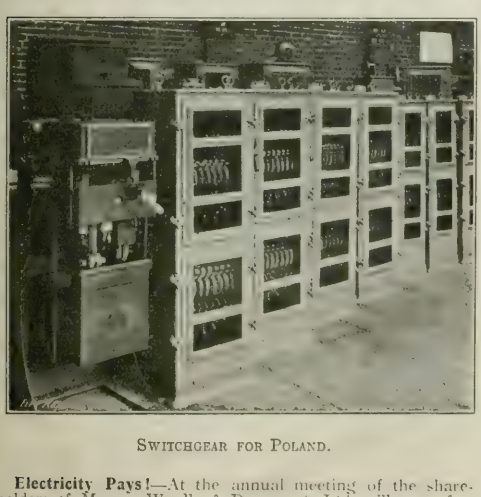
Electricity Supply Rifle League.—The following are the results of matches during September and October:—City Co., 584, Central Co., 574; County Co., 579, City Co., 579; County Co., 571, Fulham, 525; Hackney, 533, Fulham, 525; Metropolitan Co., 565, Hackney, 521; County Co., 580, Central Co., 578; Shoreditch, 582, Central Co., 568; Central Co., 571, Hackney, 527; City Co., 586, Hackney, 516; City Co., 589, Metropolitan Co., 578; Shoreditch, 584, Hackney, 507; County Co., 573, Hackney, 530. The City Co. heads the list with 19 points.

A G.E.C. Exhibition.—We are reminded of the near approach of Christmas by an exhibition which the General Electric Co., Ltd., has organised at Magnet House, Kingsway. The idea of electrical gifts has been growing steadily for the last two or three years, and the lower prices at which appliances are now obtainable is certain to give the sale of these a considerable "lift."

The display arranged at Magnet House is intended to guide both the electrical dealer and the private individual in the choice of suitable presents. For the retailer, several suggestions for displaying goods have been included in the show. Two representations of window displays contain many ideas upon which the dealer can draw. Another device which is likely to prove effective is a revolving table about 2 ft. in diameter, bearing examples of the company's smaller appliances, driven slowly by a "Witton" fractional horse-power motor. For the public at large there is a wide selection of appliances both for use and for ornament. There are the more prosaic irons, boiling rings, kettles, &c., and, on the other hand, novelties such as the now-popular small dynamo hand lamp, or the more-or-less "luxury" articles—cigar lighters, wireless telephony receiving sets, &c. Larger articles are also included, there being cookers, washing machines, &c. A helpful feature of the show is the written explanation and estimate of cost attached to many appliances. On one side of the showroom various types of bowl fittings are placed side by side to enable comparisons to be made. Near this a twin-division cabinet contrasts the effects of an ordinary electric lamp with a "daylight" lamp.

The industrial side is represented by a selection of switchgear and electrical tools.

Switchgear for Poland.—Messrs. Brook, Hirst & Co., Ltd., have secured a contract for the switchgear required in connection with the electrification of a Polish textile factory—the first Polish-owned undertaking of the kind to be equipped entirely by British manufacturers. The accompanying illustration shows a part of the gear being supplied. These are air-break rotor-starting panels of the multiple-lever type.



Switchgear for Poland.

Electricity Pays!—At the annual meeting of the shareholders of Messrs. Wardle & Davenport, Ltd., silk manufacturers, Leek (Staffs.), the chairman stated that the power plant for electrically lighting the works and driving the machinery had come into operation during the year, and the expense incurred had been justified by the result shown.

For Sale.—By direction of the Disposal Board, Messrs. Bowling Bros. will sell by auction, on November 21st and following days, at the Royal Naval Hospital, Pembroke Dock, equipment, machinery, plant, and electrical fittings; and on Monday, November 27th and following days, at the Royal Engineers' Stores, Scott's Road, Southall, Messrs. G. Head and Co. will offer by auction electrical material, fittings, lamps, &c. (See our advertisement pages to-day.)

Electrical Apparatus for Electrical Men.—Mr. F. H. Howell, the London Sales Manager of "Hotpoint" and "Falco" electrical appliances, draws our attention to an offer of great value which his principals are making to electrical engineers, contractors, and salesmen. They are prepared to supply their standard cookers for personal use at a special net price, which can be paid, if necessary, in four quarterly instalments. This matter is commented up in our leading columns to-day.

German Electrical Legislation.—According to statements made at a recent meeting at Dusseldorf of the members of the Union of Electricity Consumers in Rhenish-Westphalia, the draft of a new electricity economy law has been prepared. The confidential information given concerning the law is said to have "greatly moved the meeting."

Book Notices.—"Wireless: Popular and Practical," by Lt.-Col. C. G. Chetwoode Crawley. Pp. vi+92; 15 figs., 10 illustrations. London: Hutchinson & Co. Price 1s. 6d. net.

"How to Form a Company," by H. W. Jordan. Fourteenth edition. Pp. viii+103. London: Jordan & Sons, Ltd. Price 1s. 6d. net.

The *Parish Almanack* for 1923 (1s.) has reached us. Size as last. It is excellently produced, and, as usual, good colour printing is largely and effectively used.

"Radio Phone Receiving," by E. Hausmann. Pp. viii+183, illustrated. London: Constable & Co., Ltd. Price 7s. net.

"Advanced Laboratory Practice in Electricity and Magnetism," by E. M. Terry. Pp. xii+272, figs. 120. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

"Transformer Standards" (27 pp.). Cleveland, Ohio: The Electric Power Club.—This is the second edition of a work setting out standard types of transformers, with details of the tests to which they must be subjected before leaving the factory. Many small points are also dealt with, as, for instance, name-plate marking, lead marking, accessories, &c.

"Bulletin Oerlikon," April, May, June, and July. London: Messrs. Oerlikon, Ltd.—This is the English edition of the firm's magazine, and most of the articles contained in three of the four numbers deal with various phases of the electrification of the Swiss Federal Railways—power stations, repair shops, locomotives, trackwork, &c. The June issue describes semi-outdoor sub-stations at Valenciennes and Jeumont erected by the company.

"The *Journal* of the Junior Institution of Engineers." Vol. XXXIII, Part 2, November. London: Percival Marshall and Co. Price 2s. net.—This issue contains a paper by Mr. W. A. Tookey on "Engineering in Bacon Factories"; the address of the president of the North-Eastern Section (Mr. H. I. Brackenbury); and notes of proceedings and book reviews.

"The Vickers-Petters Sportsman." Special Palestine Number. November, 1922. Ipswich: Vickers-Petters Sports Club.—This contains many interesting notes, and the main article is a description of the methods adopted in conveying the waters of the Nile into Palestine for supplying the troops and railways. This should prove of interest to those who served in this region during the war.

"Railway Signalling: Automatic," by F. R. Wilson. Pp. xiv+116; figs. 75. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

"The Law Relating to Electrical Energy in India," by J. W. Meares. Second edition. Pp. xx+381. Calcutta: Thacker, Spink & Co. Price 24s.

Sports Club.—On Saturday last, the football section of the Sports and Social Club, run by employés of the Union Cable Co., Ltd., played a friendly game with Henley's Athletic Club on their own ground at Dagenham Dock, a good game resulting in Henley's being the victors by 4 goals to 0. After the game the members of the Union Club entertained the visitors to tea, followed by a pierrot entertainment presented by "The Philippians," a new troupe. Mr. J. Snow Huddleston, the general manager of the Union Co., was in the chair.

Steel Works Reopened.—After being closed for about 18 months, the Cleveland steel works of Messrs. Bolckow, Vaughan & Co. have been restarted.

Switchgear Gift.—Messrs. Brook, Hirst & Co., Ltd., of Chester, have presented a motor-control equipment to the electrical engineering department of the University College of North Wales.

Unemployment.—The number of persons on October 30th recorded on the live registers of the Employment Exchanges in Great Britain as wholly unemployed was 1,337,100. This was 9,084 more than in the preceding week and 486,633 less than the figure recorded at the beginning of last January. The number working short time and drawing benefit for intervals of unemployment was 49,400 on October 30th, as compared with 48,858 on October 23rd and 934,786 on July 1st, 1921.—*The Times*.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—January 3rd and 4th, Physical and Optical Societies' Exhibition; February 19th to March 2nd, British Industries Fair; March 15th to 24th, Photographic Fair; June 1st to 4th, International Mining Exhibition.

Birmingham.—February 19th to March 2nd, British Industries Fair.

Hull.—April 20th to May 5th, International Domestic Economy and Trade Exhibition.

Leicester.—December 7th to 16th, International Domestic Economy and Trade Exhibition.

Belgium (*Brussels*).—April 9th to 25th, Commercial Fair.

Finland (*Helsingfors*).—July 1st to 7th, International Samples Fair.

France (*Paris*).—December 15th to January 2nd, International Aero Exhibition; January 20th to 28th, Agricultural Machinery Exhibition. (*Bordeaux*).—June 15th to 30th, Samples Fair. (*Lyons*).—March 1st to 15th, Spring Fair.

Germany (*Cologne*).—Spring, 1923, Samples Fair.

Italy (*Milan*).—April, Samples Fair.

Madagascar (*Antananarivo*).—August 15th to September 15th, International Commercial Fair.

Deferred Australian Duties.—It is officially announced that the operation of the deferred duties on the undermentioned tariff items under and has been postponed to the date shown opposite each item. —Item 147: Iron and steel, viz., plates and sheets, plain, tinned, March 30th, 1923. Item 152 (a): Iron and steel, tubes and pipes (except riveted, cast, close-jointed or cycle tubes or pipes), not more than 3 in. internal diameter, iron and steel boiler tubes, March 30th, 1923. Item 161 (b) (2): Cables, telegraph and telephone, paper-insulated, lead-covered, January 1st, 1923.—*Reuter's Trade Service* (Melbourne).

Copper and Lead Prices.—Messrs. F. Smith & Co. report November 7th:—Copper (electrolytic) bars, £71, 5s. increase; do. do. sheets, no change; do. do. wire rods, £81, 5s. increase; do. do. h.c. wire, 10½d. 1/16d. increase.

Messrs. James & Shakespeare report November 9th:—Copper bars (best selected), sheet and rods, no change; English pig lead, no change.

Local Exhibition.—On Monday next the Mayor of Poplar (Councillor C. E. Sumner) will inaugurate the new extensions to the Glaucus Street electricity works, and at the same time open an electrical exhibition, which will run until November 18th. The co-operation of a number of leading manufacturers has been obtained, and the E.D.A. has published a series of special pamphlets for the occasion dealing with "Power and Progress in Poplar," indicating the advance that has been made in recent years in this direction. Incidentally, these publications show that the E.D.A. is alive to the value of local exhibitions for inculcating the "electrical idea."

New French Companies.—Secteur Electrique de la Brie is the style of company formed at Guignes-Rabatin (Seine-et-Marne) for general electrical purposes. Its capital is 1,000,000 fr. in 4,000 250-fr. shares. The capital may be raised up to 3,500,000 fr. by the simple decision of the Board.

The Société d'Electricité Régionale des Cantons de Lassigny et Limitrophes has been constituted at Noyon, with a capital of 200,000 fr. in 2,000 100-fr. parts. The object of the company is to supply electricity to the agricultural districts named.

LIGHTING AND POWER NOTES.

Alderley Edge.—New Plant.—The South-East Lancashire Electricity Board has approved of the installation of a further 150-kW set by the Alderley and Wilmslow Electricity Supply Co., Ltd.

Alton.—Electricity Supply.—The Urban Council has consulted Sir Charles Bright & Partners, Ltd., with a view to providing a supply of electricity for the town.

Athboy (Co. Meath).—Electricity Supply.—Sanction is being sought from the Free State Local Government Department to a scheme for supplying electricity in the district.

Atherton.—Price Reductions.—The Urban District Council has decided that from the date of the meter readings for quarter ended September 30th, 1922, the charges for electricity be reduced as follows:—For lighting purposes, by 1d. per kWh; for power, by ½d. per kWh; the minimum charge to be reduced from 5s. to 4s. per quarter.

Australia.—New South Wales.—According to the *Commonwealth Engineer*, the N.S.W. Minister for Public Works has endorsed the necessity for a Commission to control the generation of electric power within the State. The question of introducing legislation to create an Electricity Commission is now under consideration. It is expected that the first work to be taken in hand will be the development of the hydro-electric resources of the State. A number of schemes have been investigated by the Public Works Department, but as the State is not richly endowed with extensive water-power resources near the centres of population, the question of establishing steam-driven plants in proximity to the coal mines will naturally receive early attention. Ample scope exists for the proposed Commission in developing the State's power resources on the most economical lines.

Bedford.—Extension of Supply.—The Electricity Committee has recommended to the Town Council that the Biggleswade Urban District Council be provided with a bulk supply of electricity, and that as that district is outside the proposed extended area steps should be taken to obtain an Order giving the Council authority to supply Biggleswade.

Belfast.—Extensions to Harbour Station.—At a recent meeting of the Corporation on the 1st inst., it was decided to further extend the new power station at the harbour. The extensions include a new 12,500-kW turbo-alternator at a cost of £66,500. The total cost of the plant, building, and equipment will be £119,330. This will bring the total cost of the new station up to £991,000. The work at the new station is proceeding rapidly, but it is not expected that the plant will be in working order until next August.

Birkenhead.—Extension of Supply.—The Corporation proposes to supply electricity to the districts of Bromborough and Gabington. It is proposed to supply the residents of these districts at the same rate as the Corporation supplies Prenton, Upton, and Nocturum. It is estimated that on an expenditure of £16,000 the first year's profit would be £1,420.

Blackburn.—Extension of Supply.—The formal switching on of the electric light for Wilpshire and district took place recently. Cables have been laid in Wilpshire, Salesbury, and Clayton-le-Dale, and most of the residents have agreed to use electricity.

Blackrock (Co. Dublin).—Amended Order Approved.—The Urban District Council has been notified by the Ministry of Commerce and Industry that the amended Blackrock Electric Lighting Extensions Order, 1922, has been approved and that steps will be taken to obtain Parliamentary approval thereof.

Bolton.—Price Reductions.—The Electricity Committee is reducing the charges for electricity for lighting, power, and tramway purposes by 0.1d. per kWh as from the commencement of the March quarter, 1923.

Bootle.—Price Reductions.—Dating back to October 5th, a reduction of 5 per cent. has been made by the Electricity Committee in the charge for electricity for lighting and 25 per cent. for power.

Brentwood.—Electricity Supply.—The Urban Council has consented to the application of the Brentwood and District Electric Co., Ltd., for power to supply electricity in the district, subject to the cables being laid underground, and to the maximum charge for electricity being 1s. per kWh.

Canada.—Nova Scotia.—A scheme of hydro-electrical development on the east branch of Bear River at an approximate cost of 11,150,000 dollars, which would supply the north shore of Nova Scotia from Yarmouth to Middleton, was outlined in an address given before the Yarmouth Town Council by Mr. K. H. Smith, chief engineer of the Nova Scotia Water Power Commission. Distributing stations under the plan would be at Middleton, Bridgetown, Annapolis, Bear River, Digby, Weymouth, Port Maitland, and Yarmouth.—*Reuter's Trade Service* (Yarmouth, N.S.).

Chester.—Loan.—The Corporation has decided to make application to the Electricity Commissioners for sanction to borrow the sum of £25,000 for the purpose of extending mains and carrying out work for the distribution of electricity in the area of supply defined in the Chester (Extension) Special Order, 1921.

Continental.—Russia.—Concerning the company's interests in Russia, the Bank for Electrical Undertakings of Zurich reports that the works of the Electric Lighting Co. of 1886 in Petrograd and Moscow continue in operation without having experienced substantial damage. The installations of the Moscow Power Transmission Co. are also still in activity.

South Jutland.—The long-discussed proposal to construct a h.p. transmission line to supply electricity to South Jutland has taken definite form, says the *Financial Times*, and the work is to be proceeded with.

France.—The Conseil Général of the Loire Inférieure has decided to erect a high-pressure network in the *département*. The plan outlined for the network, drawn up by the Administration, has been submitted to the departmental Commission and to the firms of Desaulty, Giraudon, and to the Compagnie Générale d'Enterprises Electriques. The loan of 15,000,000 fr. voted in 1921 for carrying out the scheme has been reduced to 10,000,000 fr. It is anticipated that the scheme will be in operation by December 31st next.

In the Oise *département* the communes of nine cantons are about to be electrified by various *syndicats agricoles*, while the Conseil Général has sanctioned the electrification by an inter-communal syndicate of the district of Ansauvillers.

The Conseil Général of the *Département* de la Corrèze has called upon the Société des Grands Réseaux Electriques to put to use its electricity works at Bar, capable of an output of 10,200 h.p., but which now yields barely 450 h.p. The Compagnie d'Electricité de Limoges has agreed to take 2,500,000 kWh, and states that there is a possibility of utilising electrical energy up to 20,000,000 kWh by supplying a number of communes and by the manufacture of chemical manures.

A scheme for supplying electricity to 222 localities in 19 communes is under consideration in this *département*.

At a recent meeting held at Sedan steps were taken to form a syndicate for the electrification of the unelectrified parts of the *département* of the Meuse. At Commercy the Syndicat Intercommunal d'Electrification de l'Aire has been formed to serve some 15 communes in the neighbourhood. Some 200 communes are about to be electrified in the Ardennes, a departmental committee having been nominated for the purpose.

M. Oneron, Minister of Agriculture, announces in the *Matin* that 1,200,000,000 fr. is to be placed at the disposal of agriculture to carry out the programme of supplying rural districts with electricity. The State, he says, will agree to grant a 30-year loan, totalling 600,000,000 fr., at 4 per cent., to the Office National de Crédit Agricole and agricultural syndicates, as well as to communes, subject to their furnishing the remaining 600,000,000 fr.—*Reuter* (Paris).

A third 6,000-h.p. gas engine and generator has recently been installed at the electricity station connected with the Mont-Saint-Martin works of the Société des Acieries de Longwy. Orders have also been placed for an additional set of 7,500 h.p. in order to meet the increasing demand for electricity for power purposes.

Finland.—*Imatra.*—Operations are now in progress in connection with the proposed hydro-electric works at Imatra by the use of the water power of the Upper Vuoksen, which will yield 392,000 h.p. The work is being undertaken under the auspices of the State Hydro-Electric Committee, and this first instalment, which will represent 70,000 turbine h.p., is expected to involve an expenditure of 161,000,000 Finnish marks.

Cullompton.—Electricity Supply.—The Parish Council has approved of an electric lighting scheme submitted by the Electric Lighting Co. Electricity will be supplied by overhead wires.

Doncaster.—Plant Extensions.—Extensions to the Corporation electricity works were formally opened on November 2nd. They comprise a new turbo-generator of 6,000-kW capacity, and extra boiler-house plant, costing approximately £84,000, and installed to meet the increased demand of the town and district. The new plant brings the total output of the station up to 8,300 kW.

Glasgow.—"All-Electric" Houses.—The Corporation Housing Committee is considering a proposal to make Cathcart Road and Hawthorn Street housing schemes "all-electric."

Electricity Scheme.—With reference to the installation of electric light at Sandyhills housing scheme, the Clyde Valley Electrical Power Co. states that it is prepared to arrange for the supply if the Corporation will pay the difference between the cost of a suitable overhead scheme and an underground scheme (£1,377).

Howth (Co. Dublin).—Electricity Supply.—The District Council has applied to the Free State Local Government Department for sanction to a proposed electricity scheme for the district. Electrical energy will be supplied by the Great Northern (Ireland) Railway Co.

Ireland.—Water-Power Scheme.—The Irish Power Syndicate has applied for a Special Order under the Electricity Supply Acts, 1882 to 1919, for authority to utilise the River Liffey for generating electricity. Power stations will be erected at Bishopland and Downings North (Co. Kildare).

Keighley.—Extension of Supply.—With regard to the contemplated supply of electricity to Skipton by the Corporation, and the proposal that the Corporation should supply electricity in bulk to the Yorkshire Electric Power Co., for the latter to supply to Skipton—a proposal which the Keighley Council has recently refused—a letter was read at a recent meeting of the Town Council from the Electricity Commissioners inviting the Council to send a deputation to meet the Commissioners in London. The meeting has appointed a deputation to wait upon the Electricity Commissioners.

Kirkheaton.—Electricity Supply.—The Urban District Council has decided to communicate with the Huddersfield Corporation and the Electricity Commissioners with respect to the question of electricity supply to the district.

Llandudno.—New Plant.—The Urban District Council has instructed the electrical engineer to obtain quotations for the installation of one 500-kW set and one 300-kW set.

London.—Stepney.—Satisfactory clauses for the protection of the L.C.C.'s interests having been inserted, the County Council has decided to withdraw its opposition to the Borough Council's application for a Special Order in connection with the Limehouse power station.

Machynlleth.—Company's Proposals.—At a recent meeting of the Council, a letter was read from a firm of electrical and mechanical engineers at Windsor stating that the approximate cost of an installation to supply electricity for the town by semi-Diesel engines would be £3,300, exclusive of buildings. Actual figures could not be given without a canvass of the town. If the company could get sufficient local support it was prepared to undertake a scheme and bear all responsibility, forming a company for the purpose. It was decided to invite the firm's representative to attend the Council and explain the scheme.

Ripon.—Purchase of Plant.—The Electricity Committee has recommended that a deputation be appointed to approach Lord Ripon with a view to the purchase of the camp power station plant.

Torquay.—Loan.—The Town Council is applying to the Electricity Commissioners for a loan of £18,000 for the erection of a sub-station at the rear of the Town Hall.

Ulverston.—Electricity Supply.—The District Council and the Barrow Corporation have come to a tentative agreement for the supply of electricity to the district from Barrow. With regard to the neighbouring township of Dalton, negotiations are at the moment at a deadlock, as the Dalton Council is asking that the charges should be at the same rates as those in Barrow, and that any profits from the undertaking be not appropriated for any other purposes. The Barrow sub-committee has refused to accept these conditions, and work is proceeding for the supply to Ulverston only.

TRAMWAY AND RAILWAY NOTES.

Bexley.—L.C.C.'s Decision.—Upon the recommendation of its Highways Committee, the London County Council has decided not to exercise its right to purchase that part of the Bexley undertaking situated within the County of London.

Continental.—France.—The Constructions Electriques de France has just completed at its Tarbes works the first electric locomotive built in France, part of the programme for the general electrification of railways. This locomotive, of the type BB, is of 1,500 h.p., and weighs 50 tons. It will be tried on the Midi Railway network throughout the winter at various parts of the system before being placed on regular service, which will probably take place about March, 1923, between Pau and Lourdes and in May between Lourdes and Montréjeau. Thereafter 50 locomotives of the same type will be delivered, 30 for passengers and 20 for goods.

The Pau-Tarbes section of the Dox-Toulouse electric railway was inaugurated by M. le Trocquer, Minister of Public Works, on October 30th. Continuous current at 1,500 V is employed, and the locomotives, which are of 4,000 h.p., are capable of attaining a speed of 56 miles per hour.

Spain.—Application has been made to the Ministero de Fomento for sanction to run a service of restaurant tramway cars between Madrid and Barcelona.

A company has been formed with a view to constructing an electric tramway line to run between Andujar and Arjona.

Switzerland.—The administration of the Swiss Federal Railways has issued a report on the progress made in electrification during the four years that have elapsed since that work began. Out of the total of 1,795 miles composing the Federal Railway system, 223 miles has already been electrified. A beginning has been made with the two main routes into Italy. The entire St. Gothard line from Lucerne to the Swiss-Italian frontier at Chiasso, 140 miles in length, is now worked by electricity. The rival route, that of the Simplon, has also been electrified from Sion to the Swiss-Italian frontier station of Iselle at the Italian end of the Simplon tunnel—a distance of 47 miles. It is proposed next year to electrify the portion of this line between Sion and Lausanne, and as soon as possible thereafter to extend the electrification from Lausanne to the Franco-Italian frontier station of Vallorbe. In 1924 the line from Lucerne to Bâle is to be electrified. Besides these two main lines, three smaller lines have been electrified, *viz.*, Berne to Scherzlingen (21 miles), Arth to Zuz (10 miles), and Immensee to Rothkreuz (five miles). Next year the line from Lucerne to Zurich, and soon afterwards that from Zurich to Berne, are also to be electrified. These figures do not include the private companies, owning a total mileage of 531 miles, some of which has already been electrified.—*Morning Post.*

Italy.—Signor Mussolini, the new Fascist Prime Minister, has decided to abolish all Government offices and enterprises that are not making a profit, including State railway control. What effect the handing over of the railways to private enterprise will have on electrification schemes remains to be seen.—*Reuter.*

Edinburgh.—Tramway Siding.—With a view to providing accommodation for cars during rush traffic, the Tramways Committee is acquiring a plot of land from the North British Distillery Co., at Westfield Road, for the purpose of constructing a tramway siding.

Leicester.—New Route.—The Tramways Committee has under consideration a proposal to construct a double tramway line along Blackbird Lane and so connect up the existing lines in Woodgate and Abbey Park Road. The estimated cost of carrying out the work is £51,000. The Great Central Railway bridge would have to be widened, which would involve an additional expenditure of £11,500.

Liversedge (Yorks.).—Accident.—Owing to the slippery state of the metals, the brakes failed to act on a tramcar proceeding down a steep hill, and the car ran into a horse and cart. The horse and cart were swung across the road, and all the glass windows on one side of the tramcar were broken. Fortunately the passengers escaped without injury.

London.—Reduction of Underground Fares.—The Underground group of companies intends to carry out a scheme of reductions in fares on January 1st. On the Underground Railways it is proposed to retain the initial 1½d. fare, but to reduce the fares above that amount to an approximate rate of 1d. per mile up to 4d., and thereafter to increase the distance given for all rates of fare above 4d. The workmen's fares will be correspondingly reduced. (The minimum return fare remains, however, 3d.) Where the season-ticket rates have been based upon the present ordinary fares, they will be reduced to agree with the new ordinary fares.

Metropolitan Railway "Speed-up."—Metropolitan Railway services are to be augmented and "speeded-up." Ten new trains will run between the City and Willesden Green, Harrow, and Uxbridge. Circle trains will be five-car instead of four-car throughout the day. Certain Harrow trains have been extended to West Harrow and Rayner's Lane. Slower services have been made possible by the introduction of three-door cars, which saves time at stations; over 100 cars are now fitted in this way. Twelve electric locomotives are also now in service.—*Westminster Gazette.*

City Tramways.—The London County Council proposes, with the consent of the City Corporation, to introduce tramways in Farringdon Road as far as Ludgate Circus, from Gray's Inn Road to Farringdon Road, *via* Holborn and Charterhouse Street, and over Southwark Bridge to Upper Thames Street.—*Daily Express.*

Tramway Route Indicator.—An indicator which shows by means of a pointer the exact position of a tramcar at any point of the route has been introduced on the tramcars running from Tottenham Court Road to Palmers Green and Enfield. The L.C.C. is considering the question of adopting these guides.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—Night Telegraph Service.—Beginning on November 1st, a night "letter telegram" service for messages in plain language became available from this country to Canada and Newfoundland, "*via* Imperial." Messages handed in before noon will be delivered on the morning of the following day; those handed in after noon will be delivered on the morning of the next day but one.

Italy.—State *v.* Private Enterprise.—Signor Mussolini, the new Fascist Prime Minister, has decided to hand over the postal, telegraph, and telephone services to private enterprise, says *Reuter*. Under the old conditions, besides being badly run, these services represented a great loss to the Government.

France.—Broadcasting.—Broadcasting of regular concerts by wireless telephony began in Paris on November 6th. The wireless companies have been released from certain administrative restrictions as to broadcasting, and they have formed themselves into an organisation named Radiola Concerts, which will give regular concerts of vocal and instrumental music.—*The Times.*

Subscribers to the broadcasting service from the Eiffel Tower number about 1,800, and fresh names are entered daily. The service is dispensing a great variety of messages, from concerts to weather forecasts and market quotations. Many French communes receive the daily weather forecast by wireless.

Telegraph Rates Increased.—Owing to the fall in the value of the franc, the telegraph rate to England was raised to 55 centimes per word from November 1st.—*Reuter* (Paris).

Hull.—Municipal Telephones.—The revenue account of Hull Corporation telephone undertaking shows an income of more than £55,000 for the half-year and a balance of £15,000. The undertaking has to hand over to the Government some thousands of pounds in royalties.

Ireland.—Cable Stations.—It was stated at the Cork Harbour Board meeting on November 1st that the cable station which was to have been erected at Queenstown will now be transferred to Plymouth, the company stating that the alteration of plans was due to the unsettled Irish conditions. The Board requested the company not to alter its plans in view of the guarantee of safety of its property at Queenstown which the Board was prepared to give.—*Manchester Guardian.*

Radio Telegraphy.—Secret Transmission.—According to a message from *The Times* Paris correspondent, M. Edouard Belin has devised a method for secret wireless communication. As in his apparatus for the transmission of script and pictures by wireless or by telephone, he employs a device for securing the almost absolute synchronism of motors at the receiving and transmitting stations. These actuate a cylinder through the medium of six concentric disks provided with notches and levers which, when engaged, revolve the cylinder. They can be set to an almost indefinite number of combinations. The particular combination at which a message is to be passed is selected beforehand by the receiving and transmitting stations, and so long as it is known only to them secrecy is secured. It is possible, however, that, by long and patient watching, a stranger might note the periods of silence and so contrive to read the messages. M. Belin has added an adaptation from a well-known mechanical cipher in which the significant words occur in the course of an apparently continuous page of writing or printing, but can be detected by placing over the sheet a secret stencil cut so as to reveal only the message. The intervals of silence in M. Belin's device are filled by messages sent out from a subsidiary apparatus and with no other purpose than to conceal the existence of the gaps.

Radio Telephony.—Broadcasting.—The G.P.O. distributed 50,000 licence books, each containing 50 licences, among post offices throughout the country on November 1st. The licence costs 10s., and one taken out now expires on September 30th, 1923. Owners of experimental or home-made receiving apparatus have to obtain an experimentalist's licence, the fee for which is also 10s.

People appear to be postponing the purchase of their licences until the actual broadcasting date is announced.

In connection with the radio-transmitting plant which has now been installed by the Metropolitan-Vickers Electrical Co., Ltd., at its research laboratories, Trafford Park, Manchester, we understand that on Mondays, Wednesdays, and Fridays, at 8 p.m., the company will carry out a test musical programme with a view to determining the best transmitting conditions.

Carrier Wave.—A demonstration which showed in striking fashion what can be accomplished in telephony by "wired wireless" took place at the Polytechnic, Regent Street, on November 3rd. The proceedings were opened by Mr. E. H. Shaughnessy, of the Post Office, with a lecture on "Recent Developments in Radio Telegraphy and Telephony." Following the lecture, Sir William Noble, chairman of the Broadcasting Committee, speaking at Marconi House, introduced by ordinary wireless the Lord Mayor of Bristol, who delivered an address from his residence in Bristol, which was transmitted over the carrier wave circuit to Paddington on the ordinary outside telephone wire, while other telephone traffic was proceeding. From Paddington it was directed to Marconi House by underground telephone wire, and there sent out broadcast.

By means of a wireless receiving apparatus installed at the residence of the Lord Mayor of Bristol, he and his friends were able to listen-in to the broadcast messages in London. The demonstration was organised by Mr. J. W. Turner, head of the Telegraph and Telephone section of the Polytechnic. —*Morning Post.*

South Africa.—Wireless Telegraphy.—According to the *Transactions* of the S.A. Institute of Electrical Engineers, the Council of the Institute has pressed upon the Union Government the advisability of a real attempt being made to put a professional Board in charge of radio communication, which would put legislation regarding radio communication and broadcasting on a basis that will ensure progress on the right lines in South Africa.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—January 15th. Electricity Commissioners.—Switchgear and accessories, for the Morwell power scheme. (November 3rd.)

January 26th. H.p. steam, drain and feed piping, valves, traps, &c. (November 3rd.)

January 23rd. Melbourne Tramways Board. One 500-kW rotary converter and a 550-kVA transformer.

December 20th. Victorian Railways. One 2-ton electric hoist.*

Barnes. — November 27th. Electricity Department. Turbo-alternator, with surface condenser and auxiliaries, rotary converter and transformer, h. and l.p. switchgear and connections. (See this issue.)

Belgium.—November 13th. Municipal authorities of Schaerbeek, Brussels. 16,500 metres of armoured cable.

Burton-on-Trent.—November 20th. Board of Guardians. Electric light installation, Imbecile Block. Mr H. S. Askew, clerk.

Dublin.—November 14th. Irish Postmaster-General's Department. 90 tons h.d. copper wire, 25 tons bronze wire, 70 tons g.i. wire. (October 27th.)

November 13th. Great Northern Railway (Ireland). Stores for six months, including electrical fittings and lamps, electric cable and wire, &c. (October 27th.)

November 13th. Electricity and Public Lighting Committee. Nickel copper condenser tubes. City electrical engineer, Fleet Street, Dublin.

Dundee.—November 24th. Electricity Department. Two-core and three-core l.p. paper-insulated, lead-covered, and steel tape armoured cable. (See this issue.)

Hull.—November 16th. Electricity Committee. Four natural-draught cooling towers. (November 3rd.)

November 16th. Electricity Department. Stores, including electric lamps, for 6 or 12 months, from January 1st, 1923. City electrical engineer, Electricity Works, Sculcoates, Hull.

London.—St. Marylebone.—November 29th. Electricity Department. Turbo-alternator and condensing plant, water-tube boilers, fan-draught water-cooling tower, and rotary converter plant. (November 3rd.)

Paddington.—November 20th. G.W. Railway Co. Stores for six months, including telegraph instruments, electrical apparatus, electric wires and cables, electric lamps, &c. (See this issue.)

St. George's-in-the-East, E.1.—November 23rd. Board of Guardians. Installation of electric lighting at the Green Street Upton Park Schools. (See this issue.)

New Zealand.—WELLINGTON.—January 9th, 1923. Five sets of 11,000-V sub-station switchgear, for the Mangahao power scheme. Two sets 11,000-V sub-station switchgear, for the Lake Coleridge power scheme.*

CARTERTON.—November 20th. Wairarapa Electricity Power Board. Switchgear, lightning arresters, &c.*

Senegal.—April 14th. Hydro-electric development of the falls of the Fellon, Upper Senegal. Bureaux Techniques de l'Agence Général des Colonies, 57, Boulevard des Invalides, 7e, Paris.

South Africa.—JOHANNESBURG.—December 4th. South African Railways and Harbours Tender Board. Twelve months' supply of electric incandescent lamps.*

Stoke-on-Trent.—November 15th. Electricity Department. Mains and cables for 12 months. (October 27th.)

Warrington.—November 21st. Cheshire Lines Committee. Stores, including telegraph materials, for 6 or 12 months. Stores Superintendent, Cheshire Lines, Warrington.

Wrexham.—Electric lighting installation for 22 houses, Acton Park estate. Mr. G. Douglas, borough electrical engineer. Willow Road.

York.—November 21st. North-Eastern Railway Co. Telegraph apparatus and telegraph wire and line stores for six months. (October 27th.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Amesbury.—Board of Guardians. Accepted:—
Installation of electric lighting at the workhouse (£150).—Electric Light Co.

Aylesbury.—The Bucks. County Council has accepted the tender of Hallaban & Hawkins for installing electric lighting at the County Buildings at £177. The other tenders received were:—E. T. Mackrill & Son (£225) and G. C. Gowan (£250).

Edinburgh.—Tramway Committee. Accepted:—
96 tramway trucks (£105 each).—Hurst, Nelson & Co., Ltd.
112 motors (£150 each).—Metropolitan-Vickers Electrical Co., Ltd.
One-piece poles.—British Mannesmann Tube Co., Ltd.

Federated Malay States.—The contract for the installation of electric lighting at the new Training College at Tanjong Malim, F.M.S., has been awarded to Messrs. Huttenbach, Lazzarus & Sons, Ltd., Ipoh, Perah.—*Reuter's Trade Service* (Singapore).

Glasgow.—Tramways Committee. Recommended:—
Traction telephone parts.—General Electric Co., Ltd.
300-amp. electric welding plant.—Equipment & Engineering Co., Ltd., per W. C. Yuille & Co., Ltd.
7-h.p. motor.—British Thomson-Houston Co., Ltd.

Manchester.—Baths and Wash-houses Committee.
Sub-contractors for electric lighting work at Gorton public wash-houses.—J. Armstrong & Co., Manchester.

Electricity Committee.
Cable.—Enfield-Ediswan Cable Works, Ltd.; Macintosh Cable Co., Ltd.; British Insulated & Helsby Cables, Ltd.
Ironclad distribution switchgear for auxiliary services for the Barton power station.—Dorman & Smith, Ltd.
Two steel ash wagons and a lifting sling.—Middleton Bros.; sub-contractors for lifting chain, W. Griffin; for wheels, British Chilled Roll and Engineering Co.
Two coal grabs.—Priestman Bros.

Reigate.—Town Council. Accepted:—
Steelwork, for extensions to generating station (£890).—Heenan and Froude, Ltd.
H.p. switchgear (£744).—General Electric Co., Ltd.
Three Diesel engine-driven generators and auxiliary plant (£39,327).—Mirrlees, Bickerton & Day, Ltd.
Extensions to buildings and machinery foundations (£6,293).—Oliver Kennard, Sydenham.

Torquay.—Town Council. Accepted:—
Steam ejectors and extractor pumps, for the electricity works (£535 per set).—Cole, Marchent & Morley.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, November 11th. At the Grand Hotel, Colmore Row. At 7 p.m. Discussion on Mr. Unwin's paper on "Alternating-current Apparatus."

Poplar Borough Council Electrical Exhibition.—November 13th to November 18th. At the Electricity Works, Glaucus Street, Bromley-by-Bow.

Electro-Harmonic Society.—Tuesday, November 14th. At Caxton Hall, Westminster, S.W. At 8 p.m. Ladies' night.

Institute of Marine Engineers.—Tuesday, November 14th. At the Institute, The Minories, E. At 6.30 p.m. Paper on "The Evolution of the Nobel Diesel Engine," by Mr. G. J. Steinheil.

National Association of Supervising Electricians.—Tuesday, November 14th. At St. Bride's Institute, Bride Lane, E.C. At 6.45 p.m. Lecture and demonstration on "Broadcasting," by a representative of Marconi's Wireless Telegraph Co., Ltd.

Greenock Association of Electrical Engineers.—Wednesday, November 15th. At the Masonic Rooms, 32, West Stewart Street. At 7.45 p.m. Paper on "Transformer Breakdowns," by Mr. W. Stigant.

Chemical Society.—Thursday, November 16th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary scientific meeting.

Chelmsford Engineering Society.—Thursday, November 16th. At the East Anglian Institute of Agriculture. At 7 p.m. "Engineering Reminiscences," to be opened by Mr. C. L. Buyers.

Institution of Electrical Engineers.—Thursday, November 16th. At the Institution, Victoria Embankment, S.W. At 6 p.m. Dr. Kapp on "The Improvement of Power Factor." Mr. M. Walker. Preceding the ordinary meeting, Mr. R. Webb will give, on behalf of the President, a demonstration of [illegible] from 5.15 p.m. to 5.45 p.m.

(London Students' Section).—Friday, November 17th. Visit to the London Terminal Aerodrome [illegible].

(South-Midland Centre).—Wednesday, November 15th. At the University, Birmingham. At 7 p.m. Paper on "[illegible] on the Various Types of [illegible]," by [illegible].

(South-Midland Centre, Students' Section).—Monday, November 13th. Visit to the [illegible] the following [illegible].

(North-Eastern Centre).—Monday, November 13th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "[illegible] ment of Power Factor," by Dr. Kapp. To be read by Mr. [illegible] Walker.

(Liverpool Sub-Centre).—Monday, November 13th. At the University, Liverpool. At 7 p.m. Lecture on "Aerial Navigation," by Sir A. F. M. Fleming.

(North-Western Centre).—Tuesday, November 14th. At the Engineers' Club, Albert Square, Manchester. At 7.30 p.m. Inaugural address by the chairman, Mr. A. S. Barnard, and [illegible].

(Sheffield Sub-Centre).—Wednesday, November 15th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Concert [illegible] smoking concert.

(Scottish Centre).—Tuesday, November 14th. At 207, Bath Street, Glasgow. At 7.30 p.m. Inaugural address by the chairman, Mr. A. S. Hampton.

(Scottish Centre, Students' Section).—Friday, November 17th. At the Royal Technical College, Glasgow. At 7.30 p.m. Opening address by the chairman, Mr. J. F. Nielson.

Institution of Mechanical Engineers.—Friday, November 17th. At the Institution, Storey's Gate, S.W. At 6 p.m. Adjourned discussion on Sir Vincent L. Raven's paper on "Electric Locomotives."

British Electrical Development Association.—SALESMANSHIP CONFERENCE.—Friday, November 17th. At the Caxton Hall, Westminster, S.W. At 7.30 p.m. Paper on "Theory and Practice of Salesmanship in Relation to the Electrical Industry," by Mr. Wallace Allwood.

Royal Society of Arts.—Friday, November 17th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "The Development of Water Power in India," by Mr. J. W. Meares.

Junior Institution of Engineers.—Friday, November 17th. At 39, Victoria Street, S.W. At 7.30 p.m. Annual general meeting.

(North-Eastern Section).—Tuesday, November 14th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. "Notes on Shop Practice," by Mr. H. Lee. Saturday, November 18th, visit to Messrs. Michell Bearing Co., Scotswood.

Northampton Engineering College Engineering Society.—Thursday, November 16th. At Northampton Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Track Working in Connection with the Electrification of Railways," by Mr. D. A. Keith.

Faraday House Old Students' Association.—Friday, November 17th. At the Hotel Cecil. At 6.30 for 7 p.m. Annual dinner.

Manchester Electro-Harmonic Society.—Friday, November 17th. At the Albion Hotel, Manchester. At 7.15 p.m. Second concert of the season.

Rontgen Society and the Electro-Therapeutics Section of the Royal Society of Medicine.—Joint provincial meeting [illegible] November 17th and 18th. At the University, Manchester.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:

The BRAIN WAVE carnival lantern.
The NICHRO iron.
Also the names of writers or suppliers of gold-lined bell indicator glasses (no indicating mechanism is required).

NOTES.

The Professional Classes Aid Council.—By an error, we gave the Council's income for 1921-22 as £7,749, but unfortunately this figure included an excess of expenditure over income of £5,903, the income being under £2,000. The amount received was, therefore, insufficient to meet the cost of the work carried out by the Council, and it appeals for further funds.

Radio Station Charts.—We have received from the Bureau International de L'Union Télégraphique, Berne, the first two of a series of five charts, on which are marked the positions of all radio telegraphic stations in the world. Their names and normal ranges are given, and the type of messages handled, and also whether the service is available during the day or night is indicated. In addition, all the principal navigational routes used by the majority of the steamship companies during both the summer and winter months are marked, the length of each route in nautical miles, and the time needed to traverse it being also given. The set of charts should be extremely useful for the purpose of choosing the most suitable radio station from which to communicate with a ship at sea, the position of the ship on a given day being found by the number of days out from port and the navigational routes and speed. The five charts cover respectively: No. 1, North Atlantic Ocean and Mediterranean Sea; No. 2, North Atlantic Ocean (Western); No. 3, Indian Ocean; No. 4, Atlantic Ocean (Southern); and No. 5, Pacific Ocean.

Trouble in the Tropics.—Electricity supply authorities in this country are occasionally put to some inconvenience by the intrusion of a rat or a cat among station switchgear, but in India a larger animal recently caused trouble. The whole of Simla was suddenly plunged into darkness one evening. The engineers at the local electric works put in the switches several times before the line was found to be clear. Upon investigation next day it was found that a panther, evidently resenting the desecration of his domain by poles and wires, had climbed one of the standards, with fatal results. The animal had apparently fought hard for its life before it succumbed to the repeated operation of the station switches.

The Hallford Electric Industrial Vehicle.—Messrs. J. and E. Hall, Ltd., of Dartford, are turning their attention to the production of two battery electric vehicles, one designed to carry 4 tons and the other 5 tons. It is not the first time that this company has produced such machines, or others in which electricity played its part; for the first Tilling-Stevens petrol-electric vehicles were built by it, and in 1909 it built some eight battery-electric vehicles, most of which were supplied to the Brighton Bus Co. They were chain driven, and the single driving motor of each was situated at the rear, and these features of design have been retained in the two models just produced.

So far as possible the standard units and parts embodied in the 4 and 5-ton petrol vehicles have been utilised. The motor is supported in a twin cradle joining the side-members of the frame, each provided with a keep. The motor is an 8-h.p. B.T.H. machine of 85 volts, and is capable of standing a 300 per cent. overload. The armature is supported in roller bearings at the front end and ball bearings at the rear. The speed is 1,050 r.p.m. at 70 amperes. The battery consists of 44 Ironclad Exide cells carried in two trays provided with rollers and supported under the centre of the chassis frame, so that the trays can be run out with ease. The battery case is supported by four double vibration dampers or buffers. The upper support the load, while the lower take the rebounds. This feature is quite an unusual one.

The controller is of the drum type, and permits five speeds forward and two reverse. It gives a series-parallel control with split-field winding. The top speed is provided with a diverter with the fields in parallel. The "dead-man control" takes the form of a small pedal, and in order to keep the machine in motion this pedal must be depressed. If released it at once breaks the circuit through a contactor of the same type as those used on the District Railway trains. Once this circuit is broken, the controller handle must be brought back to first-speed position before a restart can be made. In addition, the application of either brake also breaks the circuit. An interesting point about the controller is that all the wiring is in solid copper, so strong that it cannot wear or vibrate. The current from the battery is brought through a main fuse before it passes through the plug circuit. The controller circuit plug must be disconnected before the charge plug can be inserted.—*Commercial Motor.*

Proposed International Wireless Exhibition.—A committee has been formed for the organisation of an International Exhibition of Wireless Telegraphy and Telephony, to be held at Geneva during the first fortnight in April, 1923.—*Reuter.*

Accident.—A plumber's labourer, in the course of excavations at Glasgow, was cutting through some brick-work when his chisel cut into a high-voltage cable and he was burned about the face and arms.

The Earth's Surface Charge.—The subject of the geophysical discussion at Burlington House on October 25th was how the electrical charge on the earth's surface is maintained. Dr. Simpson, director of the Meteorological Office, opened the discussion, says the *Morning Post*. The surface of the earth in fine weather always shows a negative charge, so that the earth air current is positive and of the order of 150 volts per metre. This charge loses 15 per cent. per minute, and yet it is nearly constant. Dr. Simpson mentioned that the resistance of one inch of atmosphere to the electrical discharge is equal to that of a copper bar reaching twenty times the distance from the earth to the star Arcturus and back.

The current must travel either by convection or turbulence. If the former, then all the charge would leak away in the first 90 metres; but it is known to be nearly the same at [illegible] upper air observations, so that convection is ruled out. If it travels by turbulence, then the turbulence [illegible] is said to be caused by a very high wind over a forest, and certainly this is too high a value for ordinary [illegible].

Another suggestion is that the earth is bombarded, either from the air or sun or space, by negative electrons. But even if these travelled with the velocity of light, it would require 30,000 [illegible] each square centimetre (0.15 sq. in.) per second, and the actual observed number is only five per second, and less in the Polar regions.

The only remaining theory is a new one by Mr. C. T. R. Wilson, who suggests [illegible] under clouds, which may be either of positive or negative polarity, may provide a sufficient current if certains assumptions are made, the chief of which is the existence of the Heaviside layer.

Dr. Chree thought that as many revolutionary ideas were being considered by physicists, the assumption that positive and negative charges must always be produced at the same rate might be abandoned, and the negative charge on the ground be supplied from below. He wished, therefore, to press for more observations of earth currents and other data bearing on the subject before discussing any more theories.

The Electro-Harmonic Society. — The next concert (ladies' night) will be held in the Caxton Hall, Westminster, on Tuesday, November 14th, commencing at 8 p.m. Mr. Frank Gill (President of the Institution of Electrical Engineers) will take the chair. The artistes engaged are: Miss Sophie Rolands, soprano; Miss Violet Openshaw, contralto; Mr. Walter Glynne, tenor; Mr. Tom Kinniburgh, bass; Miss Evelyn May, violinist; Mr. George Ellis, humour and philosophy; Miss Winnie Vaughan, in humorous songs at the piano by herself and Mr. Roland Merry; Mr. Bernard Flanders, solo pianoforte.

Lectures.—Mr. H. C. Wheat, chief illuminating engineer to the British Thomson-Houston Co., Ltd., lectured on November 3rd on "Artificial Illumination of Buildings," under the auspices of the Royal Technical College Architectural Craftsmen's Society, Glasgow. Mr. Wheat classified lighting systems, and gave the general rules to be observed. Reference was made to the human eye and the effect of glare, and intrinsic brilliancy was explained. In dealing with lighting in relation to architecture, he treated of fittings and illumination without visible fittings. By means of lantern views, he showed results secured in practice.

"Water Power in the Highlands" was the subject of a lecture delivered by Professor Magnus Maclean, D.Sc., to the Scottish Engineers' Association on October 26th. The lecturer described some of the power undertakings already in existence, including those at Foyers and Kinlochleven, and also dealt with schemes that were materialising at present, particularly the Lochaber and the Grampian undertakings. The lecture was illustrated by references to several small schemes where water-power was utilised without battery or other storage for lighting large houses and for driving motors for farm purposes.

Appointments Vacant.—Plumber-jointer, for the Hackney Corporation electricity department; plumber-jointer (78s. 4d.), for the Loughborough Corporation electricity department. (See our advertisement pages to-day.)

INSTITUTION NOTES.

Institution of Electrical Engineers.—On November 2nd the first meeting of the 1922-23 session was opened by Mr. J. S. Highfield, retiring president, presenting the premiums, prizes, and scholarships that had been awarded during the past session, in the presence of a large gathering. The chairman then read a message of greeting from the Society of Electricians, France, and announced that the Institution of Mechanical Engineers had invited members of the I.E.E. to attend on November 17th the adjourned discussion on Sir V. L. Raven's paper on "Electric Locomotives" (see ELECTRICAL REVIEW, August 25th, 1922, p. 284). Mr. Highfield then vacated the chair and the new president (Mr. F. Gill) called on Mr. Roger T. Smith to propose a vote of thanks to the past president, which was seconded by Mr. Ll. B. Atkinson and passed with acclamation. Mr. Gill then read his inaugural address, which is abstracted elsewhere in this issue, for which, on the motion of Sir John Snell, seconded by Sir Richard Glazebrook, he was heartily thanked.

Preceding the ordinary meeting of the Institution on November 16th, Mr. R. Webb (graduate) will give, on behalf of the president, a demonstration of cathode ray oscillations from 5.15 to 5.45 p.m.

WESTERN CENTRE.—At Cardiff, on November 6th, despite inclement weather, Mr. F. Tremain had the satisfaction of presiding over a large attendance. The membership report, presented by the hon. secretary, showed a net total of exactly 500, being a slight decrease since the previous report; four new members of various grade had been enrolled since the last meeting, but 11 members had been transferred to other Centres, thus although the actual membership had declined, a steady increase was reported. The paper discussed was entitled "The Interconnection of a.c. Power Stations," which was read by the joint authors, Mr. J. B. Palmer and Mr. L. Romero. The paper was illustrated with lantern slides of a descriptive nature, and the subsequent discussion was candid and very sustained, and elicited contributions from Messrs. Chamen, Morley-New, Fidoe, Nairn, Idris, Jones, Holley, J. H. Thomas, Jenkins, C. T. Allan, Prof. Bacon, and Major E. I. David.

LIVERPOOL SUB-CENTRE.—The opening meeting of the 1922-23 session of this Sub-Centre of the North-Western Centre took place on November 6th at Liverpool. Mr. Welbourn delivered his Chairman's address, which was illustrated with lantern slides. The address in the main covered a detailed account of his recent visit to Canada and the United States of

America, outlining the recent developments in telephony, electricity supply, h.p. transmission schemes, and railway electrification. Mr. Barnard (Chairman, N.W. Centre) supported Mr. Welbourn, and addressed the meeting on the advantages of the Institution to its members, its wonderful growth of recent years, and the work local Centres and Sub-Centres could do in maintaining it and adding to its usefulness. The meeting was well attended.

Scottish Centre.—The annual report of the committee for the 1921-22 session shows that the general meetings numbered seven, with fair attendances and a display of interest. It was gratifying to notice the improvement in the discussions. The meeting at Dundee was again specially interesting. As formerly, many of the visitors spent the Saturday following on the golf course at Carnoustie. These visits of the Centre to Dundee may now be considered as annual events. Both the smoking concert and dinner were well attended, and regarding the summer meeting of the Institution, which took place in the territory of the Scottish Centre, the committee has been much gratified by expressions of congratulation and thanks from the president of the Institution, and visitors from all parts of the country. The committee regrets to put on record the discontinuance of the Aberdeen Sub-Centre on account of the small number of members in that district. Due to the initiative of Mr. W. F. Mitchell, it is expected that, in addition to the ordinary meetings of the Scottish Centre, one or two informal meetings will be held in Edinburgh during the current session, at which lectures will be delivered. This, it is confidently hoped, will benefit some of those members who find it inconvenient to attend the Glasgow meetings, and a local sub-committee is dealing with the matter. In response to an appeal on behalf of the Benevolent Fund, members of the Scottish Centre subscribed the sum of £181 18s. 10d. The session ended with a total membership of 621, an increase of 54 on the previous year, and the average number present at ordinary meetings was 72.

The committee has published a new edition of its booklet containing a full list of the members of the Centre, the Institution's rules, names of officers, &c. The programme includes the following arrangements:—November 14th, Chairman's (Mr. A. S. Hampton's) address; November 25th, smoking concert; December 12th, "The Possibilities of Transmission by Underground Cables at 100,000/150,000 Volts," by Major A. M. Taylor; January 9th, 1923, "Domestic Load Building," by Mr. W. A. Gillott; March 2nd, dinner; April 10th, annual general meeting; the subjects for ordinary meetings to be held on February 13th, March 13th, and April 10th and 27th will be announced later.

Students' Section.—The annual report for the 1921-22 session show that the meetings numbered 10 and were well attended, the average number present being 36. This is a small decrease on the previous session, but, considering the extended programme, is very satisfactory. The success of the smoking concert, the first social function, should warrant its continuance as an annual event.

Dundee Sub-Centre.—The annual report of the committee for 1921-22 shows that the membership at the close of the session was 51, and the average number present at ordinary meetings was 17; the meetings numbered seven.

The following is the session's programme:—December 14th, "Automatic Protective Gear," by Mr. A. E. McColl; January 11th, 1923, "A Modern C.B. Telephone Exchange," by Messrs. R. J. Lawson and S. D. Cawood; February 8th, "High-Voltage Transmission by Underground Cables," by Major A. M. Taylor; March 8th, "Hydro-Electric Schemes," by Mr. H. Richardson.

North-Eastern Centre.—*Students' Section.*—The second general meeting was held at Newcastle on November 3rd, when Mr. E. J. Allman (Student) read a paper on "The Purification of Oils." A very interesting discussion followed. Mr. W. N. Kilner was in the chair.

North-Western Centre.—The following arrangements have been made for the present session:—December 12th, informal discussion on "Low- and Medium-Tension Industrial Wiring," to be opened by Mr. J. Frith; January 9th, 1923, "Electricity in the Home," by Mr. J. W. Beauchamp (ladies invited); January 23rd, "Works Production," by Mr. G. H. Nelson; February 6th, informal discussion on "Power Circuit Interference with Telegraphs and Telephones," to be opened by Mr. S. C. Bartholomew; February 20th, subject to be announced later; February 23rd, annual dinner; March 6th, popular lecture; March 20th, subject to be announced later; April 10th, annual general meeting.

Institution of Mechanical Engineers.—Professor H. S. Hele-Shaw, D.Sc., F.R.S., delivered his presidential address on October 20th. He referred to the fact that this year was the 75th of the Institution's existence, and reviewed its work during that long period, especially mentioning its educational activities. The high standard required to be attained by aspirants to membership had resulted in the official recognition by many Government departments of the value of membership. Referring to future prospects, the president said that it was expected to establish further provincial branches shortly. He outlined the session's programme, which included papers and discussions on electric locomotives, boiler efficiency, the economics of plant purchase, the inspection of engineering material, and other subjects of interest alike to electrical and mechanical engineers. A large part of the address was devoted to a consideration of the British patent system, pointing out that a great many patents were granted for useless or impracticable inventions. Prof. Hele-Shaw advocated a number of amendments, including cheap short terms for improvements, and methods of simplifying the present procedure to prevent litigation.

Institution of Production Engineers.—At the general meeting to be held on November 24th, at the Engineers' Club, Mr. G. Hey, [illegible] Messrs. Jigs, Ltd., will read a paper dealing with "Standardisation."

Birmingham and District Electric Club.—Before the reading of Mr. Unwin's paper on alternating current apparatus to-night members of the club will pay an afternoon visit to the works of the General Electric Co., Ltd., and the Magnet Club. The party will proceed direct from the works to the Grand Hotel, Birmingham, for the discussion.

Society of Technical Engineers.—The Bristol Branch Council has arranged the following meetings:—November 24th, 7.15 p.m., whist drive at the Grand Hotel, Bristol (open to members and friends, including ladies); December 1st, meeting, to be addressed by Mr. Norman Wyld, the general secretary of the Society.

Questions to Candidates.—The Society of Technical Engineers has drawn up a list of questions to be put to Parliamentary candidates. These relate to the representation of administrative and technical workers upon bodies dealing with industrial questions, unemployment insurance, and superannuation schemes. One of the questions is: "Are you in favour of an attempt to arrange that the cost of unemployment insurance of manual workers within an industry shall fall partly on that industry, so that there will be a stimulus to regulate output in such a way that unemployment will be more uniform than hitherto?"

Manchester Association of Engineers.—At the Manchester College of Technology, on November 3rd, before a meeting of the Association, to which members of the local branches of the Institutions of Civil, Mechanical, and Electrical Engineers had been invited, Mr. A. P. M. Fleming, the head of the research department of the Metropolitan-Vickers Electrical Co., Ltd., lectured on "Radio Telephony, with Special Reference to Broadcasting."

In his introductory remarks Mr. Fleming referred to various methods of signalling through space, and proceeded to explain how radio signals were transmitted. Pictures of broadcasting stations and studios, and of the apparatus employed, were thrown upon the screen. Most of the evening, however, was occupied by an experimental demonstration. A programme of music, vocal and instrumental, at first hand or by gramophone reproduction was broadcast from the Metropolitan-Vickers' works at Trafford Park. The power used was slightly over one kilowatt and the wave-length was 382 metres. In every case the items were received in their entirety and with a naturalness of tone equal to any gramophone reproduction. Sometimes the reproduction was attended with frictional noises varying in intensity, and Mr. Fleming explained that this was mainly due to running machinery and other accidental sounds in the immediate vicinity of the college. At present this trouble could not be altogether avoided. They were compelled to use a "loud speaker," which magnified things that were not wanted. It was a very great problem to fill a hall with a good reproduction that did not suffer some distortion; but in one's own drawing room one could use either a "loud speaker," which did not need to be of anything like equal magnitude, or the ordinary head 'phone, which gave a remarkably good and true reproduction. The transmission sent out that evening might be picked up all over England. In the last few days such signals had been picked up in the Channel Islands and near Dingwall, in Scotland. He was afraid there had been a good deal of very tall talk about the ranges at which wireless messages could be received, but the instances he had mentioned were actually verified. In the Southern States, where the smaller churches were too poor to maintain a regular minister, loud-speaking instruments were being installed, and the complete service was picked up from the broadcasting station. Probably there were now in America some 3,000,000 receiving sets. The crystal detector type was extremely good for its range, but the range was short. He had known it act perfectly well over a range of 40 miles, but from 15 to 20 miles was more nearly the right figure. For longer ranges one should use a valve detector with an amplifier.

Chelmsford Engineering Society.—On October 26th, Mr. W. A. Tookey, M.I.Mech.E., delivered a lantern lecture on "Modern Oil Engines." Mr. Tookey pointed out that early types of oil engines ran on lighter oils, such as kerosene and paraffin, but as these engines became popular and the demand for light oils increased, prices increased also. Engineers then turned their attention to constructing an engine to use the heavier oils, for which there was little demand. The modern cold-starting oil engine was the result. The lecturer showed slides illustrating the latest designs by various makers. The formation of the combustion chamber was the principal feature. In the discussion which followed Mr. Tookey stated that the lowest consumption of oil yet obtained was .336 lb. of oil per b.h.p.-hour.

On November 2nd Mr. J. G. Widdowson (director of the Apex Steel Co., Ltd.) read a paper on "The Effect of Heat Treatment on the Micro-Structure of Steel." The author laid great stress on the need for the user of steel to adhere rigidly to the instructions for heat treatment given by the makers, since a very great difference might be effected in the steel by only a slight variation of the treatment.

National Association of Supervising Electricians.—As a sign of progress, attention may be drawn to the removal of the above Association to new offices. After November 10th, the new address will be 82, Victoria Street, S.W. 1, and the new telephone number: Victoria 2206.

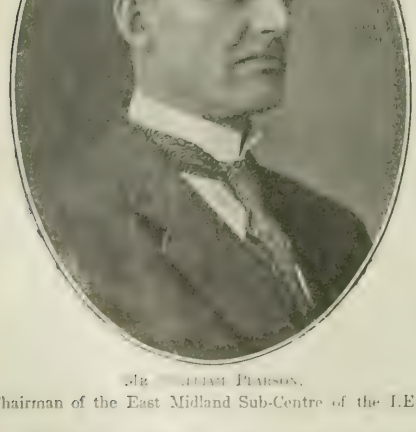
Electrical Power Engineers' Association.—A lecture, arranged by the Southern Divisional Council of the Association, entitled "The Scope of Publicity in a Public Service," will be delivered by Mr. J. W. Beauchamp, M.I.E.E. (Electrical Development Association) at the Institution of Electrical Engineers on December 1st. The Council extends a cordial invitation to readers to be present at this as well as any subsequent lectures on matters connected with the electricity supply industry arranged by the Association.

Institution of Automobile Engineers.—At a meeting of the Institution of Automobile Engineers, on November 7th, Mr. J. D. Morgan, M.Sc., read an interesting paper on "The Duty of High-Tension Ignition Apparatus," and dealt very thoroughly with the subject, among the points touched upon being that of the h.p. spark as an igniting agent, the capacity moment of the h.p. spark, and plug insulation leakage. In conclusion he contrasted the principal characteristics of magneto, and coil and battery ignition, each of which he considered was capable of useful service.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. WILLIAM PEARSON, who is chairman of the East Midland Sub-Centre of the Institution of Electrical Engineers, is a Manchester man by birth, education, and training. He was educated at the Manchester Grammar School, and technical education followed at the Salford Royal Technical Institute and the Manchester School of Technology. He served his apprenticeship with Messrs. Mather & Platt, Ltd., at the Salford Ironworks, and remained with the firm until February, 1910, when he joined the Brush Electrical Engineering Co., Ltd., at its Falcon Works, Loughborough. Early in 1914 he became chief of the Estimating Department there, and he still occupies that post. He became an Associate Member of the Institution of Electrical Engineers in 1910, and was a member of the Committee of the South Midland Centre in 1919-1920. He has been a member of the Committee of the East Midland Sub-Centre since its formation, two years ago.



MR. WILLIAM PEARSON.
Chairman of the East Midland Sub-Centre of the I.E.E.

MR. T. BAXENDALE, resident engineer of the Stuart Street power station of the Manchester Corporation, has been transferred to Barton power station to fill the position of resident engineer, at his present salary. MR. A. L. LUNN, assistant resident engineer, Stuart Street power station, has been appointed resident engineer at Stuart Street at the salary prescribed by the N.J.B. schedule (at present the inclusive figure is £688), subject to the cost-of-living adjustment from time to time.

Hastings Town Council has appointed MR. A. J. RYAN, who has been chief assistant electrical engineer since 1913, as deputy borough electrical engineer.

MR. ERNEST KAYE has severed his connection with the Enfield Ediswan Cable Works, Ltd., as wire mill manager, and has commenced business as a wire manufacturer at Perseverance Wire Mills, Queensway, Ponders End, in conjunction with his brother, Mr. Edgar Kaye. Upon leaving the Enfield Ediswan Co. he was presented with a silver hunter watch and a case of pipes. The presentation was made by Mr. A. V. Downton, technical director.

SENATORE MARCONI, who has been suffering from a mild attack of influenza, complicated by bronchial catarrh, is now well on the way towards recovery.

MR. S. R. MELLONIE has resigned his position as Engineer-in-charge of Design with the Admiralty at Portsmouth in order to take up a position as switchgear engineer at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd. He is thus returning to Manchester after spending three years in London with Messrs. Geipel & Co., and four years on Tyneside with Messrs. A. Reyrolle & Co., Ltd., and Messrs. J. H. Holmes & Co.

MR. R. L. WEDGWOOD, general manager of the N.E. Railway, has been appointed to be chief general manager of the Eastern Group of Railways.

The *Commonwealth Engineer* announces that MR. A. GAVEY, of the New Zealand public works department, who for the past 18 months has been in charge of the Lake Coleridge hydro-electricity installation, has taken up a position in Wellington in connection with the hydro-electric installation under construction at Mangahao. MR. R. G. MCGIBBON, who was in charge under Mr. Gavey, has taken over the duties at Lake Coleridge. MR. A. S. HERBERT, formerly general manager of Messrs. Siemens Bros., has returned to Australia, and is associated with the English Electric Co. MR. A. J. BRADSHAW, of Sydney, has been appointed to the position of assistant electrical engineer with the City Council of Launceston, Tas. The resignation of MR. R. WOOF, power-house superintendent, Sydney electricity supply, as from March next, has been accepted, and the Council has appointed MR. A. J. WILSON, assistant superintendent, to the position.

Dr. J. F. CROWLEY, who has recently severed his connection with the English Electric Co., was on Tuesday last presented with a mahogany clock as a mark of esteem. The presentation was made by Mr. P. J. Pybus, C.B.E., managing director, on behalf of Dr. Crowley's friends and colleagues.

We regret to learn that MR. EDWARD MANVILLE is too ill to take part personally in the election at Coventry, where he is the Conservative candidate.

Obituary.—MR. E. DURFORD.—The death is announced of Mr. Edward Durford, chairman of the directors of the Ludlow (Salop.) Electric Co., Ltd. He was 66 years of age.

Will.—The late MR. LIONEL G. ROBINSON, a director of the Underground Electric Railways Co., of London, Ltd., left £236,332 gross and £133,952 net personalty.

NEW COMPANIES REGISTERED.

Harris & Russell, Ltd. (185,312).—Private company. Registered October 27th. Capital, £100 in £1 shares. To experiment with, manufacture, and develop methods and means of lighting, heating, and ignition, produce and destroy gases, produce neutralising effects by electrical, chemical, or mechanical means, and to use, manufacture, and turn to account by-products and waste material, &c. The first directors are: A. E. Harris 15, Great Chapel Street, W.1, precious metals refiner; J. J. Russell, 17, Trinity Rise, Brixton, S.W.2, electrical engineer. Qualification £25. Remuneration, as fixed by the company. Registered office: 3, Percy Street, Tottenham Court Road, W.1.

Chaplin Bros. (Birmingham), Ltd. (185,304).—Private company. Registered October 27th. Capital, £3,000 in £1 shares. To take over the business of a wire drawer and manufacturer of dynamo brushes carried on by F. J. Chaplin at 229-233, Park Lane, Aston, Birmingham, as "Chaplin Bros." The permanent directors are:—F. J. Chaplin, Nateby Lodge, Vesey Road, Wylde Green, Sutton Coldfield (chairman and managing director); Mrs. M. M. Chaplin, Nateby Lodge, Vesey Road, Wylde Green, Sutton Coldfield. Qualification: £50 shares. Registered office: 233, Park Lane, Aston, Birmingham.

F. W. Ames, Ltd. (185,335).—Private company. Registered October 28th. Capital, £3,000 in £1 shares. To take over the business of electrical engineers and contractors carried on by F. W. Ames and F. Hollinghurst at Long Eaton, Derby, as "Ames & Co." The permanent directors are:—F. W. Ames, 4, York Road, Long Eaton (chairman and managing director); F. Hollinghurst, 9, George Avenue, Long Eaton; T. R. Wallis, "Inver Garry," Briar Gate, Long Eaton. Qualification: 250 shares. Solicitor: H. L. Jackson.

British Radio Wireless Manufacturing Co., Ltd. (185,455).—Private company. Registered November 2nd. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of, and dealers in wireless sets, machines, or other wireless apparatus, loud-speaking trumpets, cabinets, and wireless furniture, aerial masts and accessories, &c. The subscribers (each with one share) are:—W. G. Hollister, 61a, Minories, E.1, clerk; Miss G. C. Cadogan, 39, Wakehurst Road, Wandsworth Common, S.W.11. First directors to be appointed by subscribers. Qualification: £100. Remuneration, as fixed by the company. Solicitor: K. L. Bartlett, 11-12, Fenchurch Street, E.C.3.

Gilbert Austin, Ltd. (12,420).—Private company. Registered November 1st. Capital, £40,000 in 20,000 pref. and 20,000 ord. of £1 each. To carry on the business of electrical, mechanical, heating and ventilating engineers and contractors, plumbers, gasfitters, &c. The first directors are:—L. Austin, 10, Calderwood Road, Newlands, Glasgow, electrical engineer; W. Manson, Junr., 18, Esslemont Road, Edinburgh, electrical engineer. Secretary: W. Manson, Junr. Solicitors: A. P. Hamilton & Callander.

H. W. Sullivan, Ltd. (185,364).—Private company. Registered October 30th. Capital, £20,000 in £1 shares. To take over the business of an electrical engineer and manufacturer of electrical and other apparatus, &c., carried on by H. W. Sullivan at Winchester House, Old Broad Street, E.C. The subscribers (each with one share) are: H. W. Sullivan, Langham Hotel, W.1, electrical and telegraph engineer; C. D. Medley, 36, Lincoln's Inn Fields, W.C., solicitor. H. W. Sullivan is permanent governing director, subject to holding £10,000 of the shares allotted to him under purchase agreement, with £1,000 per annum as remuneration. Registered office: Winchester House, Old Broad Street, E.C.

Tingey Wireless, Ltd. (185,379).—Private company. Registered October 30th. Capital, £10,000 in £1 shares. To carry on the business of a wireless and electrical engineer and manufacturer as formerly carried on by W. R. H. Tingey at 92, Queen Street, Hammersmith, W., and elsewhere. The first directors are:—W. S. Nathan, C.M.G. (chairman), 33, Tothill Street, Westminster, S.W.; W. R. H. Tingey, 22, Leinster Gardens, Hyde Park, W.2 (both permanent, subject to holding 2,000 shares each). Qualification of ordinary directors, £500. Secretary: W. Sutton. Registered office: 174, Wardour Street, W.

Holborn Radio Co., Ltd. (185,366).—Private company. Registered October 30th. Capital, £1,000 in £1 shares (450 ordinary and 550 10 per cent. cumulative preference). To adopt an agreement with C. W. Hine, A. V. James, and J. Deverell, and to carry on the business of mechanical and electrical engineers, manufacturers of telegraphic and telephonic apparatus, &c. The first directors are:—C. W. Hine, 119, Farrant Avenue, Wood Green, N.22, radio engineer; A. V. James, 30, Elm Grove, Crouch Hill, N.8, radio engineer; J. Deverell, 15, Ampthill Square, N.W.1, radio engineer. Qualification, £1. Remuneration: £260 per annum. Secretary: A. V. James. Solicitors: Turner & Evans, 124, Chancery Lane, W.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bell Battery Co., Ltd.—F. R. Wilcock, of 1, Great Winchester Street, E.C., was appointed receiver on October 20th, under powers contained in debenture dated June 12th, 1922.

North Somerset Electric Supply Co., Ltd.—Satisfaction in full on October 3rd, 1922, of first debentures, dated August 25th, 1917, securing £5,000.

Brighton Lighting and Electrical Engineering Co., Ltd.—Mortgage dated October 12th, 1922, to secure £1,000, charged on 10a, 10b, and 10c, St. Martin's Place, Brighton. Holder: Miss S. B. Sers, St. Andrew's House, 12, Tavistock Crescent, Westbourne Park, W.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.

The report for the year ended June 30th, 1922, shows that the revenue, derived mainly from interest upon the City of Auckland Corporation debentures, amounted to £52,086. After providing for all expenses chargeable to revenue, including £11,822 for debenture interest and £4,719 in respect of income tax and corporation profits tax, there is a balance on revenue account of £33,209, making, with £8,491 brought forward, a total of £41,700. The dividend on the preference shares to June last requires £9,000, and the directors now recommend that a dividend be paid on the ordinary shares at the rate of 5¼ per cent. for the year (free of income tax), requiring £23,625, and leaving £9,075 to be carried forward. During the year £15,353 of the company's first mortgage debenture stock was bought and cancelled, the average cost to the company being approximately 92¼ per cent. Since the close of the year a further £2,690 of debenture stock has been purchased, and £124,935 stock has been redeemed by an exchange for City of Auckland 5¼ per cent. debentures. The amount of debenture stock now outstanding has thus been reduced to £104,483. The directors are of opinion that the time has now arrived to consider the winding-up of the company, and they propose to take a favourable opportunity of realising the assets with a view to the liquidation of the company and the distribution of the proceeds.

Montevideo Telephone Co., Ltd.

At the annual meeting, on November 1st, the chairman (Viscount St. Davids) spoke of the complications which had interfered with the company's working during the past year. The company had offered to sell its system to the Uruguayan Government as an alternative to the Government's instituting a separate service of its own, and in June a contract was signed. In September, however, the company's employés struck for higher wages. The Government then stated that if these concessions were made there would have to be an abatement in the purchase price. Owing to the action of the municipality, the company was forced to concede the increased wages, but obtained, at the same time, permission to increase its rates.

A dispute had arisen as to the power of the Uruguayan Post Office to enter into such a contract, but the company had been assured that if the shareholders approved the scheme, a verdict in favour of the contract would be obtained in the courts of law. Accordingly the board was adopting this course, and if the scheme went through, the shareholders would receive, not only their capital, but possibly a good margin as well. If the scheme did not materialise, and they were deprived of their undertaking, the available assets should produce about 15s. in the £ for the shareholders. The report and accounts were adopted and a subsequent extraordinary meeting ratified the agreement with the Uruguayan Post Office.

French Companies.

The report submitted to the ordinary meeting of the *Secteur Colier*, held at Lyons on October 19th, showed net profits of 227,431 fr., from which, after making provision for sinking fund and reserve, a dividend of 60 fr. gross was declared. The directors stated that the business of the company continued to develop favourably.

In agreement with the powers conferred on it by the extraordinary meeting of the shareholders of the *Union d'Electricité*, held on June 24th last, the Board has decided to raise the company's capital from 120,000,000 fr. to 140,000,000 fr. by the issue of new shares dating from January 1st, 1922.

The Allgemeine Elektrizitats Gesellschaft.

The report of the directors of the Allgemeine Elektrizitats Gesellschaft, dealing with 1921-22, states that the year was to be judged taking into consideration the conditions created through the depreciation of money. These led to a sale turnover representing milliards in paper marks, and exceeding by many times that in the preceding year. The stock of orders in paper marks was correspondingly much greater than at the beginning of the past financial year; moreover, the volume of the turnover also considerably increased, so that all the shops were abundantly provided with work, and the number of persons employed was correspondingly augmented. The world's requirements of products of the electrical industry proved to be very great, and could only be satisfied under long terms of delivery. The efficiency of labour certainly increased, but it still remained far behind the pre-war standard. In the meantime the decline of German currency has made terrible progress, and any outlook was prevented so long as the currency had to be brought into equilibrium. The constantly rising prices of foreign raw materials and the continued increases in the wages of staff and workmen compulsorily brought about advances in sale prices, with a sliding scale and more strict conditions of payment. Adverse consequences of this unsound economy for industry and trade could not fail to appear, and the unfavourable situation of the money market served to increase the anxieties.

Concerning the new connections established by the company, the report recalls the conclusion of a community of interests with the Mix & Genest Co., the participation in the Mansfeld (copper) Syndicate, the Rhenish Metal Co., and the Otavi and Aero Union, and the augmentation in the capital of the Osram Co. In addition, the company acquired the majority of the shares in the Hartung Co. in order to ensure the supply of grey castings, and also participated in the capital increases of the Bank for Electrical Works, the Felten & Guilleaume Co., and the German Shipbuilding Yard Co., of Hamburg. In Austria the company was in intimate business relations with the A.E.G. Union Co., and had a corresponding financial interest in it, and this brought about co-operation in the conversion of the former Austrian State Arsenal at Wollersdorf into a joint economic undertaking. It is further mentioned that the capital augmentation of 250 millions of marks decided upon in December, 1921, had been carried out, and it is now proposed to make a further increase of 300 millions in ordinary shares.

The gross profits, including the balance brought forward, are returned at 744,616,000 marks (247,720,000 marks in 1920-21); the amount written off for depreciation is 2,480,000 marks (2,023,000 marks); the sum placed to works maintenance account is 100,000,000 marks (100,000,000 marks); the net profits are 166,610,000 marks (82,388,000 marks); and the dividend on the ordinary shares, as recently reported, is 25 per cent. (16 per cent. in 1920-21).

Prospectuses.—*Marconi's Wireless Telegraph Co., Ltd.*—On Monday last there was offered for sale by Helbert, Wagg and Co., Ltd., who had purchased them, £1,500,000 of 6½ per cent. convertible 10-year first debenture stock. They were offered at 99 per cent. It was pointed out that substantial sums were required for the construction of new telegraph stations, and broadcasting was expected materially to increase the company's business both at home and abroad, requiring the continuous employment of from £700,000 to £800,000 for some time to come. It was announced that the list was to close on or before to-day (Friday), but it actually closed on Monday morning.

Reduction of Capital.—Electric Supply Corporation, Ltd. and Reduced.—A petition has been presented to the High Court for the confirmation of the reduction of the capital from £250,000 to £150,000, and will be heard in London on November 14th.

Stock Exchange Notices.—Applications have been made to the Executive Committee to allow the following to be [illegible] quoted:—

[illegible] fully paid £50,000 7 per cent [illegible]

Dealings in the following securities have been specially allowed by the Committee under Rule 153:—

[illegible] £60,000 [illegible] shares of £1 each, [illegible] £60,000 to £500,000; [illegible] shares of £1 [illegible] £1,000,000.

Anchor Cable Co., Ltd.—A financial daily announces an interim dividend of £1 per share upon paid-up share capital.

STOCKS AND SHARES.

TUESDAY EVENING.

WITH the General Election only a week ahead, and with the Turks doing their successful best to stir up renewed trouble in the Near East (causing heavy falls in the French franc), the Stock Exchange markets manage to maintain only a fair show of activity. Prices of most international issues are flat. All the political turmoil, at home and abroad, is unfavourable, of course, to enterprise on the part of capital. A good deal of home stock has been sold already in order to meet expenses in connection with the General Election, and while the sellers have experienced no difficulty in obtaining good prices for sound investments, it has not been quite so easy to deal advantageously with the more speculative varieties.

Fortunately for the Stock Exchange, the famous manifesto of the Labour Party has been of obvious advantage to the other side, and with the trouncing which Labour received at the municipal elections, the possibility of the Party coming into power before the end of next February is so appreciably diminished that Lloyd's underwriters are accepting substantially lower rates against this contingency than they asked a fortnight ago. So long as the uncertainty remains, however, it will have its effect upon business. France, meanwhile, has sold heavily on the Turkish developments. In the best-class stocks, it is a little surprising to find the 4½ per cent. debentures of the three Tube companies standing at a discount of 10s. per cent. on the partly-paid scrip, while the fully-paid, which came out at 93, is quoted at 92½.

Metropolitans have been 56, but slipped back to 55½, at which they show a gain of a point, and Districts from 42½ went back to 41½, leaving them also 1 better on balance. The Underground Electric stocks are steady, but the steam companies' issues, after a show of strength, went back sharply.

Brazil Tractions, at 47 ex dividend, exhibit a gain of nearly 2 points on the week. British Columbia deferred at 74½ is 3 up, attention being directed to the stock by reason of the excellent yield obtainable. Taking into account the fact that the dividend is paid tax free, the return on the money is equal to 11 per cent., less tax. Mexico Tramways 6 per cent. bonds at 44½ are 2 higher, in consequence of a demand that has arisen from Brussels. Other Mexican utilities have scarcely moved. Anglo-Argentine Tramways second preference are 2s. 6d. higher.

Brompton ordinary, with a rise of 10s., show the principal improvement in the list of home electricity companies. London Electrics at 3 1/16 have lost a sixteenth of their 10s. gain of last week. Metropolitans hold their rise at 6½. The new County of London ordinary shares are better at 4s. premium, while the preference are unchanged at 1s. 9d. to 2s. premium. Business would be more active were there a larger supply of shares available for this market to deal in.

British Aluminiums weakened to 16s. 9d. On the other hand, Metropolitan-Vickers preference advanced to 2 7/16, in consequence of the better tone which has set in for iron, coal, steel and allied shares. The Vickers company has recently secured two or three big contracts; this assisted the tone of a market already disposed to improve by reason of the settlement of labour disputes in South Wales. Dealings in Power Securities, ordinary and preference, were started early this week on the basis of 9d. to 6d. discount, at which price buyers came in, causing it to improve to 3d. discount. The issues were fully subscribed by the public, and the underwriters consequently have been relieved of their liability. General Electric 6½ per cent. "A" preference are 6d. harder at 21s. 9d.

Evidence of the way in which the public are taking investment stocks has been afforded several times this week, by the prompt closing of subscription-lists for new issues. One of the first and most successful was the offer for sale of 1½ million pounds 6½ per cent. convertible 10-year first debenture stock of the Marconi Company, at 99. Shareholders received special consideration, half the stock being set aside for their subscription. For the other half there was eager demand, partly, no doubt, on behalf of stags, but partly also on behalf of those who appreciate the debenture stock as a good security, likely to improve in price. The company's shares strengthened a little, on this illustration of the public's willingness to support Marconis.

In addition, there is the success which Mr. Marconi claims to have achieved in rendering secret the transmission of messages by wireless over, at present, a limited distance. Possibly, too, our references to the likelihood of further subsidiaries being floated in the near future—the shares in which are likely to be offered to holders of the parent company served to promote a little mild optimism, though the attitude of the shareholder can also be well understood who is rather inclined to sell his present holding in order to transfer into the company's new debenture stock.

Cable stocks and shares are not affected by the important claims put forward with regard to secrecy by the wireless system. There is little alteration in the leading cable stocks and shares; the strength of the market remains unimpaired. New York exchange movements have had the effect of forcing up prices of American and Canadian industrial securities to the extent of several dollars. Holders on this side of the Atlantic who still retain such investments can now command good prices for their stocks, and it may be to their advantage to look into the matter with a view to exchanging these into something else that pays better on the money. Chile Telephones and Oriental ordinary have gained 2s. 6d. and 1s. 3d. respectively.

Rubber statistics moved in the direction hoped for by the holders of rubber shares, and prices in the market are generally steady, without there being, however, any such repetition of activity as characterised the rubber share market towards the end of last month. Talk runs on the probability of the raw produce reaching 1s. 3d. per lb. in the near future, but against this must be set the fact that a good many rubber shares have recently doubled, and more than doubled, in price, a consideration which gives pause to the speculative buyer who has seen reactions in Stock Exchange markets before.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Nov. 7. 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	9	+ ½	£6 13 4
Charing Cross Ordinary	8	9	7⅞	—	5 18 8
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6⅛	—	4 12 4
City of London	14	14	21/-	—	6 15 7
do. do. 6 per cent. Pref.	6	6	23/-	—	5 14 4
County of London	6	6	1⅞	—	6 11 4
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 8
Kensington Ordinary	9	10	7½	—	6 13 3
London Electric	2½	4	3⅞	- ⅛	3 17 6
do. do. 6 per cent. Pref.	6	6	6	—	6 17 1
Metropolitan	7	7	6⅝	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9⅛	—	6 11 6
South London	7	7	4	—	7 0 0
South Metropolitan Pref.	7	7	1⅜	—	5 18 0
Westminster Ordinary	10	10	7¼	—	6 9 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref	6	6	102	—	5 17 6
do. Def.	1½	84/6	20½	—	7 16 6
Chile Telephone	6	6	6⅞	+ ½	4 16 0
Cuba Sub. Ord.	7	7	8⅝	—	8 12 4
Eastern Extension	10	10	19⅛	+ ½	5 2 7
Eastern Tel. Ord.	10	10	193½	—	5 8 0
Globe Tel. and T. Ord.	10	10	19⅝	—	5 2 7
do. do. Pref.	6	6	11⅛	— ⅛	5 5 0
Great Northern Tel.	24	99	28	—	7 17 2
Indo-European	10	10	85½	—	7 1 0
Marconi	25	15	2⅞	—	6 9 6
Oriental Telephone Ord.	12	13	2⅝	+ 1/16	*5 1 0
United R. Plate Tel.	8	8	7⅜	—	*5 .6 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19½	—	*5 2 7
HOME RAILS.					
Central London Ord. Assented	4	4	87	—	5 19 5
Metropolitan	1½	2½	55½	+1	4 1 1
do District	Nil	1	41½	+1	2 8 2
Underground Electric Ordinary	Nil	Nil	3	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	86½	—	*4 12 5
FOREIGN TRAMS, &C.					
Anglo-Arg. Trams, First Pref.	5½	12½	88	—	7 11 9
do. do. 2nd Pref.	Nil	5½	8⅝	+ ½	6 19 8
do. do. 5 per cent. Deb.	5	5	82½	—	6 2 2
Brazil Tractions	Nil	Nil	47xd	+ ½	8 10 2
British Columbia Elec. Rly. Pcs.	5	5	76½	—	6 9 9
do. do. Preferred	5	98/-	66	—	*7 2 6
do. do. Deferred	8	124/-	74½	+3	*8 6 9
do. do. Deb.	4½	4½	73	—	5 16 5
Mexico Trams. 6 per cent. Bonds	Nil	Nil	72¼	—	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	49½	—	Nil
Mexican Light Common	Nil	Nil	20½	—	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds	Nil	6	65½	—	7 14 6
MANUFACTURING COMPANIES					
Babcock & Wilcox	15	15	8⅝	—	4 18 0
British Aluminium Ord.	10	5	16 9	—1/-	5 19 5
British Insulated Ord.	15	15	44/6	—	6 14 10
Callenders	15	15	2½	—	6 13 4
6½ Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	15	Nil	9/-	—	Nil
do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1⅜	—	7 17 0
English Electric	8	5	15/0	—	6 7 0
do. do. Pref.	8	8	18/3	—	6 8 0
Gen. Elec. Pref.	6½	6½	21/9	—6d.	5 19 6
do. Ord.	10	5	18/-	—	6 8 1
Henley	15	15	2½	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	14/6	—	—
Met.-Vickers Pref.	8	8	2⅜	+ 1/16	6 11 6
Siemens Ord	10	10	25/9	—	*7 15 4
Telegraph Con.	20	20	25½	—	*4 18 6

* Dividends paid free of Income Tax.

ELECTRICITY IN MINES.

First Annual Report of the Secretary for Mines, 1921.

The first report of the Secretary for Mines appointed under the Mining Industry Act of 1920, and embodying the annual report of the Chief Inspector of Mines, has recently been issued, the price being 6s. 6d.. For such an important publication, in which the general public are interested—seeing that for the last few years the mining industry has been in such a state of ferment—we think it would have been a wise policy to have sold the book at a price which would have brought it within reach of the man who, while interested, is not sufficiently so to spend 6s. 6d., especially in these days. He would at least learn something of the truth of the "control" of coal mines, which might give him cause to think about what would have happened under "nationalisation"; as Mr. Bridgeman informs us, it cost the taxpayer no less than £34,000,000. Under control, all the money received from the sale of coal went into a pool, the miners' wages were guaranteed, and while prices remained high everything went splendidly; but the Government could not keep prices up, and, as Mr. Bridgeman says, the "sudden depression of trade completely upset the economics of the industry. A credit balance on the whole of the industry, after payment of wages, royalties, and other costs, of nearly £13,000,000 in the quarter ending September, 1920, was changed in the quarter ending March, 1921, to a loss of over £16,600,000." It was because of this credit balance of £13,000,000 that the miners came out on strike for more wages, yet in six months, such are the vagaries of the mining industry, that not only had the £13,000,000 been lost in selling coal below cost price, but, in addition, a further £16,600,000, or a total of £29,600,000. The miner thinks, and is even told by his leaders, who ought to know better, seeing that they profess to be experts in the mining industry, that all the "profits" go into the coalowners' pockets, who spend it on themselves. The fact is, however, that the greater portion of the revenue derived from the sale of coal goes back into the industry for plant and development and to make up for losses in bad times. Hence, looking at the question from this point of view, it is easy to see what would happen under nationalisation or the miners' "pool," for which foolish idea the miners came out on strike on April 1st, 1921, and remained out for three months, and by withdrawing the "safety" and pump men caused untold damage to the mines and their own livelihood, from which the country and the miners themselves are still suffering.

Regarding the search for oil in the United Kingdom, which was undertaken by the Government, we learn that eleven bore holes were put down in different parts of the country, and resulted in the obtaining from one hole at Hardstoft to the end of December, 1921, of 932 tons of oil. The others all proved blanks, and have been abandoned. Nothing, however, is said of the cost of these borings, or the value of the oil found, both of which items it would be of interest to know.

On the question of health and safety in mining, it is satisfactory to learn that "in the ten years ending 1920 the proportion of persons killed in mines to the number employed was smaller by nearly a *half* than the proportion for the ten years ending 1882"; but in spite of regulations the divisional inspectors, after examining the records of the accidents during 1921, have expressed the view that no less than one-third could have been prevented by observance of the regulations or reasonable precautions. Scientific research is being carried on in collaboration with the Department of Scientific and Industrial Research and the Medical Research Council through various committees. There is also a department for testing and approving safety appliances and explosives and analysing samples of air, dust, &c. Under this head it is interesting to note that *fourteen* new types of electric lamps and five modifications of approved types have been tested, and thirteen have been recommended for approval. Few of the new types of electric lamps, however, have shown any novel departure from existing types, but in three instances attempts have been made to increase the light-giving power of the lamps without unduly increasing their weight. The method adopted in two cases was by an increase in the voltage of the battery, while the third employed two bulbs in parallel.

With regard to H.M. Chief Inspector's report relating to the use of electricity in mines, he refers to the introduction of storage battery locomotives which have been installed at eleven coal mines and three metalliferous mines. The use of these locomotives is subject to the consent of the Secretary of Mines, who may impose special conditions to meet the circumstances, and each application for such consent is considered upon its merits after inspection of the proposed place of use and examination of the intended equipment. There is without doubt a distinct field of usefulness for the self-propelled tractor as a feeder to the main haulage system.

Another interesting application of transportable electric storage batteries is their use for driving rotary electric drilling machines at the working face. The batteries also supply power for their own transport between the place of use and the re-charging station.

Out of 3,045 coal mines in the United Kingdom and Ireland, electrical power is installed at 1,570 mines, as well as at 57 mines under the Metalliferous Mines Act. At the former the capacity of electric motors in use in 1921 reached a total of 1,148,103 h.p., and at the latter 18,581 h.p. The following table shows the aggregate h.p. of electric motors in use for different purposes:—

Total h.p. in Use at Coal Mines.

	1921.	1920.
Underground—		
Haulage	261,358	257,049
Pumping	297,901	279,612
Portable machinery ...	64,406	62,214
Miscellaneous	21,240	19,993
Total	644,905.	618,868
Above ground—		
Winding	62,665	52,965
Ventilation	84,543	80,309
Haulage	50,959	47,411
Coal washing and screening ...	83,686	77,783
Miscellaneous	221,345	203,486
Total	503,198	461,954
Grand Total	1,148,103	1,080,822

Coal-cutting machines were in use at 776 mines in 1921, against 760 in the previous year. The total number of machines in use was 5,259, as against 5,071 in the year 1920. Of these, 2,257 were driven by electricity, leaving 3,002 driven by compressed air, for the year 1921. In the previous year the figures were 2,153 electrically driven and 2,918 driven by compressed air, so that out of 188 machines introduced in 1921 104 were electric machines. The total quantity of coal cut by the machines amounted to 23,039,705 tons, against 30,194,306 tons in 1920; but, of course, in 1921 there was a three-months' stoppage of all work. Unfortunately, the report does not give separately, as in former years, data for the various machines driven by compressed air or electricity, so that we are unable to state the quantity of coal obtained by the electrically-driven machines compared with that obtained by compressed air-driven machines.

There were 268,538 electric safety lamps in use in 1921, as against 245,000 in the previous year, a sure indication of the growing popularity of the electric lamp. That this is gradually taking the place of the oil flame lamp is shown in the fact that 605,566 oil lamps were in use in 1921, as against 635,127 in 1920.

or nearly 30,000 less, whereas the electric lamps increased by nearly 23,000. An electric device for the detection and measurement of the quantity of gas has still to be discovered, but if a really satisfactory and portable apparatus could be found, it would mean the end of the oil flame lamp.

During 1921 there were, unfortunately, four fatal accidents to workmen caused by electricity—three on the surface and one underground. This is the lowest on record for accidents below ground, which is a very satisfactory improvement in this respect, and we sincerely hope that the next report will not contain any. In addition to these, however, electricity was a contributing cause in one accident resulting in the death of a pump attendant, who suffered severe burns by an ignition of fire-damp in a haulage engine-house at the top of a dip tunnel. The gas appears to have been ignited by the break-flash at the contacts of a protected type tramway-pattern controller, which was not designed so as to prevent *open sparking*.

Two boys—one 10 years of age, the other 16 years of age—were killed by electric shock in two separate accidents while trespassing. One climbed a stove pipe outside a motor-house and came in contact with the bare conductors carrying alternating current at a pressure of 3,000 volts. The other climbed a steel lattice mast carrying 11,000-volt alternating current.

In the other four returnable cases of accident, the first was due to a binding wire having cut through the insulation of cables connecting a pole line with switchgear at the pit-head. The deceased stood upon an old coil of wire rope and took hold of a stay wire attached to a wood pole, which carried an overhead line at 440 volts, 3-phase. The loop of the stay wire made casual electric contact with a small lightning conductor running down the pole, which, unfortunately, was broken between the point of contact with the stay wire and the ground, whilst the upper part was in contact with the binding wire before mentioned. The neutral point of the 3-phase system was not earthed, but the distributed leakage sufficed to provide a return path for the current through the man's body. Thus, through an unfortunate chain of circumstances a valuable life was sacrificed. In the second case a collier was walking along the railway track and became entangled in a broken wire forming part of an overhead circuit for lighting the track. The wire was bare copper, and served to connect lamps in pairs between two phases of a 460-volt, 3-phase circuit with earthed neutral point. In the third case a chargeman sinker was preparing to replace lamps in a "bonnet" fitting suspended in a shaft, when he received a fatal shock either by touching an imperfectly-insulated joint in the conductor leading from the fitting to the shaft cable, or from the unearthed metal hood of the fitting, which may have been live by reason of the defective joint. The control switch provided in the banksman's cabin may have been turned on inadvertently, or it may not have been turned off. In the fourth case a labourer was assisting in the erection of a switchboard, parts of which were in use controlling the supply of electricity from the power station. He was set to work by one of the erectors in a cubicle containing an unprotected live terminal with which he appears to have come in contact while withdrawing from the cubicle after completing his work. An electric arc was set up between the terminal and the walls of the cubicle, and the deceased suffered severe burns to which he succumbed next day. His instructor appears to have been ignorant of the risk incurred. The system was 3-phase alternating current at 11,000 volts. One can scarce believe in these days of high-pressure current that any one working near or with high-pressure apparatus would be ignorant of the dangers or risk of fatal accident incurred by coming into contact with it.

These accidents, however, show how necessary it is to avoid anything of a flimsy character, to see that everything is perfect, sound, and solid in construction, and, most of all, to see that men working with electrical apparatus really understand something of what they are doing, and of the risk and danger of electric shock.

ESTIMATING OFFICE ORGANISATION.—II.

By Major J. C. CONNAN.

At the present moment, when competition is so keen throughout the world, too much attention cannot be given to the estimating office, where a mistake is much more likely to seriously affect the profit on the job than a mistake in the erecting department.

An estimate at the best of times is bound to have a number of uncertainties in its composition, but for the moment neglecting these it may be said that the accuracy of an estimate will depend on three things:—(1) The engineer making the estimate (this includes the cost clerk if this work is not done by the engineer), (2) the tools he uses, and (3) his surroundings.

The Engineer.—Little need be said about his qualifications. He should be technically trained, and should have had practical experience in erecting the class of material for which he will estimate. He should be given the opportunity of seeing the work erected for which he has estimated, and enabled to analyse the final cost of the job when completed. The latter point is extremely important, as it enables him to see where he has made mistakes and too allow for them in future estimates. The final cost sheets, which should also include the net quantities of material supplied to the job, should always be checked against the estimate by the chief engineer or manager, as the case may be, and should serious discrepancies be found, an explanation asked for from the engineer. This introduces a healthy feeling of control into the office, and stimulates keenness in the work. Much time is lost in most offices due to unpunctuality, and as a result a considerable amount of overtime becomes necessary, a most unsatisfactory state of affairs, as work done under these circumstances is usually full of mistakes. However, it is of little use to insist on punctuality amongst the junior engineers if the day's mail is not opened before 10 o'clock. The manager should be in his office at least an hour before the general opening hour, and should have in that time gone through the mail and sorted out the work for each engineer. This should be on their desks by the opening hour, and a quarter of an hour afterwards a short conference between all engineers and the head should be held to discuss along what lines special estimates should be made, as well as any other points arising out of the letters.

It would certainly increase the keenness of the engineers if they were given a percentage on all successful orders resulting from their estimates. The estimating and erecting staff in most offices are in an inferior position to the salesmen in this respect. Their responsibility is very much greater, for a mistake on their part is of much more serious consequence to the firm than almost any mistake which a salesman can make, representing in the first instance a loss of actual £ s d, but in the second only a loss of potential £ s d. This should be recognised by some encouragement in the manner suggested above.

Tools.—This is a general term to include all the appliances, &c., which the engineer finds necessary in the preparation of an estimate. It includes such things as pocket books, tables, drawing instruments, scales, slide

rules, cycle meters, &c., which all should be of first-class quality, and should be of such a size as to meet most readily the engineer's needs; printed data sheets, estimate forms, self cost sheets, labour constants, &c., as well as the typist (who must be considered as an accessory), a most important and very often unsatisfactory member of this group. As regards the last item, the typists' office is usually run separately from the other offices, the engineer sending for one when required. Unless the head of this office is of strong personality, it will often be found that a good deal of favouritism goes on, and that as a result certain of the typists will be underworked, with a consequent rush in the work of others. Till the universal use of the dictaphone comes about, this trouble will never be entirely eliminated, but much might be done by efficient control.

The general effect of an estimate on the prospective customer depends to a very large extent on the manner and neatness with which it is typed, and too much attention cannot be given to this side of the work.

It will frequently be found that a customer's inquiry does not contain all the information necessary to enable an accurate estimate to be prepared. To avoid unnecessary delay and correspondence, a data sheet should at once be sent when this is found to be the case. This data sheet is nothing more than a printed list of questions, the answers to which will enable the engineer to work out a definite estimate, and in the case of specialised plant, such as rolling mill plant, colliery winding gear, &c., exact answers are exceedingly important. It is advisable to make the data sheet a little more than a bare list of questions, and a few notes added to explain exactly what type of answer is required to each question will often be found extremely useful.

In order to eliminate the possibility of omitting items in the preparation of an estimate, printed estimate forms should be used.

This will involve a fairly comprehensive list of forms depending on the class of work done by the firm, but will be found to be worth the expense not only in avoiding mistakes, but also in saving the time the engineer would spend in writing out the particulars on a blank form. The printed form will naturally include more items than are likely to be required on any one estimate in order to allow for possible alternatives, but the blank spaces so left will not be found to introduce any disadvantages. Whether the pricing is done by the engineer himself or by a self cost clerk, self cost sheets are absolutely essential. These are ordinary price lists, most convenient in loose leaf form without technical data, but with the firm's actual self cost ex their works, arranged according to size or type as the case may be. They should be kept rigidly up to date, newly typed lists being used to replace any altered sheets, to avoid mistakes in written figures. Many firms use price lists subject to a discount. This necessitates a calculation every time a price is required, with a consequent possibility of error and a loss of time.

The estimation of the cost of labour on a job is a fruitful source of error in an estimate. Almost every engineer has his own methods, and seldom will two estimates for the same work be the same. The difficulty no doubt in the estimation of this item has also been greatly added to during the past war years by the continually fluctuating rates of wages. In order to reduce these uncertainties to a minimum, and to introduce into the estimation of labour costs an element of standardisation, the author has prepared a number of "Labour constants." These have been used, to some extent, in the building trade for many years, but have not, as far as can be ascertained, been employed on electrical work. They consist of a series of figures representing the time in hours rquired to do a certain unit of work, such, for instance, as running 100 yards of cable or fixing on foundations a 10-h.p. motor, but under certain specified standard conditions. This form of estimating necessitates a special column for labour costs on the estimate form, and may take up a little more time, but by allowing modifications to the standard time for conditions other than standard, reduces the element of guesswork very considerably.

Whether the estimate should be independently checked or not is a point about which there has been considerable debate.

For a small firm it would appear to be more satisfactory, and would also be less expensive to concentrate the whole of the responsibility for the estimate in the hands of the engineer rather than divide it between the engineer, cost clerk and checker. The engineer usually can devise methods for rapidly checking through his estimate, and he should also be greatly helped in this respect by the analysis of the past orders secured. But when the amounts involved are very considerable—and this is mostly the case with large firms—it is extremely desirable to have the estimates independently priced and independently checked both for quantities and price. This naturally adds to the expense of getting out an estimate, and also introduces a certain amount of delay in sending it off, but avoids serious errors in the price put forward. An instance of the importance of checking recently came to the notice of the author, when an error of £17,000 was made in a tender, and not found out till after the work was in hand. This amount would have paid the staff of the whole estimating office for 10 years, or the salary of a checker for the best part of his lifetime.

Of tools in general there should be no shortage. They should be provided by the firm, so that there will be no necessity to borrow this, that, or the other thing from one of the other engineers, and although most engineers worth their salt usually provide themselves with everything they are likely to need, it should not be left to them to do so.

Surroundings.—The estimating engineer is essentially a brain worker, and as such everything which will distract his attention or reduce his power of concentration should be avoided.

His desk and chair should be comfortable, his room silent, warm, well ventilated, and above all well and correctly lighted, his tools readily accessible to his hand. In the author's estimation this necessitates a separate room for each engineer. This may sometimes be difficult to arrange, but it is not necessary that the room should be large if the above requisites are provided. An engineer is an individual, and can work best under conditions peculiar to himself. These he can provide for himself without interfering with the working conditions of anybody else, if he has a room of his own.

Estimating in the past has frequently been a system of glorified guesswork. This should not be so. An effort has been made above to show how much greater certainty may be introduced into the preparation of an estimate, enabling closer prices to be put forward. Some may contend that the methods suggested are unnecessarily expensive, but even if this should be found to be the case, it would be more than offset by the larger amount and greater accuracy of the work which each engineer could turn out.

X-ray Research.—Manchester will shortly be in the proud position of possessing the most up-to-date and powerful X-ray department in the country, says the *Daily Dispatch*. Some time ago the Manchester Royal Infirmary received a donation of £5,000 for the purpose of equipping the new X-ray department, which will be formally opened on November 18th by Sir Humphry Rolleston, president of the Royal College of Physicians. By 1913 the X-ray, massage, and electrical work of the infirmary had increased to such an extent that it became almost impossible to cope with it. Twelve months ago it was decided to utilise the whole ground floor of the teaching block. Considerable alterations have since taken place, and the department has been equipped with the latest and most powerful apparatus. It will now be able to undertake every form of X-ray diagnosis and treatment. Cancer research with X-rays is also carried out in this department under a special committee. A special feature is the fully-equipped demonstration room, where students and doctors will be able to see the cases under examination without in any way interfering with the routine work.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

INAUGURAL ADDRESS, by FRANK GILL, O.B.E., President.

(Abstract.)

The Institution.

The Institution is in point of numbers now the largest engineering Society in the British Empire, the total membership at the commencement of this session being 10,461 and the increase during the past twelve months 867. Membership is becoming more recognised as a qualification, and the Royal Charter gives an added dignity and prestige. I do not hesitate to call for ungrudging service to the Institution from all its members, certain that if each will actively realise that the Institution is *his* Institution, its powers of and opportunities for useful service to mankind will be greatly enlarged.

Technical Education.

As one illustration of service, the new Technical Education Scheme may be mentioned. The Board of Education has sought the assistance of the Institution in its management of technical education in England and Wales; accordingly, a Joint Committee, on which the Board of Education and this Institution are equally represented, will be responsible for the curriculum in electrical engineering at such schools as elect to join in the scheme, for certifying the satisfactory nature of the schools and the final examinations; the certificates and diplomas issued to successful candidates will be signed on behalf of the Institution, the Board of Education, and the school. Apart from service on the Joint Committee, cases will certainly arise where members can help by showing interest in those schools which adopt the scheme, by gifts of apparatus and plant, by facilitating visits of students to works, by finding work for the students, and by criticism of the course of training, so as to make it really adapted for turning out men best equipped for their work in the world.

It is tremendously important that, during their course of study, students should get first-hand acquaintance with actual commercial conditions, both as regards the conditions of work and acquaintance with the workers. Managers (it is becoming an anachronism to speak of "employers") ought to feel it a duty to make temporary vacancies for such students, realising that as hereinafter they will require adequately trained men from the schools, so in the meantime they also must do their share in the educational scheme by providing facilities impossible to the schools, but possible to industry. I make a very earnest appeal to all those members of the Institution who are in positions enabling them to influence either opinion or practice on this matter, to make a point of doing what they can to meet this need. During my time I have had a considerable number of men direct from the universities and colleges, and I do not recollect a single failure. But I do not remember an instance of a student being familiar with the economic aspect of engineering studies, nor of one who had any idea of how to tackle a problem of engineering economics. Yet that question of economics is the fundamental problem of the engineer; the time at the schools is very fully occupied, but engineering economics ought not to be left untouched.

Electrical Communication.

Other things being equal, the nation best equipped with the means of production, communication, and transportation, will enjoy a great advantage in the race for commercial supremacy, and perhaps also in the search after national well-being. It follows, therefore, that a great responsibility is laid on those to whom is entrusted the means of communication, or who control those means, particularly so because it is at last generally recognised that competition is not an aid to efficiency in this business. In return for the grant of facilities to carry on its work, each grantee authority must ultimately recognise its duty to the public and must diligently and actively search out new means and facilities and also set about educating the public with regard to their need for communication. Efficient communication is the life blood of [illegible] and international understanding and [illegible].

The passive attitude of merely satisfying public demands must be abandoned and an aggressive attitude take its place.

The assumption that lack of profit-earning robs a Government of the [illegible] used by a public company; also that a Government [illegible] should not earn any more money than is necessary [illegible] to be self-supporting, are both fallacious. Only let it be realised that communication means something real—that it is a tool for the benefit of the nation, a necessity—and who is more vitally interested in obtaining the fullest possible utilisation of that necessity than a Government? The stimulus of profit-earning to produce development is small compared with the stimulus which comes to a public department as trustee for the nation.

But it seems also wrong to assume that a Government department should not earn something more than just enough merely to pay its way. With a large staff it is unhealthy that the idea should prevail that profit-earning is of no account. Without a surplus of income over expenses, there is no margin for unforeseen contingencies; service trials and research are likely to be adversely acted upon, and capital will be raised with greater difficulty. Further, there seems no reason why a Government should not include in the rentals a sum plainly intended to be a contribution towards revenue; it is difficult to see any reason why it is permissible, for the purpose of raising revenue, to tax, say, food, but not telephones, or why it is proper to make a considerable surplus on postage, but not on telephones. It would seem that the correct course is for the Government, if it operates the telephones, to raise from them something towards the National Revenue, and to pay such a return on the capital invested in the business as to make certain its ability to raise whatever money may be required to extend the business.

The following are some of the alterations in practice, caused by recent developments in telephony as they affect long-distance or through communication.

Loading is the deliberate addition of inductanc in a circuit for the purpose of increasing the distance over which satisfactory speech is feasible.

[Curves were exhibited by the author to indicate the results of loading and its effect on the cut-off frequency and upon the velocity of propagation of cable circuits].

So far as open lines are concerned, the reactions on the general plant caused by loading are that a higher class of construction, including transposition, and maintenance is required to avoid cross-talk and to keep up the insulation, for loaded lines are much more susceptible to reduction in transmission efficiency due to lowered insulation than are non-loaded lines. With poor maintenance it may well be that the number of days in the year during which the improvement due to loading is gained is not sufficient to pay for the cost of loading.

This condition of constantly maintained high insulation applies also to loaded cable lines, but, high insulation being comparatively easy to achieve in cables, little reaction is caused by this. The increased cross-talk caused by loading has, however, caused real difficulty, which has been overcome by great advances in the cable art, not only as regards the construction of long-distance cable in the factory, but also as regards the jointing of the wires in the field, both these being intended to secure such freedom from unbalance between circuits as will obviate cross-talk. Further, the effect of variables is not necessarily local; that is to say, a defect in one place may be felt a long way off in a section where no defect exists.

Repeaters are devices which relay the received current, but they have many important functions besides the amplifying one, and the reactions on telepone practice, due to the advent of the practical telephone repeater, will be of very special importance.

While the three types can be employed on either open or cable circuits, the four-wire type is economically more suited to cable circuits; and since the gains obtainable can be made so high as to render the line loss zero between the terminals of the 4-wire section (which cannot be achieved by any other type) it is economically possible to employ this type of circuit in cable for distances up to 1,000 miles—perhaps further—and so it is pre-eminently suited for groups of long-distance lines carrying heavy traffic.

Whenever repeaters are employed in any line they must be located at the right positions determined by engineering considerations alone and not by political ones. It might, for example, be correct for a line to run through Limburg on which there would be a repeater in Holland, but no appreciable length of line in that State. In any such case the networks at the repeater in one country must conform to the lines situated in other countries.

The gain given by the repeater [which the author illustrated by means of curves] must be adjusted to, and suitable for, the type of line with which it is to be used; a repeater is not a universal article which can be attached to any line regardless of its make up.

What is the overall result in transmission when employing a long line in which copper and repeaters both contribute to the effective transmission of speech—what, in fact, is the transmission afforded over the whole system? Fig. 1 shows frequency/attenuation curves for a non-loaded open copper wire line 3,400 miles (5,472 km.) long. The curves represent: (A) actual measurements on the line when using repeaters of a type designed for and suited to the line; (B) computations based on using imaginary repeaters giving uniform gains at all frequencies; (C) actual measurements when using repeaters suitable for other types of line, but unsuited to this one. The line includes 12 repeaters in tandem, and curve A shows that the specially designed repeater in conjunction with the suitable line gives a fairly uniform overall loss, approximately 10 standard miles, between the frequencies of 400 and 1,800.

On the other hand, curve B shows that the theoretical uniform-gain repeater, if used, would give a frequency/gain characteristic of a very undesirable kind which would greatly increase the frequency distortion. Lastly, curve C shows that a repeater suited to the character of one line, if used with another line to which it is unsuited, may give overall transmission of a highly unsatisfactory nature.

Since it is not yet practicable to transmit all frequencies equally, it is evident that some sort of a compromise must be made; and if a line is composed of several sections, on each of which a different compromise had been made final through result may be less satisfactory than need be, solely because the compromises contain no unity of treatment.

When repeaters are in operation, they must maintain constant the gains to be given out or there will be serious effects on the speech. If the gains fall off by 2 per cent., the net result will be an increase of 23 per cent. in the loss in the line. Should the gain on each repeater fall by 7.5 per cent. the final net loss would be an increase of 84.5 per cent., so great that probably the line would become unworkable. These examples show the importance of uniformity of construction, uniformity of maintenance, and uniformity of operation. The examples are rather understated than exaggerated.

Fortunately, the design of repeaters has been carried far enough, so that, if correct design is employed and if certain regulations for operating routine and maintenance are followed, the gains can be held steadily; but among those routines are tests which determine when the useful life of an amplifying element, a vacuum tube, has ceased, and the required constancy in gain can ony be held if all repeater stations are operating to the same routine, employing the same technique and under the one control. If it were possible to foresee all possible combinations and emergencies, it would doubtless be possible, though not economical, to establish

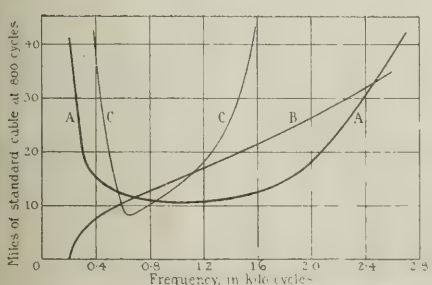


Fig. 1.—Attenuation-Frequency Characteristics.

routines covering all cases requiring attention; but the only commercial solution lies in unity of control of the line from beginning to end. It is no longer necessary to sacrifice the quality which can be obtained on open-wire circuits by loading them in order to reduce the attenuation—this reduction can be effected by repeaters. Long, heavy, open-wire lines are not now loaded at all, but are repeatered, resulting in improved articulation, and the increased speed of propagation avoids echo trouble, which only became insistent because of the more powerful effects derived from repeaters. With cable circuits, on the other hand, loading cannot be abandoned since it is necessary for the reduction of frequency distortion, but the tendency is towards lighter loading so as to raise the speed of the circuit, thus reducing the echo trouble which, because of the reduced speed and the great electrical length of loaded cable circuits, demands most careful consideration.

Carrier circuits have recently been put into commercial service, the new system having been added to the well-known methods of superimposing phantom telephone and compositing telegraph circuits. Special treatment is needed in the construction and maintenance of carrier lines and equipment, and because the equipment is expensive such lines must be of considerable length in order to be economical.

As an illustration of the advantages to be gained by using the latest development, the following may be quoted: On the New York-San Francisco line the circuits are of open wire from Harrisburgh to San Francisco, about 2,500 miles (4,050 km.) direct distance apart. On four conductors on this route the loads carried are:—

2 physical telephone circuits,
1 phantom telephone circuit,
4 earthed telegraph circuits, and a varying number of carrier telegraph circuits ranging from 6 to 20.

Two of the sections on this route in detail are:—

(*a*) *Between Chicago and Omaha*, fig. 2, 450 miles (729 km.) direct distance apart, four open-wire conductors carry:—

2 physical telephone circuits,
1 phantom telephone circuit,
4 earthed telegraph circuits, which can be worked either 1-way or 2-way at will,
20 2-way carrier telegraph circuits.

27 total circuits on 4 wires.

(*b*) *Between Chicago and Pittsburg*—450 miles (729 km.) apart—eight open-wire conductors carry:—

4 physical telephone circuits,
4 halves of phantom telephone circuits (equivalent to 2 circuits),
8 earthed telegraph circuits which can be worked either 1-way or 2-way at will,
37 2-way carrier telegraph circuits.

51 total circuits on 8 wires.

On another route *between New York and Philadelphia*—90 miles (145 km.) apart—two conductors in cable carry, though not by carrier circuits:—

1 physical telephone circuit,
30 special signalling circuits.

31 total circuits on 2 wires.

From Chicago to Omaha or from Chicago to Pittsburg the direct distances are about the same as from Paris to Berlin, from Paris to Marseilles, or from London to Milan. From New York to Philadelphia is about the same distance as between London and Birmingham.

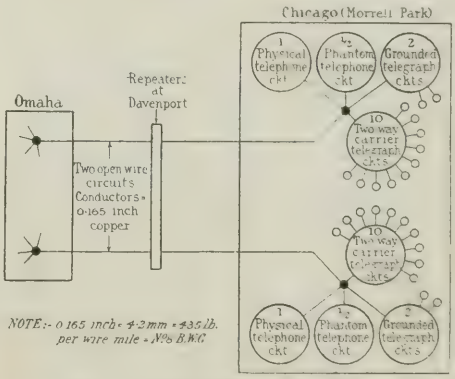


Fig. 2.—Chicago-Omaha Carrier Line Load.

At present there are in actual service in the United States the following miles of carrier route and channel:—

	Miles of route.	Miles of channel.
Carrier telephone	4,776	16,576
Carrier telegraph	10,919	78,870
Totals	15,695	95,446

Interference, meaning the reactions which occur between weak-current communication circuits and heavy-current light, power and traction circuits, is assuming increasing importance.

It must be recognised that the industries—involving the telegraph, telephone and railway signalling systems as representative of the light energy group, and the lighting, power, railway and tramway systems as representing the heavy group—are both of them necessary to the well-being of the world, and they must learn to live together harmoniously and to avoid or mitigate the otherwise serious reactions between their respective circuits. It must also be recognised that in grappling with this difficult problem there cannot be, and ought not to be, any claim by either side for priority of protection or preferential treatment.

There is only one sensible solution.- Let the engineers of the two industries first get together, unfettered by any partisan tie, to seek the best methods of getting rid of the trouble, and after those best methods have been found, on the basis of the least total cost, then, and only then, let the question of settling the apportionment of cost as between the interests be taken up.

Possible Improvements.—Heretofore a long-distance telephone line was a relatively simple structure, but it is no longer possible to consider maintenance of each part solely as a sectional matter—what is done at one place may cause

serious reactions at another, and the line as a whole must be considered. We can now, therefore, obtain certain advantages in the construction of through lines, but only if we are willing to give the attention necessary to secure them. The benefits are :—

Great increase in the distance over which communication can be given.

Great increase in the number of channels of communication, telephone and telegraph, which can be provided by one pair of wires.

Great increase in the number of circuits which can be placed in cable, numbers such that it would be impossible to find space for them if all circuits were to be open wires.

Greatly reduced annual cost of circuits and improvement in quality of speech.

Increased security of service by reason of circuits being in cable.

Increased speed of service by reason of greater number of circuits.

The principal points to which attention must be given in order to secure the above advantages are :—

Definite decision as to the work each line is to do, that is, planning in advance.

Definite standards of performance to be required of the complete line.

Unity of treatment of all transmission matter affecting the line over its full length.

Unity of treatment of all transmission matters affected by the connecting of the line to other lines, whether trunks or subscribers' lines.

Unity of maintenance control over complete length of the line.

Unity of control over repeater gains over the complete length of the line.

Unity of operating control over the whole length of the line.

Education of all sections of the telephone staff in transmission, maintenance, and operating practices. It is not sufficient for a few engineers in any administration to be familiar with these matters.

American Systems.—The telephone systems of the United States are in advance of those operating in Europe. The telephone system in the United States now has nearly two-thirds of the telephones installed throughout the whole world. In that country there are at present over 10,000 companies owning and operating over 14,000,000 telephone stations. That total number divides into two broad classes: those having some kind of connection with the Bell system, and those which have not. Again, the first class divides into those known as Bell-owned, and others as Bell-connecting with an independent ownership. The telephone statistics of the United States are :—

	July 31st, 1922, No. of Companies.	No. of Stations.	Per cent.
Bell-owned companies ...	26	9,223,770	65.0
Bell-connecting companies (independent ownership) ...	9,289	4,520,725	31.8
Total Bell system ...	9,315	13,744,495	96.8
Non-Bell-connecting companies	879	452,597	3.2
Totals	10,194	14,197,092	100.0

Since 1905 the increase in the number of stations of the Bell-owned companies has been an average of 410,000 per annum. Taking the population of the United States at 109 millions, there is now one telephone station to every 7.7 persons, while in the year 1900 there was only one station to every 56 persons. Since the beginning of the twentieth century, while the population has increased by 45 per cent. and the volume of general business (judged by the best data available) by 100 per cent., the number of telephone stations has increased by over 900 per cent. Again, the investment of the Bell-owned companies, which was $180,700,000 in 1900, had increased by 267 per cent. by 1911, and by 755 per cent. by 1921, and then stood at a total of $1,543,865,545, say £316,000,000.

From his telephone in that country a subscriber can reach out over more than 4,000 miles and can call practically any of the 13,700,000 stations referred to, situated in 70,000 cities, towns and villages; and the statistics show that the telephone communications in that country outnumber the postal communications by 50 per cent. It is agreed by those best qualified to judge that American industry on its present scale could not function without the telephone service as they know it now.

While there are many telephones which are not part of the Bell system, the great majority (97 per cent.) are part of that organisation of companies and, further, with a few exceptions those companies which are not part of that system are, on the average, associations of small concerns.

There are five outstanding features in the organisation of the Bell system, and they are essential in any effective organisation for telephony on an extended scale, namely :—

(1) Local operating organisations, thus making for decentralisation. These organisations, or companies, possess large measures of authority.

(2) A central administrative direction and control over the local organisations.

(3 A long-distance organisation constructing and operating the long lines by which the local organisations effect intercommunication.

(4) Control of the manufacturing organisation.

(5) A central organisation for scientific research, development of apparatus and technique of construction, maintenance and operation.

European Systems.—In Europe, generally speaking, and considering the nations separately, we find :—

(1) An organisation having a central authority with no separate local authorities.

(2) A series of administrative areas charged with the duty of maintaining the service under the central authority.

(3) No one department charged with the duty of through business.

(4) No control over manufacture.

When we consider Europe as a whole we find :—

(1) A number, about 40, of self-contained local operating organisations each, in the majority of cases, conducting local business and a through business within its area, also that part of the international through business which lies within its own borders.

(2) No organisation controlling or co-ordinating the various local operating organisations, which yet have to function as a whole.

(3) No means of keeping the separate organisations in touch with each other, and no systematic means of adjusting differences in matters of daily practices.

(4) No organisation of any kind which handles and cares for the through business as a whole.

(5) No common agreement as to manufacture.

(6) No common research, standard practice, or technique of construction, maintenance, and operation. There are in Europe large centres of population within such distances of, and in such commercial relationships to, each other that traffic would be forthcoming did adequate facilities but exist. There is no engineering difficulty so far as distance is concerned, in constructing and operating lines at commercial rates to give satisfactory speech from any part to any other part of Europe, but at present the through business is meagre in quantity, slow, and inefficient. Under the present conditions, practically the only way in which the nations can co-operate in these matters is that, when new lines are to be constructed between countries, there is co-operation and consultation between the representatives of the countries concerned, and occasionally there are international conferences. But these cannot produce a unified system.

Given facilities there is traffic waiting to be handled between the cities of Europe as between the cities of the United States. The opinion of some of those well qualified to judge is that the differences in language and customs do not constitute a serious bar to international communication by telephony, and there are weighty reasons (such as the present necessity of improving the relationship between nations, in addition to the normal commercial advantages) which render it safe to forecast sufficient through business to warrant the setting up of a competent organisation with the plant necessary to handle the traffic.

Long-distance Telephony.—There is, however, little likelihood of speedy and economical construction and operation of such lines as are necessary between, say, London and Stockholm, involving three, or perhaps five, intermediate non-interested countries; yet there is nothing fanciful in the idea of quick communication between such places. The direct distance over land between London and Delhi is about the direct distance from Key West, in Florida, to New York, thence to San Francisco and thence to Los Angeles, in California, over which distance calls can be made regularly. The new York-Chicago cable, now in course of construction, will have a gross transmission equivalent so great that if a 435-lb. (4.2 mm.) open-wire circuit were constructed to that equivalent it might be 10,000 miles long, enough to connect Paris to the telephone system at Seattle in the North-West of the United States and leave enough to spare to take care of the cable across the Behring Strait. Of course, this illustration is uncommercial, but it serves to show that land distance is now no difficulty to telephony.

There are originated at New York over 4,000,000 long-distance calls per annum, and in the United States many calls are made over lines of considerable length belonging to the local companies, and do not go over the long-distance lines. Similarly, Chicago and Philadelphia each originate a number approaching 2,000,000 long-distance calls per annum, while such places as Boston, Cleveland, and Pittsburg each originate about 500,000 long-distance calls per annum.

In the U.S.A. there exists a long-distance telephone service such as is not known in Europe. And yet there is no reason whatever why the service in Europe should not be extended in a somewhat similar fashion; from the fact of its denser population and less distant cities, Europe enjoys advantages over the United States, and these should make for much greater development of the through business than she now has.

Through-telephony in Europe under the present conditions

can never be worth the name of a service. Each nation is, from the telephone point of view, merely conducting a local business over an area which is not very great; each local authority, although vitally interested, must at its boundaries hand over the conduct of its business, in part, to someone else.

The through business must be handled as a complete unit if it is to be efficiently done. The correct course, therefore, appears obvious, *viz.*, to depute a body to do for all European nations that which no one nation can do for itself. This is already practised by banks and railways in their clearing houses. Once the fact has been grasped that there is no reason whatever for the corporate spheres of influence and the operating areas to be identical, and that each requires quite separate consideration for its determination, there will be no real difficulty in arranging operating areas for efficiency and apart from corporate spheres.

If it was possible for the nations to agree on unity of control for the purposes of war, it ought not to be beyond their powers to agree to a unity of control for the efficient working of the through-telephone business. It is not enough for the separate organisations to attempt to agree to a code of rules to which each shall subscribe—such an attempt would only be to court failure. Control can only be effected by a living authority always on duty.

Besides the engineering considerations there are weighty reasons connected with the circuit lay-out, business policy, rates, and operating, which make it impossible to give an adequate through service without unity of control.

Suggested Organisation.—At present it is difficult enough for the various administrations to obtain the money required for the construction of such plant as is demanded by their own traffic, let alone for the fostering of traffic by the construction of lines not yet called for by public demand and for the construction of lines between non-contiguous countries, which, although demanded, are not required by the intermediate countries through which they pass.

The alternative suggestions which present themselves are:—

(1) To operate all the through business, both within and between the various countries in Europe, by a single long-lines company working under licences from the various Governments, taking the calls from the local originating organisations, and being entirely responsible for them until turned over to the local receiving organisation.

Governments would put the long-lines company into a proper legal position, and make it plain that the company had the goodwill and support of the country, and they would co-operate with the company in the handling of the traffic. It might also be found desirable to turn over to the company, either on purchase or rental, certain lines and equipment already in existence for handling through traffic.

The advantages of this course would be that unified control could be achieved at once. The service would be on an ordinary commercial basis, and, if the fees were correct, sufficient money could be raised to construct all lines and equipment called for.

(2) The second alternative is for the various Governments to form what would in effect be a private company or Commission, of which the Governments only would be the stockholders, to do the work described in the first alternative, and from each subscribing Government the Commission would derive its authority in that country. The Commission being supplied by funds on some agreed plan of participation by each Government, would be the sole judge of the plant to be constructed and operated, within the scope of the money put at its disposal, and it would assume the ordinary responsibilities of a board of directors of a public company, carrying out all the necessary functions and periodically reporting results to those who supplied the capital.

The above is the merest sketch of a scheme, but if it should find acceptance I am ready to put forward for consideration by the proper authorities a plan which I believe will be found to provide a basis on which the countries can be represented on equal terms, and by which no unfair burden is placed on any country, and I believe such a plan would result in better service and be self-supporting.

(3) The third alternative is frankly one of a temporising nature. It is that the various operating telephone authorities should form themselves into an association for the purpose of studying this and other matters.

If I may venture to make a definite suggestion, it is that the telephone authorities of Europe—including the United Kingdom—as telephone-operating authorities rather than as Government departments—should hold an early conference of all the telephone authorities, companies and municipalities as well as Government departments, to study in detail this problem and endeavour to find a solution. I am convinced that unity of control over the through traffic must obtain in the end, but whether the through traffic is handled by one organisation or by many, there are matters which urgently require agreement for the improvement of telephony as an efficient agent for service in Europe.

Almost entirely, what has been said is limited to through communication by telephony. This is not because there is nothing to be said regarding local service, but rather because it seemed better to try to focus attention on what at the moment is the greatest telephone problem in Europe, namely: How shall the through business be organised? The time has come when the organisation must, if it is to remain efficient, change from unicellular to multicellular and the various cells must take up special functions rather than all functions; in that way only can the whole organisation have progress.

In the telephone we have the most perfect means of communication of which we know. If only we will use it, not alone will it benefit the industry of the nation, but we shall be making a definite step towards reducing international jealousies and fears and increasing the goodwill without which there cannot be peace on earth.

Irish Centre.

Chairman's Address.—*Abstract.*

Mr. E. C. Handcock, M.I.E.E., presiding, in Trinity College, Dublin, at the opening meeting of the 1922-23 session of the Irish Centre of the Institution, dealt with the future of the Centre and of the electrical industry in Ireland.

As regarded the Centre, he asked the members to consider how the recent change of Government in Ireland was likely to affect their profession. Irishmen were conspicuous in the profession. They had given it many of its greatest men, from the late Lord Kelvin to their President, Mr. Frank Gill, who was not only a Dublin man, but one of the founders of the Irish Centre, which was composed of electrical engineers of all branches, with one exception, numbering 148. It was on this body of men that the community relied for its supply of electricity; in fact, there was not a profession or trade that was not in a major or minor degree dependent upon them.

There were two paths open to their Centre—one, that of apathy, allowing others to accept responsibility; but if they remained apathetic they could not expect to be taken seriously if they protested against any technical rule or regulation of which they disapproved. The second path, and to him the only possible one, was to manfully accept their responsibility and, further, to make it clear to all concerned that their members could not reasonably be expected to be responsible for the carrying out of technical rules and regulations unless the Centre had a voice in their framing. The change of Government was going to be beneficial to the Irish Centre in the ratio that it accepted responsibility. He urged the necessity of a definite understanding between the Institution and the Government Department covering the technical regulations for the generation of electricity.

Another matter was as to the possibility of electrical manufactures in the Irish Free State. He regretted that, apart from one small company, he knew of nobody attempting electrical manufacture. That was a most unhealthy state of affairs, not only for the profession, but for the whole country. The change of Government in Ireland would give a strong inducement that had been absent before, for the Government would be able to place contracts at home, and these would ensure the manufacturer a start. Without such contracts it would be difficult to face outside competition.

Proceeding, Mr. Handcock advocated the establishment of a bureau of inventions and a research department. There should be, he said, a laboratory at each of their electrical training colleges. Tens of thousands of pounds of national money were annually expended in technical colleges covering the first step in the education of young electrical students, but for the second, and, nationally, more important step not a penny was expended, and, in consequence, young men had to leave the country to gain the necessary knowledge and experience, and they seldom returned.

They in Ireland were relatively a small community, now starting at a most critical period in their economic development; but they were starting free from precedent and vested rights. That, he held, was a combination that made for efficiency. It was most desirable that everybody interested in electricity should co-operate in building up the country. He would be satisfied if his remarks had any effect in awakening them to their responsibilities.

Turning to electrical schemes in contemplation, Mr. Handcock said the River Bann would, judging from present appearances, be the first of the Irish rivers to be harnessed on a substantial scale for the generation of electricity. A strong syndicate had the undertaking in hand, and it hoped to pilot a Bill through the Northern Parliament in the immediate future. The Centre and other engineering associations had discussed the possibilities of the harnessing of the Liffey, and were now awaiting final recommendations. It was to be hoped that the decisions covering the method of finance and control would be taken and published without delay. These decisions would be very important, as they would form a precedent for other schemes; and, seeing that water-power was a national resource, national money, to some extent at least, should be applied to its development. It was reasonable to assume that, in 12 or 15 years, after a considerable portion of the capital had been repaid, the Liffey scheme would prove a valuable source of revenue to the nation.

On the question of wireless, it was for the Centre [illegible] to say whether it would retain a directing control. If it were to do that the members must actively interest themselves in the new science, co-operate with those specialising in it, and help from their wider experience.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Steam Condensing Plant.

We have noted with much interest the statement recently made in your Journal by Messrs. Cole, Marchent & Morley that the "Delas" ejector uses 25 per cent. less steam than any other type of ejector.

Possibly Messrs. Cole, Marchent & Morley have carried out tests on every type of steam jet apparatus constructed, but we are unable to agree with their figures. If, therefore, they will refer to three surface condensing plants fitted with the "Delas" ejector and in commercial use in power stations in this country, we shall endeavour to arrange with Professor Stoney, or some other eminent and independent engineer, to carry out tests at our expense with a view to comparing the results with figures at present in our possession.

With reference to the cooling of ejector throats by the circulation of cold water, Messrs. Cole, Marchent & Morley claim this as the basis of the Delas design, and a feature possessed by no other ejector. We can refer to several ejectors having such an arrangement, and perhaps the most interesting type of ejector possessing this feature is the ejector designed by the Wheeler Co., of Philadelphia, in which the convergent portion of the throat is surrounded by a cold-water jacket. This ejector is described in British Patent No. 157,211, which has recently been cited by the British Patent Office against the "Delas" patents, and appears to us to be a very clear anticipation of the "Delas" ejector, and certainly disposes of any claim that they alone are entitled to cool the throat of an ejector by a circulation of cold water.

H. Fothergill & Co.

Westminster, *November 6th*, 1922.

Salesmanship in Relation to Small Electric Fires and Cookers.

Mr. F. E. Rowland ventilates, in your issue of November 3rd, a long-recognised difficulty in selling, experienced by makers of electric fires and of other electrical apparatus. The cost and inconvenience of the wiring does, unfortunately, deter many people.

The real way out is for electrical contractors to do as was suggested by Mr. Hughman at the E.D.A. Salesmanship Conference referred to by Mr. Rowland. When a contractor secures a wiring contract for lighting only, he should use all his persuasive powers to induce his customer to install a power circuit, if not for immediate, then for future, use. If the case is properly presented, the consumer will often agree.

For wiring for power, or for an extension to an existing installation, I think one of the modern metal-sheathed surface systems, such as the Henley wiring system, provides the most economical method.

W. A. Moore.

Forest Gate, *November 6th*, 1922.

The Administrative Staff and Sir Lynden Macassey.

My attention has been drawn to an article appearing in the Electrical Review, of October 13th, 1922, dealing with Sir Lynden Macassey's book entitled "Labour Policy: False and True," and more particularly to a reference in the book to the staff and the comments of your reviewer.

The distinguished author of the book in question expresses the opinion that "The Administrative Staff has not attained to a true conception of their real part in industry." He is probably entirely unaware of the fact that it is not so much the case that the staff has not a true conception of its part in industry, but rather that its conception is so advanced that it has necessitated the use of the combined forces of the employers in an endeavour to subdue it.

Your reviewer, however, is even wider from the mark. I have yet to learn that the members of the commercial and clerical staffs in the electricity supply industry have ever acted "as the catspaw of the employer," as he asserts. On the contrary, I know of several cases where members of this Association have suffered considerably through participation in the affairs of the Association.

It is almost humorous to note that an exception is made in the case of the E.P.E.A. and the comments, in addition to advertising that Association, are written in such a strain that one is tempted to think that the paragraph in question was written by a member of the E.P.E.A. It is also exceedingly strange that your contributor should state that he has never heard of a staff union other than the E.P.E.A., which has [illegible] about the improvement of the lot of its members." Either your correspondent is new to the industry or he has not turned the Electrical Review very closely during the last few years—else he would have seen that continued [illegible] by this Association to enlist the membership of every commercial and clerical worker in electricity supply undertakings throughout the country. This work of extensive propaganda has been carried out continually during the past four years, and a very high percentage of membership was attained in 1920. The Association was, with the E.P.E.A., a constituent member of the National Joint Board and, far from being a catspaw of the employers, fought through with its salary scheme which culminated in the recommendations of the National Joint Board of May, 1920. It was then the fiasco began. Employers all over the country repudiated the decisions of their chosen representatives and, with the exception of a few undertakings, refused to honour their agreements. The employers' side of the National Joint Board never tried to do anything, either alone or in conjunction with the employés' side, as a National Joint Board, to bring the undertakings into line. Their only answer was to the effect that the force of circumstances and the opposition of employers throughout the country was too strong for them to do anything at all for the Association or its members. Does this admission sound like acting as a catspaw for the employers?

The Association was eventually forced, and without protest from its colleagues of the E.P.E.A., to withdraw from the National Joint Board in October, 1921, which act seriously affected the membership of the Association, and in conjunction with the general reaction and depression in trade union circles, had a marked effect upon its membership. The Association, however, has emerged from that time of crisis, and is pursuing a policy of progress and reconstruction which is bound to appeal irresistibly to all the commercial and clerical workers in the industry.

An opinion of a well-known employer in the industry is worth quoting. He said: "that so far as the industrial ideals of this Association are concerned, we are about five years too early, but, unfortunately, on the wage question we are about 12 months too late." This was said in 1920, so, perhaps, we are nearing the period when the fundamental principles advocated by this Association in 1919 will be most opportune.

This Association is still the only organisation registered as a trade union specially and exclusively organised among the workers, and for the workers, on the commercial and clerical side of the electricity supply industry.

In the same number of your journal a paragraph appears relating to a successful concert recently held by this Association at Anderton's Hotel, from which it would appear that the Association is still flourishing. The trouble in the past has been largely due to the fact that the Association has not given full publicity to its progress and, what would have been more to the point, its struggles against the almost overwhelming opposition of the employers and other staff unions in combination against us.

As I have mentioned above, a more progressive and constructional programme is in progress, and in future we shall publish far more about ourselves than in the past, as it would seem that any work undertaken without a flourish of trumpets is not recognised, but to bang the big drum is to give the impression of making the most progress.

Much could be written with regard to the opinions of the members of this Association, both regarding the employers' attitude on the National Joint Board and the outlook in general, but space will not permit it.

In one sense we agree with your correspondent's remark that the solution of the labour problem is not going to be "reached by flying to it or rushing to it. It is education, and education alone, that must bring about the permanent improvement of the position." That sentence simply embodies one of the most difficult things my Association is out to undertake, *viz.*, to educate the commercial and clerical members to the fact that their salvation lies in industrial organisation, such as is provided by this Association.

G. R. Smith.
General Secretary,
Electricity Supply Commercial Association.

London, S.E.9., *November 6th*, 1922.

[The article in question was editorial. Our correspondent goes out of his way to fit on a cap which does not belong to him. Why should he suppose that the "Administrative Staff" referred to by Sir Lynden Macassey, in dealing with industry in general, is that of the electrical industry in particular; or that the administrative staff consists only of commercial and clerical members? The technical members will have something to say on that point.

We are pleased to know that the Association is flourishing, and is about to adopt a more progressive policy; it has always been assured of the sympathetic interest of the technical Press. - Eds. Elec. Rev.]

Shift Engineers' Salaries.

Well done, the shift engineers! Be British and keep on keeping on. Constant dropping wears away the hardest stone. We have it on the highest authority that the most obstinate cases, even though they "Fear not God neither do they regard man," yield to this treatment. The shift engineers have an unassailable case of flagrant injustice; it would be a crime and an outrage on every drop of British blood in your veins to sit down under it.

On the other hand it is as well to remember the story of the eminent philanthropist and the small boy, who had lost a shilling. The poor little fellow was crying bitterly. His mother had sent him out with two shillings to buy groceries and a big boy had taken one shilling away from him. "But why didn't you shout out?" the good man asked. "I did, the boy answered, and gave a sample of how he had shouted. "Can't you shout any louder than that?" the man asked. The boy shook his head. Then the eminent philanthropist, sympathetic tears rolling down his cheeks, took the other shilling.

C. S. W.

November 6th, 1922.

LEGAL.

Costs in the Marconi Case.

The question of costs of Marconi's Wireless Telegraph Co., Ltd., against the Mullard Radio Valve Co., Ltd., in the action in which judgment was given on October 19th (*vide* Elec. Rev., October 27th), came before Mr. Justice Lawrence for argument in the Chancery Division on November 1st.

Mr. Hunter Gray, K.C., appearing for the plaintiffs, asked that they should have the costs, as they had succeeded upon an important question raised.

His Lordship said that when there was only one claim in a patent action, and that failed, the action would be dismissed with costs, but in this case he was prepared to give a certificate of validity of the patents which had been attacked.

Sir Duncan Kerly, K.C., appearing for the defendants, in reply to a question of the Judge as to why defendants should not pay the costs of the action so far as the validity of the patents was concerned, said that the rule had always been that the successful party should have the costs of the action unless the Judge thought otherwise.

His Lordship: I am going to give you the general costs.

Sir Duncan Kerly said the question was whether the plaintiffs should have any costs on the issue of validity. He agreed that that might have been a separate issue, but it was material to the other matter. He submitted that in the circumstances the defendants should be paid the costs of the action, and that they should have the costs of the separate issue in addition. The plaintiffs had really failed to make out the patent which they came to support.

His Lordship, after further argument, said it was admitted that the question as to the payment of the costs was a matter for his discretion, and he purposed to exercise that discretion by ordering the plaintiffs to pay to the defendants the general costs of the action and the costs of the issue of infringement. He would further exercise his discretion in ordering that the defendant company should pay to the plaintiff company the costs involved by the attack on the validity of the Letters Patent of the plaintiff company. There would be a return of those costs if so ordered by the Court of Appeal. He would also give a certificate of validity of Round's patent, limited, on the third claim, and also a certificate of validity of Peri's patent, of which the plaintiffs were the registered owners.

Compensation Award against the English Electric Co., Ltd.

On November 27th, at the Stafford County Court, George Draper, a fitter employed at the works of the English Electric Co., Ltd., applied for compensation in respect of an accident by which he was rendered unable to follow his employment. The applicant said that while employed in dismantling a motor-generator on a crane, on July 19th last, the hook and chain fell upon him, fracturing his jaw and giving him severe facial wounds, and shock. He stated that he was totally unable to work. Counsel for the company and a medical referee considered that the applicant was able to do light work, and, accepting this evidence, the judge made an award of £1 a week for partial disability.

Walsall Hardware Manufacturing Co., Ltd., *v.* Electric Components.

In the Chancery Division on Tuesday, Mr. Justice Sargant heard this action, in which plaintiffs sought for an injunction to restrain the defendants from selling or advertising for sale any electric fittings under the name of "Walsall Grip," not being fittings of the plaintiffs' manufacture.

Sir Arthur Colefax, K.C., said the main question for the Court was whether or not the expression "Walsall Grip" was distinctive of the plaintiffs' goods. These consisted of continuity fittings for the tubing of wires carrying electric current. The fittings consisted of elbows, bends and tees. The defendants' case was that the expression "Walsall Grip" was distinctive of a known method of coupling up fittings, and was known to the trade and public to bear such a meaning. The plaintiffs complained of the sale by the defendants to the Jenner Light & Power Co. of fittings not of their manufacture in execution of an order for "Walsall Grip" elbows, tees, and couplings. Counsel did not suggest that that was [illegible] occasioned to the publication by the defendants of [illegible] list, and the case the defendants dealt with [illegible] vided, he submitted, ample evidence that the "Walsall Grip" did mean what plaintiffs said it meant.

The case was [illegible], to the injunction asked for. Sir Arthur Colefax said the plaintiffs did not ask for any further relief and each party would pay their own costs.

Harrison *v.* [illegible], Ltd.

In the Shoreditch County Court, on Friday, before Judge Cluer, Mr. John Frank Harrison, of 96, Princess street, Southend-on-Sea, dealer in electrical goods, sued Messrs. Webber, Ltd., of 47, Great [illegible] dealer in electrical goods, to recover £5 [illegible] storage of electric lamps, 36s.; for 6 doz. broken lamps, 60s.; and railway carriage, 7s. Mr. A. E. Robinson appeared for the defence.

A month ago the plaintiff was [illegible] a quantity of electric lamps supplied, which Mr. Harrison denied ordering, as the voltage did not suit Southend. He lost the day on that occasion. On [illegible] claim had to do with an order given some [illegible] to the lamps referred to in the last action, six dozen of the lamps arriving smashed. The defendants advertised in the Electrical Review that they would change all broken ones, so they were returned, but the defendants once more sent them back to him; so that he had to pay the carriage both ways. He did not counterclaim on the occasion of the last action, as the present summons had already been issued.

Judge Cluer: It would have been wiser to have counterclaimed at the time.

For the defence, Mr. Webber said that he had never heard of the broken lamps, either by letter, telephone, or otherwise. At the particular time referred to by the plaintiff they were refusing all goods from Harrisons—they actually returned the 500 lamps which were disputed in the last action.

Judge Cluer said that if that was so, they might have been returned, so he would adjourn the case to enable the plaintiff to call evidence from Southend, but the plaintiff would have to pay the costs of the day.

Westminster E.S. Corporation, Ltd., *v.* Wykeham Studios, Ltd.

This case, which was heard before Lords Justices Bankes, Scrutton, and Eve, in the Court of Appeal on November 2nd, was an appeal of the defendants from the judgment of Mr. Justice Swift in the King's Bench Division, the case raising the question whether professional photographers were under a liability to pay for the energy used for arc lamps solely for taking photographs on a power or lighting basis.

The plaintiff company brought the action to recover £82 18s. 5d. for electricity supplied to the defendants.

The case was reported in our issues of May 19th and 26th last.

Mr. Blanco White, for appellants, said that there was no dispute as to the figures. The learned judge had found that plaintiffs were entitled to charge at the lighting rate. He (Counsel) said that that was wrong. There was a separate meter for the arc light. There was no statutory distinction between current supplied for power and lighting purposes; it was a distinction introduced by the supply authorities themselves for their own commercial purposes. They quoted a lower rate for power purposes to induce people to take electricity during the day-time. The plaintiffs were entitled to charge 8d. unless defendants could protect themselves by Sections 19 and 20 of the Electric Lighting Act, 1882. The judge had found that the plaintiffs were entitled to do so provided they treated all photographers alike. He submitted that that was wrong in law.

Counsel explained that a special arrangement was made in October, 1921, by which, since that date, defendants and other professional photographers in the area were charged 4d. a unit.

Without calling upon Mr. Kennedy, for respondents, Lord Justice Bankes, in his judgment, said that it was not disputed that the plaintiff company was entitled to differentiate between the charges it made and to do so up to whatever the maximum charge might be. As between customers the Electric Light Act, 1882, contained provisions against granting undue preferences, and the defendants now contended that the plaintiffs had not brought themselves within the protection afforded by Section 19 of that Act. The case for the defendants was that the current supplied to them was for power; that fact, in his opinion, had been rightly found by the learned Judge in the defendants' favour. But defendants said they had been overcharged having regard to what other customers for electricity for power purposes, who were not photographers, were charged, and that there was nothing to justify this distinction. The answer made by the plaintiff company was that it was entitled to charge photographers for power in excess of what it charged its other customers, and it justified that on the ground that the circumstances of the case were not similar. That being so, the claim in respect of an overcharge failed and the appeal failed, and must be dismissed with costs.

The other members of the Court concurred.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens, Patent Agents, 265, High Holborn, London, W.C. 1.

28,633. "Variable condensers for wireless telegraphy, &c." J. Stockton. October 21st.

28,634. "Dynamos for lighting vehicles." I. Peck. October 21st. Switzerland, October 21st, 1921.)

28,635. "Leclanché batteries." E. E. Dutt and S. H. Godfrey. October 21st.

28,636. "Time switch." B. I. Cotton. October 21st.

28,637. [illegible] Metropolitan Vickers Electrical Co., Ltd., and A. W. Rice. October 21st.

28,694. "Speed-controlling system for motors, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). October 21st.

28,714. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. October 21st.

28,715. "Sparking plugs." A. Baker and J. Hudson. October 21st.

28,774. "Combined clamp and spring cup for testing sparking plugs." C. K. Jones. October 23rd.

28,805. "Manufacture of metallic filaments for incandescent electric lamps, &c." Edison Swan Electric Co., Ltd., and G. A. Percival. October 23rd.

28,813. "Electric motor-driven compressors." G. J. Spohrer. October 23rd.

28,831. "Electrical operation of typewriters." J. D. Roots (J. R. Lyness). October 23rd.

28,832. "Electric welding machines." I. G. Gale. October 23rd.

28,836. "Protecting metals from corrosion." British Thomson-Houston Co., Ltd. (General Electric Co.). October 23rd.

28,869. "Electric brakes, &c." W. J. Gooseridge. October 24th.

28,884. "Electric plug-connecting boxes, &c." J. Phillip. October 24th.

28,885. "Electric switch fuses." C. C. Garrard, A. H. Railing, and A. F. Searle. October 24th.

28,887. "Thermionic valve transmitters for wireless telegraphy." C. Matthews, J. G. Preston, and G. Shearing. October 24th.

28,898. "Electric water heaters." J. Bousfield. October 24th.

28,900. "Electro-magnetic control for telegraphic apparatus, &c." E. L. Gruneswald. October 24th. (France, November 3rd, 1921.)

28,904. "Incandescent cores." S. H. Godfrey. October 24th.

28,907. "Incandescent electric lamp." W. J. Cameron. October 24th.

28,911. "Electric switches." Hoover Suction Sweeper Co., Ltd. (Hoover Suction Sweeper Co.). October 24th.

28,928. "Electric traction installations for railless vehicles, &c." J. Vila. October 24th.

28,935. "Non-spillable containers for electric accumulators, &c." W. R. Lowndes. October 24th.

28,936. "Colour sight signals." S. M. Dey. October 24th.

28,937. "Electric cables." Siemens & Halske Akt. Ges. October 24th. (Germany, October 25th, 1921.)

28,942. "Electric bulb holders." S. Percival (Wells and Llewellyn). October 24th.

28,947. "Electrolytic apparatus." J. P. Scott. October 24th.

28,959. "Electric plugs." I. Klotzli. October 24th. (Switzerland, July 3rd.)

28,966. "Compass and magnetic dip indicators." British Thomson-Houston Co., Ltd. October 24th. (United States, October 27th, 1921.)

28,957. "Electric switches." British Thomson-Houston Co., Ltd., and J. Sugden. October 24th

28,958. "Cooling and ventilating dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. October 24th.

28,959. "Electric ship propulsion." British Thomson-Houston Co., Ltd., and E. A. Haigh. October 24th.

28,962. "Electron discharge apparatus." D. J. Heilig and H. Willson. October 24th.

28,972. "Speed regulators for electric motors." W. Dornig. October 24th

28,974. "Electric speed governors." W. Dornig. October 24th.

28,976. "Aerials, &c., for radio telegraphy." H. L. Milner and United Manufacturers & Agency, Ltd. October 24th.

28,979. "Combined sparking plug and signalling instrument." E. Amerio. October 24th.

28,982. "Protective coverings for X-ray tubes." F. Wranek. October 24th.

28,984. "Combination electric kettle and alarm clock." W. S. Mott. October 24th.

28,986. "Electric lanterns." G. B. Burnside. October 25th.

28,989. "Torsional suspension for galvanometers, electrometers, &c." F. Dinkelmann. October 25th.

29,005. "Trip switches." W. C. Priestly. October 25th.

29,014. "Ignition mechanism for gas engines." W. I. Diffendorf. October 25th.

29,031. "Receiving wireless signals." Nederlandsch-Indie. October 25th. (Holland, October 29th, 1921.)

29,063. "Coil-holders for wireless apparatus." H. Saville and C. H. Thornton. October 25th.

29,039. "Starting switches for alternating-current motors." S. S. Wheeler. October 25th.

29,057. "Paper-insulated electric cables." Hydroloid, Ltd. (Exportingenieure für Papier und Zellstoftechnik Ges.). October 25th.

29,075. "Electric wall plugs." A. Reyrolle & Co., Ltd., and H. F. Secretan. October 25th.

29,076. "Protective arrangements for alternating electric current systems." R. W. Biles, Electrical Improvements, Ltd., and B. H. Leeson. October 25th.

29,078. "Variable condenser." C. G. Hill. October 25th. (United States, May 26th.)

29,081. "Electric ship propulsion systems." J. P. Campbell, Metropolitan-Vickers Electrical Co., Ltd., and L. Miller. October 25th.

29,085. "Electric generators." J. Parr. October 25th.

29,104. "Ignition apparatus for internal-combustion engines." Rolls-Royce, Ltd., and F. H. Royce. October 25th.

29,105. "Ignition apparatus for internal-combustion engines." Rolls-Royce, Ltd., and F. H. Royce. October 25th.

29,106. "Ignition apparatus for internal-combustion engines." Rolls-Royce, Ltd., and F. H. Royce. October 25th.

29,112. "Electric switches." British Thomson-Houston Co., Ltd., and L. Griffiths. October 25th.

29,117. "Improvements in hermetically sealing in glass conducting wires." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken. October 25th. (Holland, May 27th.)

29,118. "Electrodes for electric discharge tubes." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken. October 25th. (Holland, June 13th.)

29,119. "Hollow bodies in which electric current conductors are hermetically embedded [illegible]." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken. October 25th. (Holland, July 28th.)

29,120. "Devices for hermetically sealing glass vessels." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken. October 25th. (Holland, August 28th.)

29,121. "[illegible]." P. G. [illegible]. October 25th. (Holland, October 26th, 1921.)

29,130. "Means for transmitting power from electric motor to sewing machine, &c." H. A. [illegible]. October 25th.

29,170. "Sparking plugs." [illegible]. October 26th.

29,164. "Automatic switch or contact device for battery or electric circuit." J. H. Barnett. October 26th.

29,181. "Aerials for wireless signalling." H. P. Ford. October 26th.

29,189. "Electro-magnetic relay for indicating current direction." L. C. [illegible]. October 26th.

29,192. "Electric resistances." W. F. Chalker. October 26th.

29,203. "Permanent magnets." W. B. Sayers. October 26th.

29,209. "Electron discharge apparatus." D. J. Heilig and H. Willson. October 26th.

29,219. "Electrically-operated oil-level indicator." R. M. Almgill and Littlehampton Motor Co., Ltd. October 26th.

29,224. "Apparatus for charging secondary batteries." T. Stretton and Thor Electric Safety Lamp Co., Ltd. October 26th.

29,266. "Ignition apparatus for internal combustion engines." Rolls-Royce, Ltd., and F. H. Royce. October 26th.

29,267. "Ignition apparatus for internal-combustion engines." Rolls-Royce, Ltd., and F. H. Royce. October 26th.

29,268. "Automatic electric lamp." P. Robert-Nicoud. October 26th. (Switzerland, December 4th, 1921.)

29,269. "Electric arc welding." Quasi Arc Co., Ltd., and A. P. Strohmenger. October 26th.

29,276. "Electric lamps for motor vehicles." C. Harvey and H. Warwick. October 27th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

10,038. "High-frequency duplex signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). April 5th, 1921. (186,946.)

10,595. "Telephone systems." Ges. für Drahtlose Telegraphie. April 12th 1920. (161,573.)

11,966. "Electric power transmission and braking systems." British Thomson-Houston Co., Ltd. (General Electric Co.). April 26th, 1921. (Addition to 180,456.) (186,953.)

12,727. "Means for switching on and off the supply of current to an electric motor." C. Sugden. February 4th, 1922. (186,954.)

15,618. "Electric flashing apparatus." W. J. Mellersh-Jackson (Bossard Railway Signal Corporation). June 6th, 1921. (186,961.)

16,003. "Brush holders in dynamo-electric machines and other electrical apparatus." J. W. Drake and G. A. Kirk. June 10th, 1921. (186,966.)

16,037. "Telephone exchange systems." Western Electric Co., Ltd., and L. Polinkowsky. June 10th, 1921. (186,967.)

16,265. "Electrical resistance." G. J. Bjerre. June 13th, 1921. (186,973.)

17,933. "Electrical starting and igniting apparatus for internal-combustion engines." Scintilla (firm of). July 1st, 1920. (186,757.)

18,086. "Masts for supporting overhead electric transmission lines and like purposes." G. V. Twiss. July 4th, 1921. (186,976.)

18,217. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (Compagnie Francaise Thomson-Houston). July 5th, 1921. (186,981.)

18,322. "Lighting fixtures." British Thomson-Houston Co., Ltd. (General Electric Co.). July 6th, 1921. (186,984.)

18,363. "Electrical storage batteries or accumulators." I. E. Kohlmeyer. July 6th, 1921. (186,987.)

18,446. "Car-control" equipments." British Thomson-Houston Co., Ltd (General Electric Co.). July 7th, 1921. (186,991.)

18,608. "Electric switches." J. R. W. Grainge and V. R. Hurle. July 9th, 1921. (187,002.)

18,633. "Electric controllers for alternating-current electric motors." J. A. Steven. July 9th, 1921. (187,006.)

18,965. "Electric switches." W. A. Coates, G. E. Gittins, D. R. Davies, and Metropolitan-Vickers Electrical Co., Ltd. July 13th, 1921. (187,027.)

19,204. "Vacuum or low-pressure tubes or the like for electrical discharges." A. H. S. Colebrooke and W. A. Williams. July 16th, 1921. (187,034.)

19,351. "Master controllers for electric control systems." N. E. North and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (187,038.)

19,477. "Electric indicating and testing apparatus." H. F. D. Jacob. July 19th, 1921. (187,040.)

19,878. "Means for recording telephone calls." L. B. Davis. July 25th, 1921. (Cognate application, 26,056/21.) (187,045.)

19,954. "Electro-magnetic control systems." British Thomson-Houston Co., Ltd. (General Electric Co., Ltd.). July 25th, 1921. (187,046.)

20,292. "Maintenance of high vacua in closed vessels, such as electric discharge devices." General Electric Co., Ltd., and N. R. Campbell. July 28th, 1921. (187,055.)

20,594. "Electric switches." R. Alkan. March 19th, 1921. (Addition to 149,940.) (177,484.)

20,595. "Speed-regulating devices for electrically-driven vehicles." D. E. Batty and Associated Equipment Co., Ltd. August 2nd, 1921. (187,059.)

20,907. "Electrical heating of incubators." L. G. Brazier. August 6th, 1921. (187,063.)

22,884. "Aluminium alloys." British Thomson-Houston Co., Ltd. (General Electric Co.). August 29th, 1921. (187,089.)

22,885. "Chemical apparatus for precipitation purposes." British Thomson-Houston Co., Ltd. (General Electric Co.). August 29th, 1921. (187,090.)

23,872. "Circuits and electro-medical apparatus for transforming and utilising electric currents." General Electric Co., Ltd., Watson & Sons (Electro-Medical), Ltd., H. B. Gough, and B. S. Gossling. September 7th, 1921. (187,098.)

24,202. "Electric circuit breakers." M. Paul. September 12th, 1921. (Convention date not granted.) (168,916.)

24,655. "Suspension insulator." M. Carolus. September 16th, 1921. (187,110.)

25,148. "Systems of electric motor control and apparatus therefor." British Thomson-Houston Co., Ltd. (General Electric Co.). September 22nd, 1921. (187,117.)

25,720. "Miners' safety and other electric hand lamps." G. Oldham and J. Oldham. September 29th, 1921. (187,125.)

25,895. "Combination connection adaptors for electrical fittings and the like." A. Milham and A. Hippesley. September 30th, 1921. (187,127.)

26,425. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 15th, 1920. (Addition to 134,193.) (170,282.)

27,464. "Adjustable electrical contacts." I. H. Parsons. October 17th, 1921. (187,139.)

31,539. "Circuits for electrical oscillations." Ges. für Drahtlose Telegraphie. November 25th, 1920. (Patent of addition not granted.) (172,024.)

1922.

2,511. "High-tension transformers." E. Haefely et Cie. Akt. Ges. February 9th, 1921. (175,261.)

3,339. "Metallic vapour lamp." Dr. P. Eversheim. February 14th, 1922. (Addition to 166,144.) (187,176.)

6,432. "Electric boosting device." B. Bomborn. March 3rd, 1922. (187,180.)

8,773. "Overload circuit breakers for electric motors started by a starting resistance." F. Krupp Akt. Ges. April 25th, 1921. (Addition to 173,524.) (179,149.)

11,121. "Insulating sleeves for electric transformers and the like." E. Haefely et Cie. Akt. Ges. April 21st, 1921. (178,849.)

19,427. "Winding devices for paying-out and winding-in electric conductors." R. D. Stowell, N. D. G. Robertson, and Wayne Engineering and Equipment Co., Ltd. July 18th, 1921. (Divided application on 184,518.) (187,188.)

19,800. "Electric flashlight lamp." Aktiebolaget Birka Regulator. September 30th, 1920. (Dividend application on 169,696.) (183,470.)

24,229. "Electrically-lighted sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (Divided application on 23,319/21.) (187,193.)

THE

ELECTRICAL REVIEW.

VOL. XCI. NOVEMBER 17, 1922. No. 2,347.

JUBILEE ISSUE.

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THE

ELECTRICAL REVIEW,

Published every FRIDAY, Price 6d.

The Oldest Electrical Paper. Established 1872.

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LOOKING FORWARD.

"This is our programme. Experience may prove modification to be desirable, and we shall gladly profit by the teachings of experience. But there will be no change in, or modification of, the tone of the Journal, or the determination to overcome any opposition that may present itself.

Thus, then, the ropes are severed, and there is launched into the waters of scientific literature a new barque named The Telegraphic Journal."

Vol. I, No. 1, November 15th, 1872.

With the above sentences the founders of the Electrical Review closed the statement of their intentions as to purpose and policy, issued on the first page of the first volume of this publication. In the course of the programme referred to, they mentioned that "while applied sciences of far less extent have several representatives in periodical literature, the applications of electricity have no special organ." The "independence" of the new Journal was made an outstanding feature in its policy, and "the only authority tolerated in these pages" was to be "born of right and reason," while "impartiality" was also "to characterise the Journal."

Those who launched out in the new enterprise were men of foresight, who, though they had settled the details of a well-thought-out programme, were not devoid of the virtue of adaptability, but were prepared to adopt modifications when experience proved such to be desirable. We and others to whom the honour of succeeding them has fallen, have humbly endeavoured to fulfil our functions under the influence of the lofty traditions and high principles which were our heritage. Under the changing conditions of journalistic life, our independence and impartiality have been put to the test, and, like the founders themselves, we have frequently seen the necessity for standing discreetly on our guard prepared for any eventualities, determined to "overcome any opposition" which was designed to harm either the interests of the electrical profession, or those of the journal which was destined to record the developments of electrical research and electrical applications. It is there, too, that we stand to-day.

Half a century has passed since that programme was prepared. We do not need to prepare programmes to-day, for as the years have flown the multifarious advances that have led electricity from its infancy to its gianthood have indicated the needs for adaptability in regard to the contents of the paper, so that to-day we are able to review in some form every week the progress taking place in all departments of electrical activity; indeed, the contents of each issue of the Electrical Review have almost entirely to be dictated by the course of events. To our keen regret, during the past eight years we have had temporarily to come short of our best ideals and anticipations, but when one compares the Electrical Review of November, 1922, with that of November, 1872, one is impressed with the fact that features which fifty years ago were regarded as important are found to be so still. As our readers and the trade are aware, we endeavour to make every weekly issue of the Electrical Review complete in itself. Special issues are a luxury in which we prefer not to indulge unless there is some quite unusual circumstance justifying them. The largest number of the Review that has ever appeared until to-day was that published on the occasion of our Twenty-fifth Birthday in 1897, when a number of eminent experts contributed a series of articles on the technical developments of a quarter of a century in the departments of electrical activity of which they had made a special study. Early in the present year the Institution of Electrical Engineers held its very successful Jubilee celebrations, when every branch of electrical science and application was alluded to in detail by one or other of the speakers. Inasmuch as the ground to be covered now, if we were to set ourselves a like task, would inevitably be very similar, in view of the fact that the Review volumes have contained the continuous record of all that has happened, we have preferred, in issuing this Special Number of the Review to commemorate our Jubilee (it was exactly fifty years on Wednesday since the Review first appeared), not to indulge too fully in retrospection. Instead, we have chosen to adopt the attitude of men who are looking forward—not forgetting the greatness of the electrical achievements of the past, but pushing onward, as it were, into the future of dazzling brilliance to see what great things are in store as present signs and promises come to their period of fulfilment in the Electrical Age that now is at its dawn.

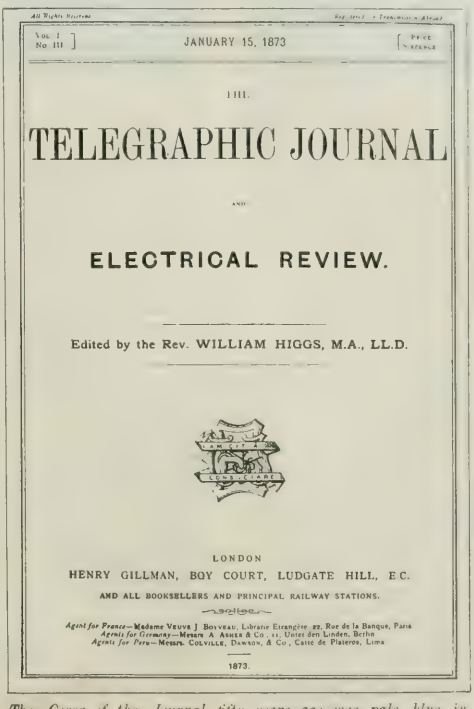
We are under deep obligations to the many writers who have so kindly co-operated with us in the production of this Special Issue. The articles and other communications contributed by them will, we are sure, meet with a cordial reception from our many thousands of readers at home and abroad.

The series of letters that have reached us from many of the organisations whose interests we have endeavoured to promote and safeguard in some way or other are particularly welcome and gratifying. Such communications serve to remind us that in our weekly contributions to electrical literature we are either reflecting or influencing the opinions and the operations of many thousands of men in all departments of electrical activity, throughout the entire civilised world. We hope to continue the faithful discharge of our responsibility, maintaining the deeply rooted principles of the Review in a spirit of optimism and of adaptability. Practically all those who were interested in electrical science when "the ropes were severed" and this journal was launched, as well as a large number of their successors who have figured in the galaxy of contributors to these pages, have passed on into the Solution of the Mysteries. Not many of us who are in the thick of electrical affairs to-day will remain this side of that doorway when the Electrical Review celebrates its hundredth anniversary, but whatever marvels and changes may lie in store, those who follow will always, if they are men of sound sense and foresight, find it desirable to "profit by the teachings of experience," and to modify their programmes in such a way as to keep in step with progressive development.

OUR FIFTY YEARS.

In the year 1897 one of our American electrical contemporaries (since absorbed) conducted an inquiry into the priority of electrical journals published in the United Kingdom, and we were privileged to print the result of that inquiry, together with communications from two well known and highly esteemed electrical authorities of those days—Thomas D. Lockwood, of Boston, and Desmond G. Fitz-Gerald (one of the founders, and the first editor, of the *Electrician* of 1861). As the Electrical Review has now completed fifty years' continuous existence, we have thought that at least some of our readers would be interested in the true record of the respective events and circumstances of our very early days. We therefore reproduce the following from our issue of June 18th, 1897, p. 838, together with the illustrated headings which appeared on the first and third numbers — November 15th, 1872, and January 15th, 1873. In the former heading it will be seen that the word "Review" of electrical science was used right from the beginning, while the sub-title "Electrical Review" was definitely adopted in the third issue from its birth. The progress of electrical science and practice led to the abandonment of the words "Telegraphic Journal" nineteen years later—on January 1st, 1892—since when "The Electrical Review" has been our only title.

We believe that the foregoing notes and the following reprint will satisfy the inquiring minds of most of our readers, but in case there are any who, in the interests of veracity and good fellowship, ought to know the facts, but do not, yet are desirous of so doing, we would add that a complete set of bound volumes of this Review from Vol. 1 to Vol. 91 (ended June, 1922) stands on the shelves of our Editorial Department, and can be inspected by appointment.


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Vol. I. No. III.] JANUARY 15, 1873 [PRICE SIXPENCE

THE

TELEGRAPHIC JOURNAL

AND

ELECTRICAL REVIEW.

Edited by the Rev. WILLIAM HIGGS, M.A., LL.D.

LONDON

HENRY GILLMAN, BOY COURT, LUDGATE HILL, E.C.

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1873.

The Cover of the Journal fifty years ago was pale blue in colour as it is to-day. The size of page was 9⅝" × 6¼"

ENGLISH ELECTRICAL JOURNALS.

[*Reprinted from* Electrical Review, *June 18th, 1897, p. 838.*]

On May 1st of this year the *Western Electrician*, of Chicago, contained the following:—

Name of Journal.	Date of issue from which information is obtained.	Self-designation as to age.	No. of Vol.	Total No.
Electrical Review.	April 16, 1897	The oldest weekly electrical paper. Established 1872.	XL.	1,012
Electrician.	April 16, 1897	The oldest electrical journal (established as a weekly journal, 1861-1878).	XXXVIII.	987

The Electrical Review, of London, had occasion recently to felicitate itself on the publication of its 1,001st number. It commenced publication in 1872. After [illegible] paper now appearing [illegible] into a semi-monthly, coming out as a [illegible] This quarter-century's record of progress shows very [illegible] achievement, and we extend our congratulations.

The anniversary serves however to direct [illegible] curious fact that Americans [illegible] ment regarding the priority of electrical journals. But there is the difference that where in the United States there are three claimants to the doubtful honour, in England, so far as we are aware, there are only two aspirants—the one named, and our esteemed contemporary, the *Electrician*. The subject has interested us sufficiently to induce us to collect the salient facts in the British case in the form of the accompanying table. . . . . Our hope is simply to see an impartial searching inquiry carried to a satisfactory and authoritative conclusion.

As the honour and truthfulness of this paper seems to be called, with that of a contemporary, into question, we may be excused for republishing replies which the above publication called forth.

We claim no virtue in age alone, and should therefore have allowed the matter to rest with our Chicago contemporary; but the two considerations mentioned above demand that the independent evidence forthcoming in the following letters, the one from the United States and the other from London, should be reproduced.

English Electrical Journals.

To the Editor of the *Western Electrician*.

I observe that on page 246 of your last issue you have an article referring to the relative ages of your two British contemporaries, the Electrical Review and the *Electrician*, both of London. In view of the apparently conflicting statements which have been made it is not surprising that the question, Which of the two was the first journal to appear? is something of an enigma.

I happen to possess the first volume of both, and can give you the facts. The Electrical Review appeared first as the Telegraphic Journal and Electrical Review in 1872, No. 1 of Vol. I bearing the date of November 15th, 1872, and as the consecutive numbers of the volumes and issues have been carried on up to the present time, there can, I conceive, be no question that this journal is entitled to its claim that the present Electrical Review is in fact the same journal as that which originally bore the double name of the Telegraphic Journal and Electrical Review. No one would dare to say that a man has changed his identity because in his mature life he may have chosen to drop one of the several Christian names given to him by "godfathers and godmothers in baptism."

The *Electrician* does not go farther back than 1878. No. 1, Vol. I, of that publication, is dated May 25th, 1878; and every editorial line of that issue shows that it considers itself to be the first of its race. Its prospectus begins as follows:—"The want of a weekly paper devoted to the consideration of electrical subjects has long been felt, and we venture to attempt to supply the want." And the same suggestion, differently stated, is also to be found at the beginning of the first leading article on page 6.

It is true that a number of years prior to this—that is, in the early sixties—there had already been a weekly journal bearing the same title, viz., the *Electrician*, but this had gone out of existence long before, and certainly the present journal cannot by any sensible person be regarded as a continuation of the earlier *Electrician*, which had lived an ephemeral life, and had passed totally out of existence.

I have never been able to obtain a copy of this earlier paper, but think that I have seen somewhere a statement that it started in 1861, and did not exist more than two or three years at the outside. It is mentioned in the celebrated 'Ronald's

Catalogue of electrical books as *Electrician*. The. A weekly ... London, 1862."

THOMAS D. LOCKWOOD.

Boston, *April 30th*, 1897.

EARLY ELECTRICAL JOURNALS.

To the Editor of the *Western Electrician*.

My attention has been directed to a paragraph in your issue of the 1st inst. referring to the London ELECTRICAL REVIEW.

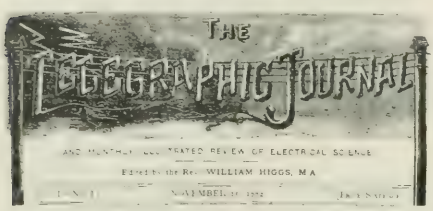
The "puzzling questions" you propound are the very ... and suggestive false—intentional or otherwise ... you have been misled.

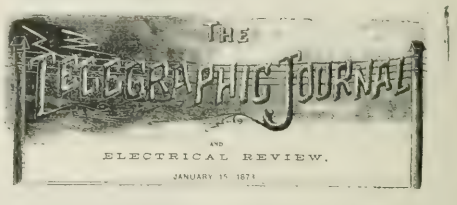
In the interval between May, 1864, and May, 1878, there was no ... In November, 1872, the ELECTRICAL REVIEW was started, in the first instance as a monthly paper. In 1878, when the *Electrician* was re-started—I will not say resuscitated—the former paper was a fortnightly one.

It would not be strictly correct to say that the new issue of the *Electrician*, under the auspices of the late Sir John (then Mr.) Pender and the late Sir James Anderson, was a continuation of the old paper founded by the late Owen Rowland and myself and edited by me, although my consent to the use of the title was, as a matter of form, applied for and given. Like the present ELECTRICAL REVIEW, the old *Electrician*, "such as it was and what there was of it," was entirely independent of any financial control or trade influences. Had it been otherwise, perhaps the awkward hiatus of 14 years would not have occurred.

DESMOND G. FITZ-GERALD.

London, *May 11th*, 1897.





Headings of First Editorial page in Nos. 1 and 3 of this Journal showing the alteration of wording of sub-title two months after the foundation of the paper.

SOME "REVIEW" DATES.

November 15th, 1872.—"The Telegraphic Journal and Monthly Illustrated Review of Electrical Science" first appeared. Price sixpence. It contained 18 small pages of editorial matter and 6 pages of advertisements.

January 15th, 1873.—The title was altered to "The Telegraphic Journal and Electrical Review."

May 15th, 1873.—"In answer to the increasing demand," the Journal was issued fortnightly instead of monthly, and the price was reduced to fourpence.

Early in 1874.—Mr. H. Alabaster (to-day Chairman and Managing Director of the Electrical Review, Ltd.) became interested in the paper as a proprietor. His connection with it has been continuous down to date, that is, for nearly 49 of its ... years.

1881.—Mr. T. E. Gatehouse became editor of the ELECTRICAL REVIEW, and continued as "Chief" until his death in March, 1921.

1882.—With the issue of January 7th, 1882 (Vol. X) the ... became a weekly paper, and the size of page was enlarged from 9⅝ in. x 6⅜ in. to what it is to-day.

1883.—The partnership of H. Alabaster, Gatehouse & Co. was formed; for a short time the title of the firm was altered ... Gatehouse & Kempe; in 1919 the business was ... a limited liability company—"The Electrical Review," Ltd.

1894.—"Telegraphic Journal" were abandoned entirely, and the title "Electrical Review" alone was retained.

In February, 1893, the first of the series of costly actions between the proprietors of the ELECTRICAL REVIEW, Dr. Tibbits, and the Medical Battery Co., Ltd. (Harness electropathic belts), were fought in the High Courts of Justice. From first to last the verdicts were in our favour.

1897.—On November 12th we published a Special Issue to celebrate our 25th Birthday.

1912.—On November 14th ... celebrated our 40th Birthday.

1922.—November 17th ... Issue of the ELECTRICAL REVIEW appears.

ADVERTISERS OF FIFTY YEARS AGO.

THE following are the names of advertisers who had announcements appearing in the first two issues of the ELECTRICAL REVIEW, November and December, 1872:—

LOCKWOOD & Co.	Publishers.
BLACKIE & SON	Publishers.
MACMILLAN & Co.	Publishers.
LONGMANS, GREEN & Co. ...	Publishers.
HORATIO YEATES	Instrument makers.
BRITISH TELEGRAPH MANUFACTORY	Magneto-electric counters and magneto-electric bells.
J. & W. RICKARD	Insulated electric wires.
JOHN BROWNING	Instrument maker.
THOS. FLETCHER	Gas furnaces.
W. LADD & Co.	Instrument makers.
JOHN FALKNER	Lightning conductors, private telegraphs and electric bells.
WALTER HALL	Telegraph contractor and manufacturer.
INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS Co., LTD.	India-rubber, ebonite, gutta-percha, telegraph instruments, insulated wires, batteries, &c.
W. M. FOXCROFT'S TELEGRAPH CASE MANUFACTORY	Telegraph instrument cases.
FRANCIS & Co.	Telegraph engineers.

The India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., have been the most regular advertisers in the REVIEW from its first issue.

In 1874 there appeared an advertisement of Messrs. H. A. Harborow & H. Spagnoletti, electric telegraph engineers, contractors, and manufacturers, Marylebone, W. The Park Royal Engineering Works, Ltd., Park Royal, London, N.W.10, who have an advertisement in the present issue of the REVIEW, are the successors of that firm, which was in business as far back as 1851.

Messrs. J. & W. Rickard, mentioned above as advertisers in the first volume, will be recognised as the Macintosh Cable Co., who are among our regular advertisers to-day.

The business of Mr. M. Selig, Junior, also an advertiser in the first volume, subsequently became known as Selig, Sonnenthal & Co., and is now the Selson Engineering Co.

Messrs. Julius Sax & Co. were advertising in the REVIEW in February, 1873, as Julius Sax, 108, Great Russell Street, W.C., telegraph, magnetic and electrical instrument manufacturer. Mr. Sax, who came to England in 1851, was manufacturing instruments here in 1855 when the present business was established, and in 1863 he turned his attention to domestic telegraphy.

MESSAGES FROM MANY QUARTERS.

Lord Riddell

(President, Weekly Newspaper and Periodical Proprietors' Association).

Hearty congratulations to the Electrical Review on its fiftieth birthday! Experts tell me, and I can well believe, that it owes its proud position to the accuracy of its information and the sagacity of its policy. Needless to say, it has rendered invaluable services to the fascinating industry which it represents—an industry which has witnessed in the course of the past half-century more changes and developments than any other. During the war the Electrical Review placed the whole of its staff, organisation, and accumulation of technical knowledge at the disposal of the Government. As chairman of the Weekly Newspaper and Periodical Proprietors' Association, of which the Electrical Review is a member, I had exceptional opportunities of realising the value of the help thus furnished and the importance attached to it by the public departments concerned. I hope most sincerely that the paper will continue to flourish, and that its centenary will be celebrated in due course. A message of congratulation from me on that occasion will, however, be out of the question unless rendered possible by some new invention which will no doubt be heralded in the Electrical Review!

Mr. Frank Gill

(The President, The Institution of Electrical Engineers.)

Electrical engineers throughout the world, and throughout the British Empire in particular, owe a great deal to the Electrical Review for the fifty years' faithful service it has rendered to the profession and industry. Starting with the very early beginnings of electrical engineering, it has kept its readers abreast of progress and has earned the admiration and gratitude of all. The Review is much to be congratulated on the position it has attained as the result of its own consistent merits, both in the reports it presents and in the opinions it expresses, and all who know it must wish it a further prosperous period in the future. Among these good wishes none come with greater sincerity than do those from the Council of the Institution of Electrical Engineers.

The British Engineers' Association

(Nevile G. Gwynne, *President*; D. A. Bremner, *Director*).

The Electrical Review, on its fiftieth birthday, is in the happy position of being able to rely, with confidence, on its record of continuous valuable service to the electrical and allied industries for eloquent testimony of its worth. It is, however, a real pleasure to us to place on record our high appreciation of the friendly relations which have long existed between the Electrical Review and the British Engineers' Association.

Our Association has often enjoyed the hospitality of your columns, and, on several important occasions, our efforts to serve the interests of British engineering industry have received your valuable support.

We trust that the enlightened and patriotic policy of the Electrical Review may long continue to promote and safeguard the interests of British engineers.

Mr. H. Marryat

(President of the Electrical Contractors' Association, Inc.)

It is with very great pleasure that I, as President of the Electrical Contractors' Association, hand you the enclosed copy of a resolution passed at the Council meeting on October 16th, 1922. This resolution speaks for itself as to the high standing of your Journal in the opinion of my Association.

Personally I, like many other members, shall always have more than a practical interest in the Electrical Review. It has been a friend in difficult times: it has helped us to find employment and business and has pointed out what are the good and what are the bad roads to follow. In looking back over the best part of a lifetime I may safely say that the Electrical Review stands out signally at many of the turnings taken.

(Extract from Council Minutes of the E.C.A., held on October 16th, 1922.)

That this Association does heartily congratulate the Electrical Review upon the completion of 50 years of publication, during which period it has rendered incalculable service to the industry by its fearless exposure of imposture, its support of legitimate enterprise, and its encouragement of goodwill and fair trading conditions. That the thanks of the Association be tendered to the Electrical Review for the part it took in the foundation of this Association in 1901 and its subsequent support which has contributed substantially to the present strong position and acknowledged status of the Electrical Contractors' Association.

Mr. Donald S. Munro

[illegible]

The Electrical Contractors' Association of Scotland congratulates the [illegible] century. The [illegible] inspiration to the [illegible] readers [illegible]

Lt.-Col. W. A. Vignoles, D.S.O.

(President, I.M.E.A.).

On behalf of the Incorporated Municipal Electrical Association, may I congratulate [illegible] continuous service to the electrical industry. This industry continually impresses me with its energy, and anxiety for progress, and this anxiety is reflected in the number of matters which are thrust upon the President of the I.M.E.A., all of which must be dealt with, in the opinion of those putting them forward, as matters of urgency.

Every section of the industry appears to share this desire to move forward, and the hearty co-operation with the I.M.E.A. of such Associations as the B.E.S.A., the E.D.A., the B.E.A.M.A., and the E.C.A., together with the firm and sane backing of the electrical Press, is a sure promise that the rapid progress in the last few years will be maintained.

The Electrical Review has contributed fully to this progress, and I feel sure that, with its traditions, in the years to come it will do even more for the industry than it has done in the past.

Mr. F. B. O. Hawes

(Hon. Sec., Electrical Trades Benevolent Institution.)

The fact that the Electrical Review is about to celebrate the completion of fifty years' continuous service, comes as a reminder of the rapidity with which time is flying, as the first occasion of my having the pleasure of reading it took place when your paper was considerably less than ten years old. Since then I have been a comparatively regular reader of it, and am pleased to express to you my appreciation of the valuable assistance it has been to the electrical industry.

In the above I write as the ordinary reader, but as Hon. Secretary of the Electrical Trades Benevolent Institution I have had opportunities of appreciating more intimately the breadth of view taken by the Electrical Review as evinced by the very great interest you have taken in that Institution and the very great help, both directly and indirectly, which you have given to it.

I must not omit to refer also to the late Mr. T. E. Gatehouse, whose personal friendship was greatly valued by me, and whose sound advice on many subjects I often used to obtain, with great advantage to myself and others. The straightforward and honest way in which he always dealt with matters, laid a solid foundation on which I hope the Electrical Review will always stand firm.

Mr. J. W. Beauchamp

(Director and Secretary, The British Electrical Development Association, Inc.)

On the occasion of your Jubilee Issue may I ask you to accept the congratulations of one of the youngest associations of the electrical industry? In doing this on behalf of the E.D.A. I would offer its grateful thanks for the assistance received from the Electrical Review in the last three years, and venture to hope that in the activities of this association you may see the logical outcome of much of your own consistent propaganda work over the last decade or so.

The call for united effort has always been a feature of the Review, its ample weekly budget of electrical news and liberal allocation of space to new enterprises and to expression of opinion by anyone interested in our great industry, have done much to secure for your journal the esteem with which it is regarded to-day.

To many of us the file copies of the Review stand as milestones along the road of progress. We have watched its advertisements for vacancies and business openings, read with appreciation its kindly references to our success from time to time, and its friendly little records of domestic events or the final passing of old comrades from the fighting line.

The pace quickens, the next few years must bring great expansion in the electrical world, change its personnel and develop its relations with the public. The increasing scope and influence of the trade journals will be a vital feature in this growth, and the past record of the Review leaves us with no doubt of the important part it is destined to [illegible] of the valuable help it will be able to give [illegible] of the industry.

Mr. A. G. Beaver

(President, Electrical Wholesalers [illegible]

Fifty years is a long time comparatively speaking, and it is a matter for congratulation that the Electrical Review has, since its inception half a century ago, been able to give continuous service to the electrical industry. The past fifty years

has seen the electrical industry grow up from infancy to lusty manhood, and to-day there is hardly an industry which can be carried on efficiently without its assistance.

The Proprietors and Staff of the Review must feel especially proud at this time of the great part they are called upon to play in the large world and field of electricity. . . . . .

The Electrical Wholesalers' Federation, of which I have this year the privilege and honour to be President, was founded some eight years ago in order to take care of and co-ordinate the interests of the electrical factor and the wholesale distributor. In conjunction with other associations it has devoted a large amount of time to the elucidation and settlement of various questions of vital importance affecting the commercial side of the industry.

The chief question affecting all those engaged in the electrical industry to-day is: How to obtain and give a cheaper and better service to the public. Only by such service can the industry hope to realise that increase in business which is essential if the electrical industry is to make progress and flourish.

To this end your valued paper will, I hope, continue to extend that help in the way of publicity and other co-operative service it has so worthily given in the past.

Mr. W. J. Jeffery

(President, Electrical Power Engineers' Association.)

It gives me great pleasure on behalf of the technical staff of the electricity supply undertakings, to convey our congratulations to the Electrical Review on reaching its 50th anniversary.

One of the first things we learnt on entering the industry was the existence of a journal, on the middle pages of which we found notices which none of us could afford to neglect. Probably the first serious attempt at joint action among staff men in the industry was in the weekly purchase of the paper, which, through its middle pages, held out hopes of a more prosperous future, and in spite of every discouragement we were inspired to do our best in the hope that one of the plums, no matter how small, might fall to our lot.

Before long we realised that after all the middle pages were merely an adjunct to the more important parts of the paper—the technical articles—which kept us in touch with the latest developments in electrical work throughout the world—the personal items—which linked us with our fellow engineers—and the editorial notes which clearly indicated the sound policy of the journal. The editorial notes have invariably demonstrated that the guiding principle of the Editors has been the good of the industry. In carrying out this policy, the Editors have never hesitated to express clearly and forcibly their views on any policy or action affecting the industry, even when it has been necessary to criticise the actions of powerful interests; the fact that they have not respected persons but have considered only the common good has earned the respect of all. And those who are trying to direct the various forces at work in the industry are fortunate in knowing that an unbiased view of their actions will be expressed in the Electrical Review. We in the E.P.E.A. are glad to have the opportunity of thanking you for the interest taken in our development, and, although at times you have been severely critical of our actions, we are indebted to you for the encouragement given us at times when we were being generally misjudged.

In a more limited sphere of action we are trying to accomplish similar work to yours, *viz.*, the serving of the best interests of the electricity supply industry.

We think that it is necessary to completely organise the technical staffs, in order that we shall not be an unorganised and inarticulate group between the two organised bodies of employers and manual workers but shall instead be in the position of a group working, as far as possible, with these other groups for the efficiency, reliability, and prosperity of the industry. Our policy throughout our existence has been directed this end and though we have found our task a difficult and complicated one it has been lightened by the inspiration and encouragement which the Electrical Review has always given to us.

Mr. W. E. Highfield

(President National Association of Supervising Electricians).

The Association of Supervising Electricians sends its heartiest congratulations to the Electrical Review on the occasion of its fiftieth anniversary. The assistance the Electrical Review has been to the electrical industry cannot be readily expressed in words of appreciation, such is its sphere of influence.

The Association of Supervising Electricians finds its main interest in the [illegible] affect its members, and holds that the conflicting interests that affect this national problem can be [illegible] to the satisfaction of all parties and it very gladly acknowledges the great influence the Electrical Review has had on the labour world by its fearless and outspoken views on trade unionism.

The beginning of the 1922-23 session finds this Association in a strong position. Its membership has steadily increased through a very difficult period. The unemployment of its members has never exceeded 1 per cent. These good results the Association believes are due to the policy of ensuring that membership carries with it a proper qualification of craft skill, and that by thus maintaining a high standard of efficiency the needs of the Union are best served.

Mr. J. Rowan

(General Secretary, Electrical Trades Union).

In the first place we wish to congratulate the Electrical Review on the completion of fifty years' continuous publication in the best interests of the electrical industry. The Electrical Trades Union may be said to be close relations with it in the evolution of the industry, and like relations we have not always been friends, although, on the whole, we have little to complain about except that the Electrical Review has always condemned the E.T.U., whether it was right or wrong if it dared to threaten a dispute. Even this, however, we can accept as an earnest (even if we may consider it misguided) effort from a journal whose object willy-nilly is the progress of the industry, and a journal which has rarely dealt with the financial relationship between employer and employé.

We would like to take this opportunity of giving a very brief outline of the progress of the E.T.U. itself. Started in 1889, in the early days following the introduction of power and light adapted for commercial uses, our progress in the early stages was somewhat slow. This was only to be expected on account of the fact that the employés engaged were mainly unskilled, were brought into a new environment, and necessarily required training. This want of skilled workmen undoubtedly had a lot to do with the slow progress of the industry itself. Time, however, healed this by the institution of apprenticeship systems to the various crafts required in the industry. The Electrical Trades Union was the pioneer who pushed forward the necessity for apprenticeship, and as a result of its efforts was able to negotiate, not without a great deal of trouble and expense, agreed standard wages for the various sections. In the early days, the Union was confined to armature winders and electrical wiremen. In the process of evolution we have considerably extended our activities, due, of course, to the greatly extended use of electrical machinery and apparatus. As we became efficiently organised in the engineering, shipbuilding, and contracting sections, we found that if we were to become an effective organisation, we would have to deal not only with those engaged in manufacture and installation, but with those engaged in distribution, maintenance and repairs, with the result, that we extended our activities to electricity supply stations, mining, iron and steel manufacture, printing and many other industries in which electricity had ousted the more primitive forms of power. We found when we investigated the conditions, that they were not such as would attract a good class of workman. However, after a considerable amount of work, material improvements were obtained and agreed conditions established in nearly every case. The natural result has been a considerable increase in the numerical strength of the Union. Whereas at the end of 1908 it had only 1,709 members, at the end of 1914 this number had risen to 8,195, and at the end of 1920, there were no less than 57,292 members. Since that time, however, due to depression in trade, we have lost a certain number, but as this is due to unemployment and the inability of unemployed men to pay contributions, we are of the opinion that this temporary loss will be recovered and that we shall go on progressing until the trade is thoroughly organised. We are further of the opinion that the organisation of the worker is not to the detriment of the employer, as experience has shown (especially since the institution of the Whitley Councils), that it is necessary that both the employers and workmen should be organised, in order that what at first sight appear to be insurmountable difficulties may be discussed and settled. Since we have been dealing locally and nationally as organised bodies on both sides, we have found that hundreds of petty disputes have been avoided. At the time of writing, we are going through a most severe crisis. In competitive sections of the industry, such as manufacture and shipbuilding, the wages have dropped below a subsistence level, and undoubtedly cannot remain as they are, but with improvement in trade which is bound to come, we feel confident that with good sense on both sides, a more equitable standard of living will be assured to those who are engaged in one of the most important industries, and certainly the most rapidly extending one, in this or any other country.

We conclude with best wishes for the continued success of the Electrical Review.

Mr. C. le Maistre, C.B.E.

(Secretary of the British Engineering Standards Association, and General Secretary of the I.E.C.)

The Electrical Review, in addition to its many other most useful activities, has always been a strong advocate of industrial standardisation and, at frequent intervals, has been good enough to place before its readers the general progress achieved, especially with regard to the work of electrical standardisation, which, with the hearty co-operation of the whole of the electrical industry, the B.E.S.A. is carrying on through its Sectional Electrical Committee, now under the chairmanship of Mr. C. H. Wordingham, C.B.E.

It is therefore a pleasure, on behalf of this Association, to wish the Electrical Review an even more prosperous career in the future than it has enjoyed in the past.

The dissemination of British Standards, in the work of which the Electrical Review has so cordially assisted, is indeed of the greatest importance to the trade of the coun. .

for their wide adoption brings with it elimination of waste of time and material, and the technical Press is one of the most useful channels through which both purchasers and manufacturers can be informed as to the issue of new Standard Specifications and the revision of old ones.

There are still, it is to be feared, sections of the community which are not as fully aware as they should be of the basic importance of the work being carried out by this Association and of the immense value it would be to the trade of the country to mention in all contracts that unless otherwise specified, materials are to be in accordance with British Standards, where such exist. . . . .

An intensive campaign of standardisation is being carried out in many countries, and both in America and in Germany its potentialities in the building up of foreign markets are very fully appreciated and are being studied in the minutest detail.

There would appear to be a greater recognition in Germany than anywhere else of the economical value of industrial standardisation as one of the strongest weapons in the tremendous struggle towards reconstruction.

Unless, therefore, in this country industry as a whole recognises much more fully than it does at present its privileges, as well as its obligations, the work of industrial standardisation at home, as well as the dissemination of British Standards abroad in foreign languages, must of necessity fall far behind the efforts of our keen competitors and the re-building of our export trade proportionately suffer.

The activities of the Electrical Review in the past justify the expectation that it will continue in the future to urge the need and the tremendous value of simplification and unification in bringing back prosperity to the country's trade.

Mr. J. W. Kirkland

(President, South African Institution of Engineers).

The South African Institution of Engineers congratulates the Electrical Review on the occasion of its Golden Anniversary.

Your fifty years' of continuous publication in the interests of electrical engineering are a record of the most wonderful development in engineering conceptions and performances which has ever occurred in human history. When you started publication in 1872 there were only a few short telegraph lines in this country. It was not until 10 years had elapsed that the telegraph penetrated to the High Veld, and the electric light did not reach us until Brush arc lamps appeared on Capetown Docks in 1885 or 1886. Even in 1896, oil lamps were used in the principal buildings in Johannesburg. This letter of congratulation is no place for statistics, but your readers may be interested to know that South Africa has never been far behind in the adoption of electricity and that our electrical achievements and projects are to-day well abreast of the times. Within 25 miles of Johannesburg one may visit one of the largest steam-electric power generating systems in the world (that of the Victoria Falls and Transvaal Power Co.), which supplies practically all of the Witwatersrand gold area with light and power. In the same district can be seen in operation the largest electric winding engines ever built and the largest underground pumping station in the world—also electrically driven. The present consumption of electrical energy in the Witwatersrand district is approximately 1,000 million kWh per annum. As the total population (white and black) of the area served is only about 450,000, this represents over 2,000 kWh per head!

South Africa has always possessed the courage necessary for progress. Work is in hand for the electrification of 173 miles of main-line railway in Natal. This a section of severe mountain grades and sharp curves, and for its operation a steam-electric generating station of 36,000 kW is in course of construction. We think that no such comprehensive scheme of main-line railway electrification involving the use of coal for the generation of power has ever been undertaken elsewhere. This first great undertaking is but a beginning of what has been planned. . . . .

We hope, with you, that another half century of great invention and progress in electricity is on the horizon, and we have confidence that South Africa will seek and enjoy the great benefits which will accrue.

Mr. H. Edwards

(President, British Manufacturers' Representatives' Association of South Africa).

I very much appreciate the opportunity you have afforded me as President of the British Manufacturers' Representatives' Association of South Africa of addressing you in connection with the celebration of the fifty years' continuous publication of the Electrical Review.

The chairman of the Electrical Engineering Section of this Association, which has done excellent work on behalf of British interests, informs me that the articles which have appeared in your journal from time to time, relative to electrical progress in this country, have indicated what is happening out here so fully that it would be unnecessary to contribute anything in the nature of a Press article on this occasion.

I have very much pleasure, however, in conveying to you the heartiest congratulations of members of this Association, who are representatives of electrical concerns, on the high standard maintained by your Journal throughout its long existence, and in informing you that these members are unanimous in testifying to the great usefulness of your Journal to the South African electrical world.

As an Association keenly interested in the development of all branches of British trade in this sub-continent, we trust that the Electrical Review will continue to develop in the years to come to the increasing advantage of all South African representatives and merchants interested in electrical matters.

M. Philippe Bede.

(Président, Société Belge des Electriciens.

The Société Belge des Electriciens is happy to express to the Electrical Review its admiration for the prosperity at which it has arrived after fifty years of incessant effort.

The Electrical Review can be proud of the work which it has accomplished in the domain of science and industry, and our Association desires to offer its congratulations on the occasion of the Jubilee of the Electrical Review, with cordial wishes for its continued prosperity. The field of activity open to electricians widens day by day, and we hope that your interesting journal will continue to contribute to the development of the applications of electricity in Belgium, and to maintain our present good relations with our English colleagues.

M. Brillouin.

(Président, Société Française des Electriciens.

I thank you for giving me an opportunity to write to you on the occasion of the Jubilee of your excellent Electrical Review, and I will profit by the occasion by affirming that the admiration of French electricians for Lord Kelvin, Maxwell, Heaviside, Sir J. J. Thomson, and Sir E. Rutherford —to cite but a few—is still as great as ever it has been. Our two countries will do well to remember the Belgian motto, "L'Union fait la force," and put it into practice with as much firmness and loyalty during the grave difficulties of peace as during the terrible ordeal of the war. Rest assured that French electricians possess for their English colleagues sentiments of the most cordial fraternity.

Mr. Eitan Yokoyama

(Secretary, Institute of Electrical Engineers of Japan.)

We heartily congratulate you on the celebration of the fifty years' continuous publication of your journal and appreciate your great service to the public.

Mr. John H. Taylor, A.M.Inst.C.E.

(Hon. Secretary, Association of British Engineers in the Argentine Republic.)

I am desired by the Council of the Association of British Engineers in the Argentine Republic to congratulate you heartily on attaining your Jubilee in the publication of the Electrical Review.

Those fifty years have witnessed remarkable progress in electrical engineering, and there can be no question that when times again become normal, we shall see still greater strides in the application of electricity to every branch of industry and particularly in its application to railways. In South America we have perhaps been a little backward in the application of electric traction to our railways, but in the production of light and power for general purposes very extensive progress has been made, much greater in fact than is generally known, and there are very few towns, even in the most remote parts, which are not lighted by electricity even if they do not boast tramways. We look to the leading technical publications to keep us in touch with current developments in the electrical world and trust that the Electrical Review will continue to be a powerful factor in distributing that special knowledge to British engineers the world over.

With every good wish for success in the future.

Mr. R. S. Hilton

(Managing Director, Metropolitan-Vickers Electrical Co., Ltd.)

No doubt you will be receiving many letters expressing good will and good wishes on the occasion of your Jubilee Issue on November 17th. On behalf of my company, I should like to add our cordial congratulations and to testify to the splendid service you have rendered the electrical industry generally and British trade in particular. During a period of such unexampled progress your journal has always kept fully abreast with development or even anticipated it, and in this respect has been a stimulus to British manufacturers, which I am sure is very thoroughly appreciated. It is with this thought in my mind that I have pleasure in tendering you our best wishes for your continued prosperity.

OUR FOREIGN ELECTRICAL TRADE.

Where Britain Buys and Sells Electrical Goods and Plant.

Right from the very beginning of its career it was the policy of the ELECTRICAL REVIEW to secure a circulation abroad keeping overseas residents who were interested in electrical science in close touch with Home sources of information and supply. Reference to the front cover used for the issue of January, 1873, which is reproduced on another page to-day, shows that at the outset agents were appointed in France, Germany, and Peru. There was very little foreign electrical trade to get in those days, but as years passed by and the world's needs and our manufacturing facilities grew, the ELECTRICAL REVIEW devoted the necessary increased attention to the encouragement of foreign trade circulation, and more and more space in its editorial pages was devoted to the requirements of Colonial and foreign markets. It was our endeavour to retain the interest of the purchaser abroad as a reader the while we collected information overseas that should assist the British manufacturer in opening up or developing his foreign trade connections. Part of our work in this department has been the publication of articles from authorities resident abroad, and we are pleased to lay a number of such communications before our readers in this Special Issue. Another part of our activities for the commercial and the total from all countries in each class. In addition to the items shown in this table, there were imported in 1921 converters and transformers to the value of £39,000, against £8,200 in 1920; control and switchgear, £26,000 (£5,000); magnetos, £3,000 (£3,700); batteries, £83,000 (£82,000); and accumulators, £37,000 (£47,000). The total value of the imports of electrical goods and apparatus into the United Kingdom was, in 1913, £1,587,000; in 1920, £1,826,000; and in 1921, £1,931,000; whilst those of electrical machinery were £1,346,000 in 1913, £1,332,000 in 1920, and £728,000 in 1921.

Reverting to the communications that we are enabled to publish in this issue regarding the position of electrical affairs in Colonial and foreign markets, we may direct attention to the three articles on the achievements and prospects in Canada. As we have stated again and again, the Canadian market is not an easy one to tackle, but the informative views of Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario; the notes on the factors making for Canadian electrical development, written by Mr. P. T. Davies, the president of the Canadian Electrical Association; and the suggestive ideas of our Special Correspondent in Canada—all

A.—BRITISH ELECTRICAL MACHINERY EXPORTS.

—	Total electrical machinery. 1913.	Turbo-generating sets. 1920.	A.C. generators 1920.	D.C. generators 1920.	Traction motors. 1920.	Other a.c. motors. 1920.	Other d.c. motors. 1920.	Rotary converters. 1920.	Static transformers. 1920.	Control and switchgear. 1920.	Ignition magnetos. 1920.	Electrical machines. n.e.s. 1920.
	£	£	£	£	£	£	£	£	£	£	£	£
To all countries (including to	2,269,000	187,000	107,000	262,000	49,000	412,000†	550,000‡	180,000	161,000§	188,000	45,000	525,000*
India	293,000	50,000	17,500	70,000	12,000	88,000	210,000	42,000	16,000	81,000	11,000	164,000
Australia ...	285,000	42,000	17,000	6,000	6,000	69,000	72,000	80,000	27,000	37,000	14,000	40,000
N. Zealand ...	72,000	—	—	6,500	1,000	14,000	21,000	—	5,000	—	11,000	10,000
S. Africa ...	144,000	—	16,000	27,000	2,000	30,000	29,000	8,000	27,000	5,500		44,000
Spain	60,000	—	5,000	14,000	—	32,000	11,000	4,500		4,500		20,000
China... ...	29,000	11,000	10,000	12,000	-	25,000	14,000	5,500	-	16,000		24,000
Japan... ...	188,000	—	—	—	—	18,000	5,000	—	—	—		11,000
Argentine ...	213,000	—	—	6,500	19,000	—	12,000	4,000	-	4,000		18,000
Brazil... ...	102,000	—		13,000	2,500	6,500		7,000	4,500	—	—	21,000
Totals, 1921 ...	4,739,000	—	459,000	474,000	195,000	1,051,000	669,000	405,000	421,000	550,000	31,000	485,000

* Total, 1920, £2,671,000. † Belgium, £25,000. ‡ Belgium, £37,000. § Belgium, £29,000.

industrial electrical expansion has consisted of the publication of statistical returns showing the course of trade and the extent of the competition of other countries, as reflected in trading results.

In pursuance of this policy, three tabular statements are here given which have been compiled from the official returns of the trade of the United Kingdom. Only since 1920 has electrical machinery been classified by the Customs under its various main heads. A detailed comparison with the 1913 figures is therefore impossible. Table A, however, shows the relative importance of Britain's chief markets in 1913 for electrical machinery as a whole, and in 1920 for the different types of machines. Further, the total exports in 1921 for each class are shown. With regard to exports of electrical goods and apparatus, including wires and cables, a complete comparison between 1913 and 1920 is possible, and is shown in Table B. The first column gives the total of all kinds, whilst the remaining columns give the totals of most of the principal classes. Finally, the corresponding totals for 1921 are given. It may be explained that for 1921 the statistics showing the distribution of the trade by countries are not yet published.

In Table C are shown the principal classes of foreign electrical apparatus and machinery imported into Great Britain. For 1913 and 1920, the chief countries of origin are given. For 1921 it is only possible to give merit the most serious consideration from all who seek encouragement from the vision of overseas possibilities.

We would also commend as deserving of special study the article by our Special Correspondent in India. He refers to the prominent part played by the ELECTRICAL REVIEW in finding new customers in India for British firms, and shows that things are moving in India in such a way that it behoves the British manufacturer to follow up the situation as revealed in Indian reports so that the chances may not be seized by others. He mentions that the German will be allowed back to India again in 1923, and that he is already laying his plans. Our correspondent, in writing to us, says.—"The average home-staying Britisher knows very little of India, and perhaps one of the surprises of an Anglo-Indian or Indian visiting England is the rank ignorance displayed on Indian matters among people who ought to know better." "This," he adds, "should be remedied if mutual business and political goodwill is to be maintained on both sides."

Professor Middleton Smith, of Hong-Kong, contributes on page 698 an article on the "Development of Electrical Engineering in the Far East," the remaining parts of which have overflowed the available space and will appear in our next issue. From South Africa, from Japan, and from the Argentine also we have received informative communications.

OUR FOREIGN ELECTRICAL TRADE.—*Concluded.*

B.—British Exports of Electrical Goods and Apparatus.

To	Total electrical goods and apparatus.		Wires and cables. Rubber insulated. Not telegraph and telephone.		Wires and cables. Insulation other than rubber. Not telegraph and telephone.		Wires and cables insulated. Telegraph and telephone.		Wires and cables insulated. Submarine telegraph and telephone.		Telegraph and telephone apparatus.		Incandescent lamps.		Batteries.	
	1913.	1920.	1913.	1920.	1913.	1920.	1913.	1920.	1913.	1920.	1913.	1920.	1913.	1920.	1913.	1920.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
All countries	5,386,000	11,601,000	422,000	1,753,000	541,000	2,041,000	711,000	1,040,000	1,904,000	1,777,000*	290,000	1,224,000†	152,000	320,000	226,000	628,000
Including to—																
India	361,000	2,478,000	64,000	451,000	66,000	274,000	27,000	379,000	-	194,000	33,000	220,000	28,000	80,000	43,000	255,000
Australia	781,000	1,128,000	132,000	345,000	133,000	237,000	251,000	108,000		—	17,000	30,000	40,000	72,000	27,000	43,000
New Zealand	158,000	433,000	23,000	165,000	14,000	41,000	66,000	15,000	-	—	4,500	9,000	8,000	20,000		23,000
South Africa	338,000	776,000	54,000	125,000	64,000	116,000	53,000	39,000	-	—	14,000	80,000	20,000	22,000	28,000	56,000
Egypt	69,000	273,000	3,000	10,000	—			—	37,000	130,000	6,000	51,000	—	7,000	3,500	11,000
Holland	34,000	872,000	9,000	156,000	7,000	344,000	—	160,000	-	—	—	57,000	—		1,000	15,500
Norway...	10,000	698,000	—	64,000	—	339,000	1,000	47,000	2,000	95,000	500	30,000	—			—
Spain	64,000	134,000	1,500	2,700	15,500	22,000	—	—	—	—	8,000	51,000	—			6,000
China	115,000	408,000	5,500	29,000	20,000	106,000	30,000	5,000	7,000	111,000	6,000	39,000	7,000	11,000	3,000	5,000
Japan	119,000	426,000	—	—	18,000	—	25,000	5,000	6,000	350,000	8,000	17,000	—		17,000	-
Argentine	386,000	485,000	62,000	68,000	84,000	44,000	87,000	69,000	-	—	33,000	102,000	14,000	7,500	24,000	44,000
Brazil	259,000	254,000	11,500	14,000	3,000	9,000	49,000	10,000	81,000	119,000	21,000	40,000	5,000	3,000	7,500	14,000
1921 totals	—	13,040,000	—	1,232,000		2,073,000	-	1,619,000	—	2,146,000		2,653,000	—	443,000	—	675,000

* U.S.A., £181,000. † Belgium, £67,000.

C. Imports into Britain of Foreign Electrical Goods and Machinery.

	Wires and cables. Rubber insulated.		Wires and cables. Insulation other than rubber.		Telegraph and telephone apparatus.		Carbons.		Incandescent lamps.		Sundry electrical apparatus.		Generators and turbo-generator sets	Traction motors.	other motors.	Sundry electrical machinery
	1913	1920	1913	1920	1913	1920	1913	1920	1913	1920	1913	1920	1920	1920	1920	1920
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Total from all countries	379,000	33,000	75,000	134,000	252,000	243,000	163,000	153,000	196,000	75,000	254,000	581,000	159,000	165,000	263,000	729,000
Including from																
Sweden...	—				79,000	21,000					500	31,000	1,500		93,000	3,000
Germany	262,000	3,000	61,000	1,000	39,000	11,000	97,000	6,500		3,000	112,000	36,000	—		7,000	10,000
Holland	—			3,000			500		16,000	45,000	—				8,500	16,000
Switzerland	12,000					1,000	1,500	2,500		1,000	1,000	65,000	1,270	11,000	16,000	24,000
Italy	52,000	8,000	4,500	16,000			—				—		—	—	4,000	7,000
United States	1,000	7,500	2,500	106,000	30,000	161,000	4,000	119,000	—	2,000	99,000	326,000	15,000	151,000	100,000	566,000
1921 totals	—	13,000		105,000		309,000		91,000	—	280,000		135,000	107,000	13,000	252,000	202,000

CABLE MANUFACTURE AND THE CHEAPENING OF ELECTRICITY.

By SIR GEORGE SUTTON, Bart.

It is always interesting to glance back over forty or fifty years and speculate on the changes time has wrought. To consider what has been done, what is being done, and what is waiting to be done, in the field of applied electricity is to make one conscious of the great possibilities of the future of the industry, and that marvellous as are the past records, the young men engaged in the industry to-day have a splendid field of research and accomplishment in front of them. Electrical science permeates every phase of life, and we, who are building in no matter how small a way on the foundations laid by Michael Faraday, have indeed stepped into a fascinating heritage.

An obviously important factor in the development of the electrical industry is the lowering of the cost of supply—not only at the station end, but at the consumers' point. Reducing station costs by improvements in thermal efficiency and operating expense is not sufficient. All efforts in this direction must be supplemented by the provision of cheap transmission. Since Ferranti produced the famous Deptford cable over thirty years ago and the impregnated paper cable of to-day came into use, improvements in cable manufacture have been constantly taking place, though no event has occurred in epoch-making as the introduction of paper for insulating.

One of the most important lines for development by the cable maker is the still further lowering of costs; but, of course, care has to be taken to discriminate between initial cost only, and initial cost plus subsequent maintenance. The second factor is sometimes overlooked when cables are purchased, but the desired progress of electrical activities will not follow as rapidly as it should, if the cheapening is carried beyond the limit consistent with quality. A 10 per cent. saving on prime cost, accompanied by a 50 per cent. reduction in life, is rarely good economics, and such practice, where followed, will result in the postponing of the electrical millennium as effectively as could any deliberate course of conduct.

The possibilities of cheapening high-grade cables are, of course, receiving constant attention at the hands of the leading manufacturers, both by perfection of works organisation and by scientific research into the quality of raw materials and works processes. Cable making can no longer remain a matter of empiricism, but must be based on sound scientific principles, and on the application of all known relative data in physics and chemistry. It is largely on account of the consideration of these factors that I am an optimist as to the future of electric cables, both as regards lowering of price and perfection of quality.

The development of power cables for higher and higher working voltages has, I suppose, been one of the most remarkable lines of progress and one which will contribute most largely to the cheapening of electricity supply. At the present time cables for 33,000 volts are quite common, and several makers are offering them for 66,000 volts. This advance is, of course, the result of a large amount of research work, and our ideas on some of the most important characteristics indicating the quality of a high-voltage cable have considerably changed during the past fifteen years. The importance, for instance, of such a question as dielectric power factor is now very widely appreciated, and the first-class cable works are equipped for furnishing guaranteed figures, whereas only a few years ago the matter received practically no consideration.

On the telephone side of cable-making such revolutionary progress is not taking place. The introduction of the dry-core cable about 25 years ago marked a distinct step forward. The previously-employed gutta-percha-covered conductors were replaced by the air-spaced paper insulated type, and as the wire of the open line was carried into a cable, so was the surrounding air with its electrical advantages. Since that time, however, only minor improvements have been effected in manufacture, and the same type of cable is in general use to-day.

I emphasise my belief that a great day is dawning for the electrical industry. I believe that the future of the industry was never brighter than it is to-day, and it is a happy augury for the continued success of the ELECTRICAL REVIEW that the celebration of its jubilee and entry into its second half-century should coincide with a period when the industry which it so ably serves is also moving on into an era so full of promise.



City Studios] [Lenkiewicz

SIR GEORGE SUTTON, BART.,
Chairman and Managing Director of W. T. Henley's Telegraph Works Co., Ltd.

The Triumph of the Cable.—Fifty years ago, the only "cables" known to electrical engineering were those used for submarine telegraphy — the cores of which consisted of seven strands of No. 20 B.W.G. copper wire, enclosed in an insulating water-proof sheath of gutta-percha. To-day the submarine cable core consists of the same materials modified only in detail; and the excellence of the work of the British submarine cable manufacturers may be judged from the fact that some of those original cables are still in use.

Since then our cable makers have maintained their pre-eminence—but what immense progress has been made! Whereas those early telegraph cables carried currents measured in milliamperes, at a pressure of, say, fifty volts, we now have power cables four inches in external diameter, capable of carrying 15,000 kilowatts at 33,000 volts between phases. Moreover, the makers are prepared to supply cables for twice that pressure, as a commercial proposition. By no other means known to engineering could a power of 15,000 kW be transmitted through an aperture three inches in diameter—the external diameter of the lead sheath of a 33,000 volt cable

THE "ELECTRICAL REVIEW" AND THE INDUSTRY.

By B. LONGBOTTOM, Chairman of the B.E.A.M.A. Council.

In offering most hearty congratulations to the ELECTRICAL REVIEW upon its fiftieth birthday, I feel that I must place on record my personal appreciation of its high standard as a paper and of the efficient manner in which it represents the interests of the electrical industry.

In doing so, two thoughts occur to me.

The first is the extreme youth of our industry, as British industries reckon age; for the births of the industry and the REVIEW are almost synchronous.

The second is the immense service which it has been the good fortune of the REVIEW to render to that industry during a period which is, by universal consent, the most trying and difficult of all—the period of youth and growth. Its consistent advocacy of progressive ideas; the uniform excellence of its articles; the model of good editing which it presents to us week by week—to all of these things we have become so accustomed that it needs an effort to realise that they might not have been so, and to remember how much they have meant to all who have lived during the past half century of extremely rapid progress and development.



Lafayette. [Manchester.

MR. B. LONGBOTTOM.

Chairman of the British Electrical and Allied Manufacturers' Association.

Every member of the industry must have been influenced from time to time by its varied articles on organisation—not the necessary and proper organisation of a private concern, but the much larger problem of the organisation of an industry, to be brought about by conferences between the members of its various branches on the principle of common interest and reasoned discussion. I am not sure, but I think I am correct in saying that our earlier attempt at co-operation was, if not actually instigated, certainly inspired, by the REVIEW—I mean the National Electrical Manufacturers' Association. I also recall with gratitude the help and encouragement which it gave to the B.E.A.M.A. in its early days. It clearly recognised the need of co-operation between the Press and the B.E.A.M.A. if the activities of the latter were to be fully understood and appreciated—and I gladly seize the present opportunity of saying on behalf of the B.E.A.M.A. how greatly we appreciate all that the REVIEW has been to us. There is a saying that every country gets the Press it deserves. If the same thing applies to an industry, then this industry, as it appears to me, should be congratulated on having its ELECTRICAL REVIEW.

Just as the electrical industry is bound to surge onwards, so must the ELECTRICAL REVIEW forge ahead, ever voicing the needs and aspirations of the industry and providing the medium through which the world is reached, and I heartily and sincerely wish the ELECTRICAL REVIEW "Long life and an increased circulation" so that its services to the electrical industry may be continued and increased.

The Chairman of the B.E.A.M.A. Council.

Our readers will recall that period in the history of the British electrical industry previously to 1911, when the "association" idea had at length taken root and resulted in the establishment of the Electrical Contractors' Association and of the National Electrical Manufacturers' Association, at the birth of both of which bodies this paper was able to render some little assistance. The growth of both associations was indicative of what might be done in a larger way, and amongst those who were the first to grasp that fact and to press the manufacturers' case for the wider outlook and a more vigorous policy of active co-operation was Mr. Benjamin Longbottom, who now presides over the Council of the B.E.A.M.A. Our pages bear testimony to the part we took in the transformation in 1911 of the old N.E.M.A. into the present Association, the B.E.A.M.A., the record of which, after ten years of work, can be safely left to speak for itself, or perhaps we might pay it the compliment of suggesting that it is now a little difficult to picture the exact state or recall the exact "atmosphere" of the electrical industry in pre-B.E.A.M.A. days.

Mr. Longbottom, whose communication we print above, is in his forty-seventh year, and has controlled the destinies of Electromotors, Ltd., Openshaw, Manchester, for over twenty-two years, from which it will be seen at what an early age he came into his responsibilities. Any manufacturer of electrical machinery in a large way could not but be interested in the particular section of the then growing B.E.A.M.A. which represented his branch of the industry, and, in fact (leaving aside Mr. Longbottom's connection with the Association as one of its founders), he soon took the office, which he still retains, of chairman of one of the most active of its Sections—the Dynamo and Motor Section.

From the chairmanship of an important section to the chairmanship of the Council itself, which represents every section, is not too difficult a transition for the right and willing man; and Mr. Longbottom was unanimously elected to that office during the present session. The position is by no means a sinecure; but Mr. Longbottom, with his gift for organisation, manages to give full time also to a variety of other public and private duties in connection with the F.B.I., the E.D.A., and the Negotiating Committee of the Engineering and the National Employers' Federations. He is vice-chairman of Richard Johnson, Clapham & Morris, Ltd., and a director of Lo-Thermo Patents, Ltd.

The war work of Electromotors, Ltd., was of an exceptionally strenuous character, and earned from the authorities special marks of recognition. In his personal capacity, Mr. Longbottom took an active part in the work of the Advisory Committee, Ministry of Munitions; the Electrical Trades (New Industries) Committee; the Ministry of Labour Trades Advisory Committee for Disabled Sailors and Soldiers; while he rendered a great variety of services on committees of the industrial or scientific bodies with which he is connected. He is, of course, a member of the principal institutions, the "Electricals" and "Mechanicals."

REFLECTIONS, PAST AND PRESENT, OF A MANUFACTURER.

By HUGO HIRST.

On the occasion of your fiftieth anniversary, I am reminded that I have just concluded forty years' hard and continuous work in the service of the electrical industry. In these days probably only a small number of your readers remember the entrance of electricity into our social structure: it may not be out of place, therefore, to record some of my impressions in the early days of this mysterious, seductive, and inspiring force and its implements as I found them.

I speak of the early 'eighties, when England was still lit by bad gas, oil, and candles. An installation of a few arc lamps here and there or an electric light plant of 20 or 30 kilowatts, was one of the wonders and sights attracting visitors from all parts of the country and abroad. The telephone had only just become practical, and the idea of telephone exchanges seemed almost chimerical. An electric bell was considered a scientific instrument, costing guineas instead of pence. The names "accumulators," "transformers," and "resistances" were only known to those who were initiated into the innermost secrets of this mysterious force, and words like "volt," "ohms," "amperes," and "watts" were understood by a few scientists, but used quite frequently by would-be electrical engineers to impress an unsuspecting public with their wisdom. Yet those imperfect apparatus spoke of the coming of the Electric Age in no weak and inaudible voice. They made their appearance at a time when the world seemed full of adventurous spirits whose imagination was fired by the magic word "electricity," its possibilities and potentialities. I seem to have been one of them. We all thought we could change the world in a few years and make our fortunes. We believed this electric infant, as it was called, could grow into a strong being without the feeding bottle or without having to go through infantile diseases.



Hugo Hirst.

Chairman and Managing Director of the General Electric Co., Ltd.

I am amazed to-day, when I ponder over the future of the electrical industry, that the picture has not changed substantially from that which our imagination painted forty years ago.

I started with the Electrical Power Storage Co., where everybody in those days was convinced that accumulators would in due course be carried to people's houses, factories, and ships to supply them with their weekly or monthly light and power. The engineers of that company owned a 3 h.p. motor to propel a little boat on the Thames, and we were all convinced that within a few years ships, tramways, railways, and vehicles of every kind would be propelled by the electric current generated in central stations dotted all over the country for the purpose of charging the cells. Electric lamps consuming 4 watts per candle were calculated to be cheaper than gas-light, and we were all satisfied that it required only a few experiments to find some other material for the filament in order that light should be produced cheaply enough to illuminate the country when the sun had gone down.

The heat generated by lamps and resistances brought up in our minds the possibility of heating and cooking by electricity, and even in those early days a number of people—including Sir William Siemens—were convinced that the rays emitted by the electric lamp had a beneficial effect on the growth of plants which, in due course, would lead to improving the fertility of the soil.

Your paper, better than any other, is the reason to know the attempts of those who tried to exploit the electric current for healing purposes. As regards the telephone, nobody doubted that in due course everybody on this globe would be able to talk to anybody else wherever he might be.

What electricity really was did not seem to matter. They knew it was something that could not be seen, that could scarcely be measured, but nothing would dissuade us in our ideas as to what it might do, and accordingly went to work with most ambitious schemes. The imperfection of the apparatus at our disposal led to temporary disillusion: failures were the rule rather than the exception. We people to-day realise that cables and wires in those days were still clamped into terminals taken over from telegraph practice: switches were designed on wood, and it was the subject of a patent to have a spring contact or direct a current through the switch without its passing through the moving parts. Switchboards were a mere collection of switches grouped in an orderly manner. Wires in houses hung loose like garlands, connected to wooden lampholder with exposed terminals. Cut-outs were merely terminals in which was inserted a piece of lead wire. Dynmos and motors were merely revolving electromagnets which were expected sooner or later to burn out through overheating.

In the light of to-day's knowledge it is not to be wondered at that so many breakdowns happened the wonder is that anything ever worked.

Some were undaunted by these failures and proceeded with grandiose schemes which led to a financial disaster in the electrical industry and consequent legislation which, for some time, stopped all progress. Others realised—and I belonged to them—that more electricity could play its revolutionary part in the life of mankind, all the parts belonging to an electric power or light installation would have to be studied and technically worked out, and that not until fireproof and foolproof apparatus and accessories forming part of an installation could be designed after proper study of their functions, could the real progress of the electrical industry set in.

To take its full share in the development of electrical apparatus was the task which the General Electric Co. set itself from the early beginning. It early advertisements in our journal, together with its earliest publications beginning with a bell push and showing the first ever complete electric transformer, all show that the fascinating possibilities were ever present in

mind in the early days of our humble beginning. The certainty that electricity would some day dominate all problems of light, power, and heat has always encouraged me to recall gain in new developments. All my actions, all my utterances by pen or by word of mouth, have been with enthusiasm and confidence that the electric current would some day dominate or influence all activities of a higher civilisation, and I am of the same opinion still. A temporary disarrangement of the mentality of the industrial world, resulting in the present industrial depression, cannot damp my belief in our future.

The many years which have passed seem only forty days. They have been spent assiduously in forging our tools to commence the real task which we set ourselves forty years' experience has given us a clearer view of what is required and how we should go to work.

The field in front of us is as great as ever. Coal is still mined in the primitive manner as before. Water power in the Empire has scarcely been touched. The difference between the present electric light stations and power stations in the country and those that I visualise in the future, is not less than the difference between the 10-kw. batt sets of the early 'eighties and the 20,000-kw. sets of modern days. The country will not rest content till we can tap the current in any part for light, heat, and power in homes and factories, or for transport, and agriculture. Cheap transport is the greatest necessity of any industrial nation, and only electricity can give it. Railway electrification and propulsion of ships will become a reality. Superstations cannot be delayed much longer. A cheap unit is, to my opinion, as I recently expressed it, the most essential raw material for the country. When I picture the many fields of activity where electric current can perform its wonders in our factories, on our mines, on the land, when I give a thought to electro-metallurgy, electro-chemistry, and to medical electricity, I stand aghast at the number of appliances which can be conceived and will have to be produced in hundreds and hundred thousands to satisfy the demands of the public.

When I compare the present state of telephony in this and any other country and its possibilities, when I realise the need that everything may have to be scrapped in the course of a generation in order to give such service as, in the light of to-day's knowledge, it is possible to give, I see a field of unlimited activities. When I realise the progress of wireless in recent years through the coming of the electric valve, its influence on communication throughout the world, its possible application even in the sphere of light and power, I feel jealous of those who come after me and who can take part in that development. I am satisfied that factories existing in this country will be none too big for the demand that will be established if agitators in labour and politics will temporarily withdraw from the stage and let the people of this country work out their own salvation.

That belief and spirit has guided me through my long career and served me for the purpose of inspiring others. It has been the mainspring of everything I have undertaken and risked, and I do not think I shall ever change my views.

ELECTRICAL AFFAIRS IN INDIA.

(From a Special Correspondent in India.)

Kindest and hearty congratulations from the electrical fraternity in India on the attainment of the fifty-first year of publication of the ELECTRICAL REVIEW! It is difficult to realise a fifty-year-old electrical weekly, as there are still those unsophisticated people who talk of "electricity being in its infancy," and therefore, by implication, a paper entirely devoted to its interests must exist in its juvenile stages. However this may be, the REVIEW has attained a good ripe age as things go, and for a healthy spell of fifty years has played its part, which was no small part, in the wonderful developments which have taken place in the advancement and practical applications of the science of electricity. Most publications have their material as well as their moral existence—the REVIEW as well as the rest of us has to live and pay its way. The moral side of the ELECTRICAL REVIEW, or rather its policy with regard to the development generally of the industry, has always been for good, and has had wisdom and experience for its guide. On technical questions, where differences of expert opinion will always arise—and it is healthy that they should arise—the REVIEW has always fairly and impartially listened to both sides and thrown its columns open to all comers who have anything relevant to say. In labour disputes it has also been equally fair, and, if anything, has championed the cause of the weak against the strong. This all points to the fact that the moral side or character of the paper is right, and proves, further, that it is what a paper of its kind should be, strictly honest, courageous, and with a sense of justice to its readers; influencing the policy of the whole electrical manufacturing community, stimulating, assisting, and directing it towards better methods and ends.

From the material standpoint, the REVIEW is, judging from the number of its readers and the quantity and style of its advertisement sheets, in a strong position. In India it is looked forward to each mail with keen interest; it is seen in nearly all station clubs and writing rooms, and it is to be found on the office tables of important mercantile and importing houses, both Indian and European. Its advertisement pages are eagerly scanned for new matter, for fresh and interesting articles of electrical commerce which may appear marketable here; and one could hazard the opinion that the REVIEW could boast, if it were not so modest, of being the means of bringing as many or more new customers from India to England as any other medium printed.

Having been a fairly constant reader for upwards of half its lifetime, one is tempted to become reminiscent and go back in memory over the old days and early struggles; but the temptation must be resisted. Perhaps a few hints to those of your manufacturing and other readers who may be interested in Indian possibilities of electrical business would be useful. India is a country of wonderful mechanical and electrical possibilities. Due to many contributory causes, a new era of Industrial Commission sat from 1916 to 1918 and issued a report subsequently, which went into detail as to the resources and water-power capabilities of the country, also multifarious other important matters bearing on industrial development were dealt with in detail. This was soon followed by a hydro-electric survey and report by technical experts, and by a report of the Store Purchases Committee. A most valuable publication recently issued is a "General Review of the Conditions and Prospects of British Trade in India," by H.M. Senior Trade Commissioner. All these reports are chock-full of useful and reliable information for those who wish to use it to the advantage of the country and incidentally of themselves, and should be procured and studied carefully. A warning note has been struck by the Senior Trade Commissioner in India in his Report of 1920-21. It is as follows:

"A most important factor to be considered is the risk that if British manufacturers do not take advantage of such industrial opportunities as India presents, our foreign competitors may do so, and thereby undersell our imported goods in the market. The Japanese have recently made several endeavours to secure a footing in Indian industries, but so far without much success, while one or two American manufacturing firms are merely awaiting their opportunity."

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[Elliott & Fry] [London.

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ELECTRICAL AFFAIRS IN INDIA.

(From a Special Correspondent in India.)

Greetings and hearty congratulations from the electrical fraternity in India on the attainment of the fiftieth year of publication of the Electrical Review! It is difficult to realise a fifty-year-old electrical weekly, as there are still those unsophisticated people who talk of "electricity being in its infancy," and therefore, by implication, a paper entirely devoted to its interests must be in its juvenile stages. However this may be, the Review has attained a good ripe age as things go, and for a healthy spell of fifty years has played its part, which was no small part, in the wonderful developments which have taken place in the advancement and practical applications of the science of electricity. Most publications have their material as well as their moral existence—the Review as well as the rest of us has to live and pay its way. The moral side of the Electrical Review, or rather its policy with regard to the development generally of the industry, has always been for good, and has had wisdom and experience for its guide. On technical questions, where differences of expert opinion will always arise—and it is healthy that they should arise—the Review has always fairly and impartially listened to both sides and thrown its columns open to all comers who have anything relevant to say. In labour disputes it has also been equally fair, and, if anything, has championed the cause of the weak against the strong. This all points to the fact that the moral side or character of the paper is right, and proves, further, that it is what a paper of its kind should be, strictly fair, honest, courageous, and with a sense of justice to its readers; influencing the policy of the whole electrical manufacturing community, stimulating, assisting, and educating it towards better methods and ends.

From the material standpoint, the Review is, judging from the number of its readers and the quantity and style of its advertisement sheets, in a strong position. In India it is looked forward to each mail with keen, live interest; it is seen in nearly all station clubs and reading rooms, and it is to be found on the office tables in all important mercantile and importing houses, both Indian and European. Its advertisement pages are eagerly scanned for new matter, for fresh and interesting articles of electrical commerce which may appear marketable here; and one could hazard the opinion that the Review could boast, if it were not so modest, of being the means of bringing as many or more new customers from India to England as any other medium printed.

Having been a fairly constant reader for upwards of half its lifetime, one is tempted to become reminiscent and go back in memory over the old days and early struggles; but the temptation must be resisted. Perhaps a few hints to those of your manufacturing and other readers who may be interested in Indian possibilities of electrical business would be useful. India is a country of wonderful mechanical and electrical possibilities. Due to many contributory causes, a new era of Industrial Commission sat from 1916 to 1918 and issued a report subsequently, which went into detail as to the resources and water-power capabilities of the country, also multifarious other important matters bearing on industrial development were dealt with in detail. This was soon followed by a hydro-electric survey and report by technical experts, and by a report of the Store Purchases Committee. A most valuable publication recently issued is a "General Review of the Conditions and Prospects of British Trade in India," by H.M. Senior Trade Commissioner. All these reports are chock-full of useful and reliable information for those who wish to use it to the advantage of the country and incidentally of themselves, and should be procured and studied carefully. A warning note has been struck by the Senior Trade Commissioner in India in his Report of 1920-21. It is as follows:—

"A most important factor to be considered is the risk that if British manufacturers do not take advantage of such industrial opportunities as India presents, our foreign competitors may do so, and thereby undersell our imported goods in the market. The Japanese have recently made several endeavours to secure a footing in Indian industries, but so far without much success, while one or two American manufacturing firms are merely awaiting their opportunity."

AFTER FIFTY YEARS.

Development of Electrical Engineering in the Far East.

By C. A. MIDDLETON SMITH, M.Sc., &c. (Taikoo Professor of Engineering and Director of the Engineering Laboratories and Workshops in the University of Hongkong).

A Letter and Recollections. The boom of a gun wakened many of us in this colony to-day. The sound brought to us good news, for we knew that the English mail had arrived. Some of us, feeling energetic, despite the hot and humid night which is to be experienced only in the tropics, went out on to the verandah in order to see the P. & O. *Macedonia* steam up the harbour. It was her first voyage to Hongkong, and we were curious to see the ship in which we hoped at some time to travel home to England. Practically every European house in the Colony overlooks the splendid harbour, and each has its wide verandah. There is something remarkably cheering in watching the carrier of the English mail thread her way amidst the Chinese junks, sampans, and the merchant ships of many nations, as well as the cruisers and destroyers which fly the white ensign. In the wonderful harbour of Hongkong they lie side by side, these junks of the Far East and the merchant vessels of the West. They are symbols of what has been and what is to be. They remind us that modern mechanism is replacing, even in this part of the world, the elementary ideas of past centuries concerning the utilisation of Nature's vast resources.

We guessed concerning the senders of letters from home, and, as usual, an unexpected letter arrived. It contained an invitation to contribute to the Jubilee Number of the Electrical Review. That letter brought a flush of pleasure to the writer's mind, for it is now twenty-one years ago that he, a young engineer in Birmingham, pushed into a pillar-box his first contribution to a technical journal. It had been inspired by an article in this Journal, and it was addressed to the Editor. The would-be contributor thought it inevitable that his work had been wasted. Would the mysterious Gods of Olympus in the editorial chairs on Ludgate Hill be other than irritated by such insolence as a criticism of what had appeared in the pages which they, and their army of assistants, produced as weekly evidence of their exalted knowledge?

Wonder of wonders—the Gods not only took notice, but replied in most encouraging terms per return of post. They were still mysterious—they signed themselves "The Editors." But there was something so human, so charming, in that encouraging reply that the young man struggling in the whirlpool of factory life in the Midlands determined to seek them out. And that is how he met, and made a friendship with that great-hearted Briton, T. E. Gatehouse. It is unfortunately true that Gatehouse has gone over to the "great majority," but in one sense this Jubilee issue is a memorial of his work. Of his colleagues still in harness it is impossible to speak in personal terms, but a tribute must be paid to that splendid man who inspired at least one young engineer to believe that his was indeed a noble profession and second to none in giving benefactions to humanity. That is why for all the ten long years of exile, and for all the ten thousand miles that separates this pen from the printing presses, it is a privilege to send to the Electrical Review a wish for a long and prosperous career. This journal has always been useful; indeed it must, from the very nature of its mission, always be useful. May it always remain true to its magnificent traditions of the past, and while retaining its older friendships, inspire the young men of the engineering profession with the ambition to spend themselves to the uttermost in the profession which has in the past fifty years showered so many benefits on poor struggling humanity.

The Engineer Adventurer.—Three or four hundred years ago the foundations of Empire were being laid by those wonderful merchant adventurers who carried the British flag to all parts of the world. In this century the foundations of a new world are being laid in every land by Anglo-Saxon engineers, who are demonstrating that only by utilising the forces of Nature can there be any real improvement in the conditions of life on this planet. This is the era of the engineer-adventurer whose energy is spent in attempting to make life easier and happier for others. In the designing office, in the laboratory, or far away from his own country in the planning, erection, or running of machinery, he is building up the new and better world. Yet, in order to fully understand the real significance of his efforts, you must travel. If a paraphrase will be excused, it may be asked, "What do they know of British inventions and machinery who only British workshops know?" You must see the wonderful transformation all over the world, but especially in the tropics, that has followed the work of Watt, Faraday, Wheatstone, and the other immortals, in order to understand.

The problem of to-day is so simple that engineers may almost be excused for the impatience with which they regard the human forces of inertia, such as ignorance, pride, and selfishness, which retard them in their work and which prevent a rapid solution to the problem. The forces of Nature are available; the workshops of Britain are equipped for the building of machinery to make use of them. In the Far East there is enormous natural wealth. Machinery, and yet again machinery, is needed to unlock the gifts of Nature and to transport the natural treasures so that they may be used to the fullest advantage. In China especially, even in these enlightened days, the intrigues of the official parasites who toil not, but who batten on the spoils of office, block the path of the engineer, just as did our own more honest but equally stupid, legislators with their absurd "Red Flag" Acts and the insane edicts which strangled early electrical developments. Fortunately we are sure of ultimate success. We may not accomplish all that we so ardently desire to do in our own short working life, but we know that always we are making progress. And as we see what has been accomplished by engineering science, and especially by the electrical branch of the science during the past fifty years, we may indeed envy those future generations for whom we are working.

The Wonderful East.—It is, particularly to the amazing transformation in the Far East that is happening in this generation, that attention should be directed. For just as the last century witnessed the passing of Europe from old ideas of production into the use of machinery, so shall we see, in this century, China replacing muscular energy by electrical power.

It is difficult for the modern engineer to conjure up a vision of the Far East for the year 1872. It is probable that the only evidence of nineteenth-century applied science to be seen out here in those days were a few steamships and the beginnings of the equipment for small local shipyards. Remember that Japan was, at that date, unaffected by Western science. Of the pioneers who went out to Nippon to teach those who delight to hear their country called "The Britain of the Far East," Sir Alfred Ewing is still an active pioneer of applied science in Scotland, and many readers of this journal remember the personalities of Ayrton and Perry.

Fifty years ago there was not a railway east of India; the steamships were small and uncomfortable, and they must have been very much outnumbered by the sailing ships; there are men out here who have taken five months on the journey from Britain to the Far East.

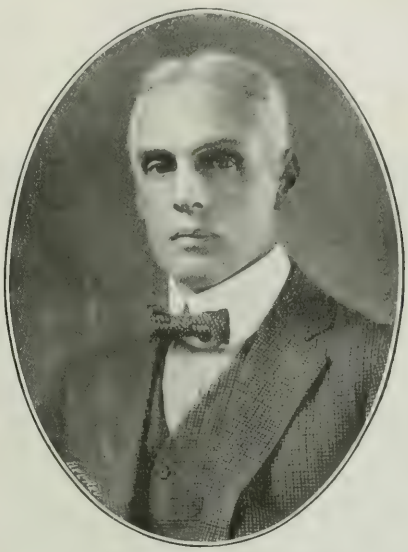
THE FUTURE OF ELECTRICITY IN CANADA.—I.

By P. T. DAVIES, A.M.I.E.E., President, Canadian Electrical Association.

Canada is already well developed electrically. There are to-day very few industrial companies using any other form of motive power than electricity obtained from hydro-electric generating stations. The domestic use of electricity is rapidly approaching 100 per cent. where electric lines are available, and even the rural districts are now being reached by farm lines, which in some cases are constructed with provincial aid.

Development in the future will therefore depend more upon the growth of Canada as a manufacturing country, the general increase of population, and financially upon new uses of electricity.

The growth of Canada as an industrial country is proceeding apace, each year finding larger numbers of new factories to manufacture those things which previously have been imported. The increase in branches of American firms is steady and proceeding at a greater rate each year. There are over 800 branches of American manufacturing organisations in Canada to-day, most of which have been established within the last five years. These factories are planning for expansion to supply not only the needs of Canada, but also the needs of those countries that have a preferential tariff on goods imported from Canada. This embraces most of the countries forming the British Empire.



Mr. P. T. Davies,
President, Canadian Electrical Association.

It has been a matter of considerable disappointment that English companies have not found it possible to establish branches in Canada, excepting in very rare instances. This question has consistently been put before English manufacturers, Boards of Trade, and other interested parties, in the most thorough manner possible by Canadian power companies and provincial and Federal Government agencies, yet the results are meagre, and the steady infiltration of American plants seems to point to the Americanisation of Canadian industrial life.

The growth of the population, being dependent upon immigration, is problematical. Canada to-day is pursuing the policy of selected immigration, which will necessarily mean the slowing up of progress.

New uses of electricity offer the most attractive field for electrical expansion. The record of one large power company, in connecting up some 40,000 kW of electrical steam generating boilers to use surplus power, is a notable step. Such installations are, of course, only possible when situated near the source of power and where surplus capacity is frequently available.

When it is considered that only some 10 per cent. of the readily available water power in Canada has been developed, and transmission distances of some 500 to 1,000 miles are now economically and commercially possible, and further, that a market for several million horse power is present south of the border line between Canada and the United States, within transmission distance of such water powers, one of the problems which Canada will have to decide in the near future will be whether large quantities of power will be exported, or whether the best interests of Canada will be served by retaining it for home use.

Electrification of railroads has progressed very slowly, but in the near future electrification of the terminals of our large cities will undoubtedly be carried out. This will call for a relatively large amount of equipment, both electrical and mechanical.

With the diminution of wood products, and lack of Canadian household fuel, electric cooking will tend to become more and more general. The growth of electric cooking at the present time is accumulative; each new installation brings others in its train. It is fairly safe to predict, where natural or artificial gas is not available, that within the next five years the revenue from electric cooking and water heating will exceed that from electric lighting.

The record of most Canadian central stations is that the load doubles every five years. I see no reason to anticipate any reduction in this rate of growth.

The sudden expansion of temporary loads during the war period has now been completely discounted, and all central stations to-day in Canada find their load increasing more rapidly than the normal rate of past years; as a result, there will be a steady demand for increased power facilities and equipment, making the business more profitable for manufacturers in the near future.

One large English electrical manufacturing company has formed affiliations with a Canadian organisation, and is now quoting on, and supplying large contracts with, apparatus manufactured in Canada.

II.—BY OUR SPECIAL CORRESPONDENT.

To forecast the future of anything in this world, unless one is possessed of prophetic powers, resolves itself into a matter of estimating the probable effect of certain factors already in existence or likely to come into being before or during the period covered by the forecast.

Assuming, then, that Canada will be free from serious disturbances due to war, industrial upheavals, and the like, it may be safely predicted that this country's electrical future is of the brightest since here exist all the elements essential to great development.

Canada, considering her vast size and her small population, stands in the very forefront in electrical progress, for which she is indebted to her wonderful heritage in natural resources, combined with the enterprise of her engineers and the greater readiness of the people at large to take up new things as compared with the inhabitants of older countries.

In telegraph and telephone engineering, great distances, absence of good roads, and sparse population have combined to provide this country with over 50,000 miles of telegraph lines, while the wire mileage for telephones is now well over 2,000,000 miles, serving more than three-quarters of a million telephones, or a telephone for one person in every ten approximately. In heavy-current electrical engineering, Canada's achievements have been specially notable, due in no small degree to the fact that two of her largest provinces—Ontario and Quebec—which are also the most thickly populated, possess practically no coal, but are compensated for this by having some of the finest water-power sites in the world.

In Canada to-day are several hundreds of miles of 110,000-volt transmission lines and some thousands of miles of lines at lower potentials—66,000, 44,000, 22,000, 13,200, and other voltages down to the ordinary distribution voltages of 2,200, 550, 220, and 110 volts. The territory covered must be several times the area of England, and the various weather conditions which these lines have to withstand, and do to a very large extent successfully withstand, comprising temperatures ranging from over 100 deg. F. to 20 deg. or 40 deg. F. below zero, heavy ice loads, and violent thunderstorms, are such as probably no other lines at present in existence elsewhere in the British Empire have to cope with.

Canada possesses several hydraulic turbines and generators of a greater capacity than any others ever built, and larger ones still up to 100,000 h.p. in a single unit are in contemplation for the near future. She has the greatest single hydro-electric development in the world, where three of the generators (55,000 h.p. each), mentioned above, are in actual operation, two more will be operating within the next few months, and the complete development (Queenston-Chippawa) will have nine immense units, some of which will be of 75,000 h.p. each. The foregoing relates to Ontario, where already plans for another Queenston-Chippawa canal as large as, or possibly larger than, the present one, are being considered. In Quebec the developments now run into several hundreds of thousands of h.p., and big extensions will be necessary within the next few years if progress is not to be halted.

Manitoba, Alberta, and British Columbia all have developments of no small size, and are either carrying out, or contemplating, large increases. Nova Scotia and New Brunswick also are actively developing their water powers, though their work is not so spectacular as that in some of the other provinces, because the water powers are of much smaller size. In Saskatchewan coal and oil are used chiefly as prime sources of energy, and no large plants are as yet in use there.

It is noteworthy that in Ontario the average individual domestic load has just about doubled in the past five years owing to the extensive use that is being made of electric ranges and water heaters, as well as the more common devices, such as toasters, coffee percolators, vacuum cleaners, and the like. Rural power is also slowly creating a load that will one day be of considerable magnitude.

It would be a simple matter to enlarge upon the advantages of low-priced electric energy for industrial, commercial, and domestic use, and to show in detail how extremely rapid has been the growth of loads in the more favoured and more settled parts of the country, but this would take up too much space. Such uses of electric power already provide loads of great magnitude, but some day another outlet will be found when it becomes feasible to electrify the railways.

Electrification will add greatly to Canada's prosperity —in Ontario and Quebec it will save the importation of huge quantities of coal, in other provinces possessing coal it will save their coal for other uses; it will enable rolling stock now carrying coal to carry other merchandise; it will improve Canada's rate of exchange on her currency; it will enable trains to be run on better and faster time schedules; it will help appreciably to extend the life of the coal resources of the continent; and it will also tend to conserve the timber resources of the Dominion, as many forest fires have been traced in the past to sparks from coal-burning locomotives.

In no country in the world are the prospects for electrical development more favourable than in Canada. In no field of electrical activity has the saturation point been approached, so far as the use of electric energy is concerned, so that in this direction alone there is room for considerable expansion, but Canada can support a population of many times the number she now has, and the increase of her requirements for electrical products will, on account of growth of population, be very considerable for several decades to come.

Electrical manufacturers at home must not, however, imagine that because Canada's electrical needs are going to be very large for a considerable length of time that all they need to do is to send their products over here in order to do a profitable business. It is true that if the American Government persists in its present policy of keeping up a high tariff between this country and its own, such procedure will help the firms in Great Britain more than a little, and in some lines it may be possible to manufacture in England and find a market here; nevertheless, it cannot be too strongly emphasised that in other lines, particularly in connection with large transformers and other equipment intended for use at very high voltages, say, from 100 to 250 kilovolts, it would, in the opinion of the writer, be infinitely better to manufacture in Canada where the staff employed could be in direct touch with requirements and gain experience at first hand of actual working conditions.

Firms at home must consider Canada very seriously as a country in which they could gain most valuable experience of long-distance high-pressure transmission work and of hydro-electric development on a large scale; they should remember that such experience, owing to Canada's varied climate, would get them to meet the problems arising in almost any other quarter of the world; Canada, too, is comparatively near to Great Britain, yet forms a good stepping stone to the Far East, where one day there will be great developments. Practical experience gained in this country in work of the kind just specified would fit any firm to tackle the difficulties that might be expected in India, South Africa, China, or elsewhere far better than any experience gained in England.

It will cost money to establish works over here, and orders will certainly not pour in immediately, but once a foothold is gained, through perseverance and good work, there ought, for any firm that can stand the initial expense, to be good rewards in the shape of orders not only in Canada, but in other parts of the Empire, and even in foreign countries.

Though the foregoing remarks refer specially to electrical engineering projects of large size, yet the ordinary demand for motors, transformers, and auxiliary equipment, as well as for domestic current-consuming devices, will, of course, be very considerable.

The actual rate of growth of Canada's markets in these lines will, of course, be, to a large extent, dependent upon the rate of growth of the population. The conditions are such, however, at the present time that the writer believes that if home firms are to make a start here at all with any chance of success it should be within the next five years, otherwise they will find themselves completely ousted by U.S.A. firms, many of which are establishing branch factories here, this policy being accelerated just now by the high-tariff policy of that country. This policy will not, however, obviate the need for British firms to manufacture here if they are to make real headway.

The "home country" is carrying heavy burdens, and new ventures in other lands are always problematical in results, but it is believed that Canada, as a field for British electrical manufacturers, is worthy of a good deal of careful study along the lines indicated above.

HYDRO-ELECTRIC DEVELOPMENT IN CANADA.

By Sir ADAM BECK, Kt., LL.D. (Chairman of the Hydro-Electric Power Commission of Ontario).

In connection with the request of the Electrical Review for a contribution to its special issue celebrating the completion of fifty years of continuous publication, I would state, first of all, that an *electrical* journal that has seen *fifty years* of service in the sphere of electrical activity deserves to be especially complimented, and it affords me much pleasure to express the hope that the Electrical Review will find that its fiftieth anniversary is but the entrance to future years of great public service and prosperity.

In your communication I note that you specially inquire whether some statement can be made which will justify hopefulness for the electrical industry in the Dominion of Canada as a part of the British Empire.

So far as hydro-electrical undertakings are concerned, I believe that in no part of the British Empire does the future hold greater promise by way of development than it does in the Dominion of Canada. Once hydro-electrical energy at reasonable rates becomes available, industries are inevitably attracted to the areas where the power is to be found, and a demand for still more power and further developments results.

Marked Development in all Canadian Provinces.—Canada is bountifully endowed with water powers, and it is important to bear in mind that over 90 per cent. of the total power generated in central stations in Canada is from water power.

In the Atlantic seaboard provinces of Nova Scotia and New Brunswick, public authorities, as well as private interests, have been taking action, and of late have greatly increased the output of hydro-electrical energy for the use of municipalities, as well as of industries, in these provinces.

In the province of Quebec the provincial authorities have given encouragement to the development of water power, including storage facilities, with the result that there has been a remarkable growth of manufacturing centres, such as at Chicoutimi, Drummondville, Grand Mère, Shawinigan, Sherbrooke, Three Rivers, and other places. Development work is still in progress.

In the province of Manitoba, the city of Winnipeg and other municipalities are increasing hydro-electric development on the Winnipeg River, which has an estimated potentiality of 450,000 h.p. The developments upon this river have already made the city of Winnipeg an important Western manufacturing centre. In the other prairie provinces of Saskatchewan and Alberta, owing to the flat character of the country, the water-power possibilities, relatively speaking, are naturally small, although some good powers are available in the undeveloped northern districts. There are no water-power developments of importance in the province of Saskatchewan, but in the foothill region of the Rocky Mountains in Western Alberta good use has been made of some of the available water powers, and effort is being put forth to increase their output.

In the province of British Columbia the water rights have been jealously guarded, and this province has demanded that these rights, when transferred to others, be *beneficially* used, otherwise they revert to the Crown. Both public authorities and private interests in British Columbia are seeking to make a greater development of electrical energy for service in connection with the commercialisation of the natural resources in this province.

It is, however, with hydro-electrical development in the province of Ontario that I am really familiar. The province of Ontario is exceptionally well endowed with water power, and both the Government and the people of this province are well alive to the economic value of this resource. Ontario, like her sister province, Quebec, has many large manufacturing centres, and numerous great water powers have been developed for use in pulp and paper, electro-chemical, and other manufacturing industries. On all hands, therefore, there is found a marked tendency to increase hydro-electrical development in order—as one chief incentive— to bring the natural resources of the country into greater service. The Hydro-Electric Power Commission of Ontario, in this connection, has recently completed the installation of the first units, aggregating 25,000 h.p., of a 75,000-h.p. plant on the Nipigon River for the development of the communities and natural resources of the Thunder Bay district, which is situated on Lake Superior at the head of the navigation of the Great Lakes. In its large new hydro-electric development on the Niagara River, in what is known as the Queenston - Chippawa plant, the Commission has provided for the ultimate development of 600,000 h.p., of which it is expected that 250,000 h.p. will be in use by the end of 1923.



Sir Adam Beck, Kt., LL.D.,
Chairman, Hydro-Electric Power Commission of Ontario.

Municipal Movement for Low-Cost Electricity.—In the province of Ontario there has been a special movement to make available for the citizens at large electrical energy "at cost," and the chief agency by means of which electrical energy at the prevailing low rates has actually been made available is the organisation known as the Hydro-Electric Power Commission of Ontario. This Commission was constituted to give expression to the desire of a number of municipalities in south-western Ontario to adopt a scheme of co-operative municipal ownership whereby electrical energy would be distributed under the control and guidance of an independent Commission freed from political interference.

Begun on a comparatively small scale, the work of the Commission—despite varied and at times strong opposition—has grown, until to-day it supplies electric light

and power to 50 per cent. of the population of the province of Ontario. This result has been accomplished in less than fifteen years.

Electricity, once a luxury, is now a common commodity of the people, as is attested by the magnitude and rate of growth of the domestic, commercial, and power loads on the Commission's systems, which indicate very clearly that the effort of the municipalities to provide hydro-electrical energy "at cost" has rendered its use popular for a great variety of purposes.

In order to distribute electrical energy at cost to the people of the province of Ontario, more than 300 municipalities acting co-operatively have invested over $200,000,000 in the hydro enterprise.

One of the most hopeful aspects of the outlook for the future of electrical industries is the extent of growth which has prevailed throughout the past, and of which present conditions give corresponding, if not indeed greater, promise for the future.

Remarkable Growth in Consumption and Development of Electrical Energy.—The extensive growth of electrical undertakings in the province of Ontario is well illustrated by the actual growth of the whole "hydro" undertaking. After initiating its undertaking in October, 1910, when the Commission was supplying only about 750 h.p., the service rendered by the Commission grew with great rapidity. At the end of five years, that is, in 1915, very nearly 101,000 h.p. was supplied to over 120,000 customers in 112 urban municipalities and 18 townships; and in 1921 over 305,000 h.p. was supplied to about 265,000 customers in 234 urban municipalities and 44 townships; and, in addition, about 70,000 h.p. was exported to the United States. At the present time the Commission is distributing a total of about 450,000 h.p., and operates over twenty water-power undertakings, which, when fully developed, will have a potentiality of over 1,000,000 h.p.



Hydro-Electric Power Commission of Ontario: Queenston-Chippawa Development.

Portion of completed power canal traversing the Niagara peninsula, as seen from the air, showing approach to Whirlpool Gully, and continuation to Forebay on the top of the cliff at the Niagara River, seen in the upper part of the picture.

The rates for light and power throughout the "hydro" system in Ontario are cheaper than for like service elsewhere in the world. It is actually hydro-electrical energy "at cost." Considering the operations of the Commission as a whole, it may be stated that the average cost of electrical energy to the consumer is, for domestic purposes, less than two and one-half cents per kilowatt-hour; for commercial purposes, less than two and three-quarter cents per kilowatt-hour; and for power used in industrial purposes, is less than $20.50 (£4 8s. 7d. at normal exchange) per h.p.-year. During the period within which the Commission has been operating, citizens of more than 300 municipalities now enjoying their "hydro" service have, for lighting alone, saved, through reduction of rates, about $60,000,000 over what would have been the cost under rates prevailing before their undertaking was initiated. Each year there is, where necessary, an adjustment made of the various rates charged in each of the co-operating municipalities, and by this means the various rates are kept in correspondence with the actual cost of the operations involved.

Past and Present Conditions Promise Great Future.—Power is not only a prime factor in world industry and commerce, but the extent of its use is also an indicator of the manner in which general industry and commerce are developing.

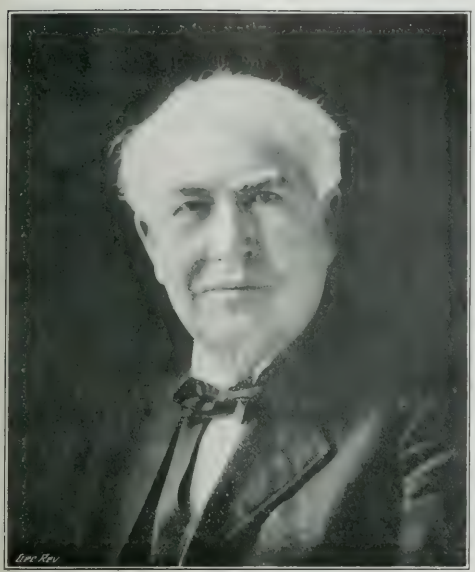
The central portion of Canada is indebted for its great industrial expansion of recent years to its water powers. These powers have been developed so as to produce the abundant and cheap supplies of hydro-electrical energy now being transmitted over an extensive network of lines to furnish electric light and power to homes and industries far removed from the sources of power supply. The length of the high-pressure lines alone of the Commission's great networks already aggregates over 3,000 miles.

The aim of the Hydro-Electric Power Commission has been to make electrical energy available at such low rates that rich and poor alike may share in its many advantages, and it is well within the fact to state that nowhere else in the world do so many of the general public make such extensive use of electricity in their homes as in the province of Ontario.

In conducting its work, the officers of the Commission naturally are brought into close touch with all phases of the electrical and allied industries. Although it is true that the electrical industries have, along with other general industries, suffered through conditions consequent upon the Great War, nevertheless, it is my judgment that in the recovery from business depression, the electrical industry will be one of the first to return to normal prosperity.

The electrical industry is basic to many other forms of industry and, consequently, in answer to your specific inquiry whether this portion of the British Empire can report hopefully with respect to the future of the electrical industry, I feel justified in stating that the substance of the things hoped for in this respect is already becoming manifest in practically every line of electrical activity and chiefly in the very source of such activity, namely, the development of electrical energy for municipal, domestic, and industrial purposes. Obviously, this implies that, in turn, the allied industries, including the manufacture of machine tools, electrical machinery, commercial, domestic, and other electrical apparatus, and the metal, rubber, glass, and other trades will all be called upon to supply their respective quotas to meet the demands which inevitably are created by new and extended applications of electricity. Let us, then, take courage and not be fearful to make preparation for the return to better business conditions of which the electrical industry already gives such substantial promise.

MESSAGES FROM EMINENT AMERICANS.



Mr. T. Alva Edison, who was recently presented by the Mayor of New York City with a key of the City in recognition of what he had done for New York since central-station service was started there 40 years ago.

Cable Address: "Edison, New York."

From the Laboratory
of
Thomas A. Edison.
Orange. N.J.

September 5th, 1922.

The Electrical Review,
4, Ludgate Hill,
London, E.C.4,
England.

Gentlemen:

The years have passed so swiftly that it is difficult for me to realise that half-a-century has slipped by since your excellent publication came into existence. Yet I understand that in November next you will celebrate the completion of fifty years' continuous publication of the Electrical Review. This is a notable event in the history of a publication devoted to electrical development, for a backward glance of fifty years in the art is somewhat akin to looking back to years of antiquity.

I think you are entitled to a pardonable pride in reviewing the growth of the Electrical Review and the many years of great and useful service it has given to the electrical profession. So, allow me to extend my hearty congratulations on the approaching commemoration of your Jubilee, and also my best wishes for an ever-increasing sphere of usefulness in the field you have so ably occupied.

Yours very truly,

Thos A Edison

Mr. Frank W. Smith, President of the National Electric Light Association, New York, whose article on "Electricity Supply in the United States" appears in this issue, writes:—

"On the occasion of the fiftieth anniversary of the founding of the Electrical Review, the National Electric Light Association extends congratulations and best wishes. This Association, of which the writer has the honour to be president, cannot boast of such longevity. It was organised in 1885, a few years after the starting of the electric light and power business in the United States, and is to-day the largest and most influential association of its kind in the world.

Enjoying as we do the common heritage of Anglo-Saxon civilisation and culture, we are naturally most interested in the development of the art among the English-speaking peoples. And how deeply are we indebted to Britain for what we enjoy to-day! We have indeed reason to remember England. We know what she has contributed to electric science and art. We do not forget Faraday or Maxwell, or Kelvin or Heaviside. We do not forget her other great engineers and savants like Hopkinson, Thompson, Parsons, Kapp, Ferranti, Swan, Merz, Wright, and a host of others living and dead who have added so much to the glory of our industry."

Frank W. Smith



Mr. Frank W. Smith, Vice-President and General Manager, The United Electric Light and Power Co.; President, National Electric Light Association, New York, U.S.A.

A GLANCE BACKWARD.

The preparation of this issue of the Electrical Review has naturally brought about us in these editorial rooms a host of presences from the past. Try all we may to adopt the looking forward attitude, old and well-known forms persistently gather round us: familiar faces rise under imagination's influence, and voices silenced in the [illegible] seem to be heard again. It must be so in any walk of life where one has long witnessed the achievements of men as they have passed through their years of activity, their rise from comparative obscurity to eminence, and their subsequent gradual slowing down and sometimes passing into obscurity where their presence has been forgotten by some, and practically unknown to the newer men in the field of battle, indeed where their existence has been seldom remembered save by a few of their attached and faithful contemporaries. It is only ordinary kindness at such a time as this to send a word of greeting to the Old Friends who, though they may have disappeared from the public eye of the electrical profession and industry, are still keenly interested in the progress of electrical affairs. Let the present issue of the Review come to them as one more hearty handshake, just like the old ones, but even a little warmer and more affectionate—for are not the old friendships treasured more and more as the years pass along? Among the oldest—indeed we think *the* oldest—of our friends connected with electrical affairs we have to name Mr. George Offor, of Sydenham, who was born in March, 1827, and is well on toward his 96th birthday. He sends hearty congratulations upon the Fiftieth Birthday of the Electrical Review, "which has been of such service in promoting the industry," and we are sure that we are voicing the sentiments of those who remember his kindly and genial personality when we wish him continued health so that he may in a few years' time be congratulated upon the completion of his centenary. Mr. Offor is, we are glad to say, in excellent health, though he is not able to wander far from home. For the interest of our younger readers, we may say that Mr. Offor was one of the pioneers of electric supply work in this country. In his early work he was closely associated with the Brush Co., and later he had the assistance of Mr. Frank King as engineer of the company which he formed under the title of The Consolidated Electric Company, with works in Cowcross Street, London, E.C., where accumulators and numerous electrical apparatus were manufactured. Among the work carried out was the lighting of Baron Rothschild's mansion, the garden being illuminated by arc lamps fixed on the roof of the mansion. Other pioneering work carried on at about the same time included the lighting of the Castle Museum, at Nottingham. Among more recent undertakings carried out by Mr. Offor's company was the electricity supply of a group of towns in the North of England, all connected with the parent company, and suggesting, Mr. Offor thinks, "the scheme for the supply of the whole country—if the Government ever carries it out." Mr. Offor was a member of Lord Thurlow's Committee appointed to consider the amendment of the Electric Lighting Act of 1882.



[London.

Mr. George Offor.



[London.

Dr. S. Z. Ferranti.

The "All-Electric" Ideal.

Dr. Ferranti, the pioneer of high-pressure transmission, in 1919 foretold a magnificent future for electricity. To Sir John Snell, Chief Electricity Commissioner, and his colleagues has been entrusted the task of hastening the realisation of that vision.



[Keith Dannatt

Sir John F. C. Snell.

FACTORS OF PROGRESS IN THE ELECTRICAL ENGINEERING INDUSTRY.

By C. H. WORDINGHAM, C.B.E., M.Inst.C.E., M.I.Mech.E., M.I.E.E., A.Inst.N.A.

The average man, though fortunately there are exceptions, when he reaches his fiftieth year sees looming ahead his threescore years and ten and is more than content to accept the fiat that it is the term of his activities, he is inclined indeed to set an earlier limit and to look back in preference to looking forward, to take stock of work accomplished rather than plan more triumphs. Not so a great technical journal which has seen the birth of an industry and chronicled its attainment to vast proportions and high achievements in the application of the forces of nature to the service of mankind, itself contributing not a little to this progress. In celebrating its Jubilee that journal looks forward through the youthful eyes of the giant that has arisen with confident hope for unlimited expansion in importance and usefulness in the days to come.

Already there is no branch of engineering with which the electrical industry is not intimately interwoven, the driving of machine tools, the running of factories and works of every kind, the operation of steel rolling mills, of heavy dock machinery, the winning and winding of coal, the propulsion of road vehicles, tramcars, trains on suburban and main lines, ocean tramps and liners, naval submarines and battleships. From no branch, the smallest or the greatest, is it absent.



Photo by] [Elliott & Fry.

C. H. WORDINGHAM.

The versatility of the industry shows itself in its application to such other work as the smelting of metals, the manufacture of new products, communications by telephone, by telegraph, by light, with wires and cables and without them, equally for the purpose of peaceful business or amusement and for the warlike operations of direction of gunfire, detection of submarines and aeroplanes, and, it may be added, for their destruction.

Wherever electrical means are introduced there are efficiency, convenience, adaptability, cleanliness, and the saving of human effort.

Who can prophesy the future of an industry which has such powers and potentialities? He would be a bold and a rash man who would set a limit to them in the domain of physical possibility. More profitable will it be to consider a few of the prosaic means by which progress may be promoted.

In the forefront of the factors making for progress should be put co-operation in its broadest sense. Co-operation does not mean combination; not the setting up of huge organisations in which individuals and individual concerns are merged; not the formation of rings, trusts, or cartels. It means literally what it says, the working shoulder to shoulder, the pulling together of each and all engaged in the industry, the sinking of petty jealousies, the concentration on one's own particular field of work and the recognition that it abuts on all sides on the terrain of others. No man can live only to himself and in benefiting others by his consideration of their interests and capabilities he promotes the good of the industry as a whole from which he himself will in due time reap an abundant harvest.

Let us take a few concrete examples. There are existing a large number of engineering institutions, some of such a character that membership of them confers a certain standing on the individual and guarantees a definite minimum standard of training and experience. Others, while conferring no hall-mark, offer very substantial advantages to their members, each of its own peculiar kind. Others again, and these very numerous, do little more than provide convenient means of intercourse and discussion among their members, often in districts remote from pivotal engineering activity. One and all serve a useful purpose, but their efforts are self-contained, detached from one another, and overlapping often takes place.

In some respects it would be ideal if one grand institution with many branches, each with appropriate sub-branches, could look after the whole of the interests, scientific, technical, commercial, and material of every kind of engineering. Were a scheme for such an institution to be launched in the present state of development of the industry, but with all existing organisations obliterated, it might be possible to cover the field adequately with economy of effort and the avoidance of overlapping, but taking things as they are, such a scheme would have no chance of success and with equal certainty it may be asserted that no existing institution could be developed to cover anything approaching the ground required. What we have at present is the result of gradual growth, the accretion of many organisations founded originally because a need for them was experienced. Natural growth is healthy, and the majority of the existing associations are virile and sound in wind and limb. They could not be destroyed or their identity submerged without grave loss, but their power for good would be enormously increased by co-operation.

Fortunately this view has gained favour, and it is a matter for profound satisfaction that a start has been made by four of the leading Institutions who have already co-operated in other directions, namely, the Institutions of Civil Engineers, Electrical Engineers, Mechanical Engineers, and Naval Architects. A Council has been set up in which each is represented on an equal footing. It is true that the beginning made is modest and the functions of the Engineering Council are in no way startling. For that very reason there is hope of growth, permanence, and the eventual attainment of great power and influence. It is the over-ambitious beginning which most often proves a flash in the pan.

But things cannot stay where they are now a beginning has been made; other Institutions are of such a standing as to have a good claim for direct representation on the Engineering Council, and some means ought to be found to secure representation in some measure, indirect it may be, of the many smaller and less important bodies which are nevertheless doing in many cases extremely useful work. As a useful preliminary,

these last named are considering the banding of themselves together to form one body representative of them all. If and when such a body is formed, it should not be a matter of insuperable difficulty for it to secure recognition by the Engineering Council and get itself represented thereon, thus giving the indirect representation above advocated for the smaller fry.

It would be going far beyond the scope of this article to attempt to indicate the sphere of usefulness of the Central Council. Its opportunities and possibilities are well-nigh without limit for economy of effort, concentration of ability on specific subjects, decision on matters vitally affecting the whole industry and the attainment of objects impossible without it.

A second example of co-operation is to be found in research, and the electrical industry affords a fine example of what can be done in this direction. The British Electrical and Allied Trades Research Association owes its inception equally to the efforts of the Institution of Electrical Engineers and the B.E.A.M.A. Each had its own research committee, each was deeply impressed with the need for research, neither had at the time devoted any large sums to the purpose, and both were acutely alive to the possibility of obtaining a share of the money devoted to research by the Government and pursued independent means to secure it. At first there was antagonism, then a deadlock in regard to joint action, and then fortunately wiser counsels prevailed and the two bodies linked hands and formed the Research Association; since then they have seen eye to eye with perfect unanimity.

At an early stage it became evident that the Institution and the B.E.A.M.A. would each contribute powerfully to the success of the undertaking, but in a different way. The Institution could provide keen workers and brilliant intellects of the first rank, but had not in its power to contribute financially to any appreciable extent. The B.E.A.M.A., while numbering among its supporters men of as high an order as those sent by the I.E.E., had to provide the sinews of war in the shape of money and in some instances in kind. It speaks well for both parties and is evidence of their mutual appreciation that while paying the piper the B.E.A.M.A. is content to allow the I.E.E. a large share in calling the tune. By means of this co-operation it has been found possible to fulfil the requirements of the Department of Scientific and Industrial Research and thereby to secure to the electrical industry a contribution out of the public funds equal to that provided by its members.

Already results of far-reaching importance have been attained. In a number of directions the present state of knowledge has been surveyed and researches started, and in some cases completed, with a view to extending greatly the data available for manufacturers and to directly improving their products.

Doubts have sometimes been expressed as to whether co-operative research could be so conducted as to effect useful results. The E.R.A. has already provided abundant evidence that they are without foundation in fact. Not only can valuable work be done, but it may be asserted that, in some instances, it could have been done in no other way. Manufacturers who would not be willing to furnish information drawn from their own experience for the benefit of a single firm are quite willing to do so where the information is pooled for the common good of those engaged in their particular branch of work.

While co-operative research is a powerful aid to individual private research, it will not displace it, and in all probability much will continue to be done by the private investigator in the direction of the making of inventions breaking fresh ground.

The E.R.A. provides a most striking instance of the best kind of co-operation within the industry. Sitting side by side on its Council, Committees, Sub-Committees, and Panels, and giving of their time abundantly and ungrudgingly without fee or remuneration of any kind, are purely scientific men in the front rank, industrial engineers, consulting engineers, manufacturers, engineers from Government Departments, each contributing his quota to the general advancement. Not the least important function served by this organisation has been the bringing together of the electrical user and the non-electrical producer of materials employed in the industry, thus for the first time enabling the maker to understand exactly the needs of the buyer and the buyer the limitations imposed on the manufacturer by the nature of the material supplied.

The E.R.A. has linked itself with non-electrical bodies carrying out researches having an electrical bearing and so promoted the general good. It may safely be said that its work and its example will be fraught with tremendous results in the future, and that, properly directed, sustained, liberally financed research will be one of the most potent factors in enabling this country to maintain and increase the lead which it has ever held in engineering.

In the British Engineering Standards Association we have another salient example of co-operation attended with far-reaching and large benefits. The ground covered embraces well-nigh every branch, but the electrical has led the way for keenness and volume of work accomplished. Here again every type of man, scientific, professional, and industrial, has worked with the manufacturer to agree on points of difference and provide standards, the adoption of which cannot fail to cheapen production, improve the articles made and promote the interests of the British exporter in overseas and foreign markets.

As the field widens and the standards set up become better known and observed the importance of standardisation to advancement will be better appreciated. Just as research will enable new inventions, processes and materials to be evolved, so will standardisation enable the best advantage to be taken of discovery.

One more instance of co-operation of recent introduction, and differing in some respects from the others, may be found in the electrical industry, namely the British Electrical Development Association. Here we have the supply engineer, company and municipal, the contractor, the manufacturer, the salesman, with the professional man all working together to promote the common good instead of being ranged in mutually distrustful and sometimes hostile camps.

It is important to notice that while each of the bodies mentioned provides a common meeting ground for engineers of divers interests, in no case do their functions overlap. Moreover, as a matter of everyday practice, they help one another. When the B.E.S.A. wants researches made it invokes the E.R.A., and when the E.R.A. has accumulated the material for a standard specification it moves the B.E.S.A. to prepare and issue it. When information is required on the commercial working of a standard article, or on the need for standardisation, the E.D.A. is there to supply the information. Only those engaged in the actual working of these organisations know how dovetailed they are together and how cordial are their mutual relations. Long may this state of things continue! It is the duty of every member of the industry to promote it by every means in his power.

The part played by the Institution of Electrical Engineers in founding these bodies, which are proving so beneficial, should not be overlooked. It has been that of the unselfish mother who, having given birth to her children, nourished them and brought them to adolescence, has, with satisfaction, seen them set up independent establishments of their own. The policy is a wise one, for it means that the Institution founds organisations to carry out work which it has neither funds nor powers to execute efficiently and which is indeed outside the scope of its charter.

One of the fundamental necessities for the developing and strengthening of engineering in the future is education, and here the I.E.E. is essentially on its own ground. Not only by its papers, lectures and discus-

sions does it afford to its members the means of acquiring information of the latest practice and invention and of improving their knowledge by discussion with their fellows, but it provides a test of education by the conditions which it imposes on those seeking admission to its benefits. Tighter and tighter is being drawn the net that catches the inefficient or incompetent. Written examination or thesis alone is not relied on as a test, but full account is taken of the whole past history of the candidate. With the raising of the standard of attainment demanded, we may hope that the progress of the industry may be promoted.

The I.E.E. also takes an active part in the education of the student by the offering of premiums as an encouragement, the providing of facilities for discussion for students and the younger members and directly by co-operation with the Board of Education.

While the I.E.E. sifts carefully those who have passed through their training, it is to be regretted that there does not exist some means of sorting out those who can never become efficient engineers, by reason of lack of ability or aptitude, at an earlier stage whereby useless expenditure of time and funds might be avoided. It is because quite a number of young men who have not it in them to become engineers are annually turned out by the educational establishments that there still persists in some quarters a prejudice against the college-trained man.

It is unfortunate that the short-lived Engineering Training Organisation, into which so much enthusiastic hard work was put by the few individuals who formed the committee, was not properly supported by the engineering industry. During its short career a vast amount of useful information was got together and tabulated, and some most valuable reports prepared by Mr. A. E. Berriman. In the single volume published by the Organisation, of which only a limited number were printed, it is very clearly brought out that different kinds of training are necessary according as the individual is fitted to become an engineer in the broader professional sense of the term, or to take a secondary position, or thirdly to become a skilled tradesman. All these grades are necessary to the industry; it could not continue in being were all individuals comprised in one of the three classes only.

The professional engineer must follow a university career or take a full-time course at a technical college, and he must have comprehensive training as an engineering pupil in practical work. He will not be completely trained until he attains some age between twenty-two and twenty-four.

For the secondary positions it is sufficient for the individual, after having had a good secondary school education, to serve as an engineering apprentice. During his apprenticeship he will obtain a broad training in practical work, and by means of sufficient part-time study acquire a knowledge of the scientific and technical principles underlying his work. His knowledge of detail of practical work will be greater than that of the engineering pupil and his scientific knowledge very much less. His training will ordinarily terminate about the age of twenty-one.

Lastly, there is the trade apprentice who devotes himself wholly to learning thoroughly the handicraft of a particular vocation. He can never ordinarily attain with this training to a position in the front rank, but a wide field is nevertheless open to him.

Much less dissatisfaction and disappointment would be experienced if this classification were recognised and if it were understood that different classes of mind and degrees of ability require different kinds of training and are capable of useful work in different spheres.

A word must be given to the commercial engineer, who will have an important influence on the engineering progress of this country. It is for him to find openings for the products produced by his exclusively technical brethren. It is necessary that he should have a good knowledge of the articles which he sells and that he should be able to discuss intelligently with the prospective purchaser the details of the latter's requirements and the advantages of what is offered for sale.

Obviously for the commercial engineer whose function it is to find new markets for British manufactures a thorough knowledge of foreign languages is essential. French and Spanish will probably serve him best, but in special cases other languages will be necessary.

It is greatly to be regretted that with certain conspicuous exceptions British engineers, and especially manufacturers, appear to appreciate so little the vital importance of adapting their engineering language, or, in other words, their system of measurement, to the needs of foreign powers. The vexed question of the adoption of the metric system in this country may well be left severely alone in an article such as the present one, but as to the absolute necessity of the use of the metric system in seeking to sell goods in certain foreign countries there can be no shadow of doubt. It is not sufficient to give the metric equivalent of English measurement; it is essential that designs should be worked out in round metric numbers, and that the exact metric dimensions asked for should be supplied. In certain countries, markets are now absolutely closed to British manufacturers because they are so shortsighted as to refuse to adapt their manufactures to the metric standards existing in those countries. A change in this attitude is of the greatest importance in securing world markets.

One more instance in which the blindness of those most concerned is painfully evident is in connection with what has been called a National Electrical Proving House. At the present time we have numerous standard specifications defining the conditions which articles purporting to be standard should conform to. In many cases type tests are specified; these tests aim at trying once for all whether a particular article does or does not conform in all respects to the specification. Often large amounts of power are involved and trials occupying a considerable length of time. It is only intended that these tests should be made on one article out of a great number, but it is necessary that for that one article they should be carried out by some properly-constituted authority absolutely above suspicion of bias. No such body exists, and it is practically impossible to get type tests carried out efficiently. In some cases the manufacturers themselves may conduct them, but obviously this course is open to serious objection.

A suitable institution worthy of the electrical industry ought to be established, and would be established if manufacturers could only be persuaded as to the immense commercial value that it would have for them. At present their attitude is one of distrust and apathy. It is not desirable that this institution should be under Government; it ought to be managed by a committee constituted very much on the lines of the Council of the Electrical Research Association. That is to say, it should be started and run jointly by all manufacturers concerned, the powers of the governing body being balanced by a combination of representatives of the Institution of Electrical Engineers, consulting engineers, and large users of electrical plant, such as power station engineers, railways, Government departments and electrical contractors.

Such an institution would complete the chain of the B.E.S.A., the E.R.A. and E.D.A. and would enable the members of the B.E.A.M.A. to prove their compliance with standard requirements. After advocating a National Electrical Proving House for over a quarter of a century one may appropriately say "Hope deferred maketh the heart sick, but when the desire cometh it is a tree of life."

This very imperfect attempt at indicating a few of the means which may contribute to the progress of the engineering industry in this country may fitly be concluded by an expression of profound belief in the innate engineering genius and instinct of the British race and of the hope, founded on reasonable grounds, that there awaits the British engineer a position of pre-eminence in the future even higher than in the past.

THE TREND OF PROGRESS IN COMMUNICATION BY WIRE.

Contributed by MAJOR PURVES, Engineer-in-Chief, G.P.O., and SIR WILLIAM NOBLE, late Engineer-in-Chief.

Telephony.

So long as speech remains the most effective means of transferring human thought, so long will telephony be the greatest possible achievement in electrical communications.

It was given to Alexander Graham Bell to live to see his original invention gradually and steadily developed until speech could be transmitted across a continent or across an ocean—and these developments were achieved in the comparatively short period of 40 years.

The remarkable successes which have been attained in the past decade in radio telephony have prompted some predictions that it would ultimately become the common means of telephonic communication; but the authors of such predictions have overlooked circumstances which must prevent the fulfilment of their dreams. Radio-telephony is broadcasted speech, and anyone who pleases may listen. The fundamental condition of secrecy can be obtained only in wire telephony, and the realisation of universal telephone communication for the business purposes of the world will be achieved by this means.

The most recent advances in telephony both by radio and by wire have resulted from the development of the thermionic valve from the original invention of Dr. Fleming. In wire telephony the thermionic valve has led to the solution of a problem which had previously presented apparently unsurmountable difficulties, namely, the evolution of a telephonic relay or repeater. Further than this, the thermionic valve has been the means of acquiring an extended knowledge of the laws governing the electrical transmission of speech, which could not otherwise have been gained.



Major T. F. Purves, O.B.E.

Before the advent of the modern telephone repeater the limit of speech transmission appeared to be the distance over which heavy-gauge copper conductors, loaded at suitable intervals with inductance coils, could be stretched in air on highly-insulated supports. Although the requirement never actually arose, there appeared to be no engineering difficulty in so providing international communication within the limits of the European Continent. In Great Britain the maximum possible distance between telephone stations was well within the limit referred to, and for some years after the taking over by the State of the trunk telephone service in 1896 it was possible to provide pole lines along the public roads, railways, and canals, to carry all the wires required to meet the demand for trunk service.

As the trunk service became more general and additional wires were required to carry the rapidly increasing traffic, it became difficult to find routes for new pole lines, especially in the vicinity of large towns, and by 1910 the congestion had become serious. Already large numbers of wires used for local service in the more thickly-populated areas had been diverted to underground cables, thus setting free pole-line space for long-distance wires, but this was only a palliative measure. The time had arrived when the number of wires required to carry the traffic between centres such as London and Birmingham could not be erected on air lines, and could only be provided in underground cables. The practical problem of reducing the high attenuation factor of cable conductors had been solved by Pupin in 1900, and it was possible, by the use of inductance coils spaced in accordance with Pupin's specification, to reduce the attenuation factor of a cable conductor to equality with that of an aerial conductor of the same gauge. The limiting condition in the case of the cable circuit, which was negligible in the aerial circuit, was the mutual interference between adjacent circuits in a multi-conductor cable. The interference factor, moreover, prevented the formation of superposed or phantom circuits in long underground cables. Whereas in aerial lines a group of, say, eight wires provided six independent circuits, only four circuits could be obtained from the same number of wires in a cable: a consideration which weighed very heavily against cable lines.

The problem of interference between cable circuits had been under investigation for many years. The invention by a Post Office engineer of the "multiple twin" method of stranding telephone cable conductors was a decided advance in method, but was only a partial solution of the problem. It had been proved that the interference arose from capacity unbalances between wires due to unavoidable asymmetry in building up the wires into a cable. A practical solution of the trouble was arrived at in 1913, when a method of balancing cable circuits by a system of selection of conductors in jointing adjacent lengths was introduced by the Post Office Engineering Department. The first trunk line cable balanced by this method was laid between Leeds and Hull, and was completed in November, 1913. From that time onward there was no looking back in the provision of trunk line underground cables. A stage had been reached where it was practicable to provide underground telephone circuits up to a distance of about 400 miles, the limiting factor being the size of copper conductors which could be successfully stranded up into a multi-core cable. Conductors weighing 300 lb. per mile were found to be the largest practicable for mechanical reasons, and four conductors of this weight were included in the mixed gauge trunk cable laid between London and Liverpool and completed in 1916.

About this time, however, considerable success had already been obtained with the telephone repeater, using a thermionic valve as the amplifying element. It was found possible to construct and maintain in continuous operation under commercial conditions a repeater having an improvement factor equivalent to the suppression of a length of line equal in its attenuation constant to 15 miles of standard cable. In other words, a line circuit having an equivalent of 30 miles of standard cable could be increased 100 per cent. in talking efficiency by

means of a telephone repeater located in the middle of the line. Translated into terms of conductor weights, it meant that as between London and Liverpool, for instance (200 miles), the efficiency of a circuit with 150 lb. conductors and an intermediate repeater at Birmingham could be made equal to that of a 300 lb. circuit without a repeater.

Later experiments proved that several repeaters suitably spaced along a line could be operated in tandem. These experiments opened out an entirely new vista in telephone line engineering. It could be foreseen that very light conductors suitably loaded and weighing only 40 lb. per mile, relayed at intervals of from 50 to 60 miles by thermionic valve repeaters, could be used to cover the distance between any of the principal cities of Great Britain.

A cable containing 160 pairs of 40 lb. conductors, giving a maximum of 240 telephone circuits, has been laid between London and Manchester, and is relayed at two intermediate repeater stations. This cable is the first instalment of a comprehensive scheme for linking together all the principal centres of the country in a network of underground cables. Many other main trunk cables are now in course of construction, and two (London-Southampton and London-Bristol) are approaching completion. These cables have conductors weighing only 20 lb. per mile, designed for "four-wire" repeater working, and each will provide nearly 500 speech channels. When completed, in the course of the next four or five years, the trunk line system of Great Britain will be unique not only in respect of the invulnerability of its whole backbone system against interruption by gales and snow, but also on account of the quality of service that may be obtained. The telephone repeater will not only ensure good transmission, but because it permits the use of very light conductors, large groups of circuits will be available between main exchanges, thereby making practicable the provision of "no-delay" service such as has recently been offered to the public between London and the principal towns of the Home Counties. A "no-delay" service between London and Manchester, for instance, could not have been visualised when aerial lines only were available.

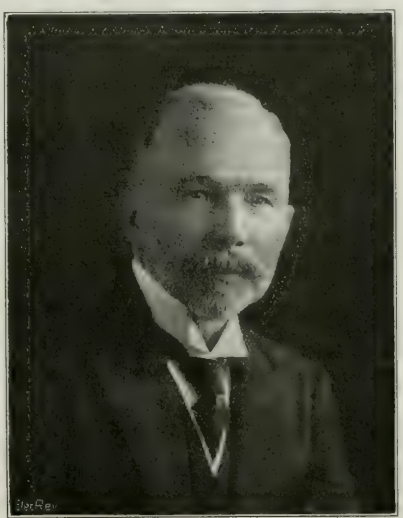


Photo by] [*Elliott & Fry.*

Sir William Noble.

The question of international communication in Europe has been raised in several quarters in recent years, and was an interesting feature of Mr. Gill's presidential address to the Institution of Electrical Engineers. Up to 1914, communication between the chief cities of Great Britain and the nearer continental cities, such as Brussels, Antwerp, Lille, Paris, Bordeaux, Lyons, &c., was maintained on quite a small number of lines, which sufficed to carry the traffic demanded by the public, but even in 1914 proposals were made for increasing the number of lines to France and Belgium and for extending the service from Great Britain to Holland, Germany, Switzerland and Italy.

Although Great Britain is far ahead of other European countries in the provision of an underground network of telephone cables, considerable progress has been made on the continent.

Holland, Sweden and Germany have already commenced the construction of cable routes connecting their principal cities, and France and Italy have similar plans in view. If it were practicable to retain aerial lines for international services, the provision of universal international service in Europe would present no new engineering problems. Some interesting administrative problems would arise, however, and will in any case arise in controlling a line, say, from London to Constantinople, relayed in several different territories *en route*.

It seems to be clear that aerial lines will not always be available for every international requirement. Some sections must be in cable, and it is already apparent that in heavy traffic sections, such as between London and Paris, the provision of an adequate number of additional aerial lines is now impracticable, and a direct cable between the capitals is an urgent requirement. Germany has already solved the problem of laying a multicore telephone cable on the bottom of the sea.

The study of long-distance transmission through underground and submarine cables over the distances to be covered in international service has revealed new and intricate problems. A considerable amount of laboratory and field research work has yet to be done before a complete solution to these problems can be obtained.

It is a fundamental principle that a commercial telephone circuit must be a duplex. A circuit which could be used in one direction only, and which required change-over switches or other devices to be worked by the users for reversing the direction of operation, would be useless for general service.

There has never been any difficulty in providing the duplex or both-way facility in a circuit consisting of a line and the usual terminal telephone apparatus. When, however, the telephone repeater first made its appearance on long aerial lines, and the range of speech was increased, the problem of maintaining the duplex facility at the repeater presented some difficulties. These difficulties were completely solved in due course, and the great work of the American Bell telephone organisation in this connection merits warm recognition.

In applying the telephone repeater to communications through long underground cables, such as are now being laid in Great Britain, the duplex problem presented new features, but none of exceptional difficulty, and a satisfactory solution was readily obtained. Practically, the problem was the construction of an artificial balancing line which would stimulate the actual line for all speech frequencies and under all conditions arising in use.

This problem which thus arises in designing a long-distance underground telephone cable, which requires to be relayed at several points, has not appeared in long-distance communications over aerial lines. It may be described briefly as follows:—

An energy impulse sent out from a transmitter at one end of a line is not completely absorbed by the receiver at the distant end; part of the current is reflected by the receiving apparatus and traverses the line in the reverse direction, where it is again partly reflected and retransmitted until it does out. Succeeding impulses making up an intelligible sound pass through similar cycles. The reflected currents arrive at the transmitting end, where they pass through the speaker's own receiver after the lapse of a definite time interval.

In an aerial line where the electrostatic and electromagnetic factors are small, the speed of propagation of speech currents is almost of the same order as the speed of propagation of electromagnetic waves through space; the time interval between the sending of an impulse and the arrival at the sending end of the reflected portion is so small that the speaker is unaware of its reception in his own telephone. The interval would be about thirty-thousandths of a second on a line, say, from Madrid to Moscow. In a modern underground telephone cable over a corresponding length, with repeaters suitably spaced, the time interval would be of the order of one-fifth of a second; and the volume of sound produced by the reflected currents at the transmitting end would be a fairly loud echo of the speaker's own voice, creating an impression that his correspondent was interrupting him. Such a telephone line would be almost useless commercially on account of this "echo" effect. In the present state of the art, it appears that this limits the length of an underground telephone cable to about 1,000 miles. It is clear, therefore, that for communication between the extremes of Europe, say between London and Constantinople, the respective national cable networks which will doubtless be constructed in due course must be supplemented by a few main arteries of aerial lines for international services.

The circuit capacity of such aerial lines will not necessarily be limited to the number of physical loops that can be erected, as it will be possible to operate each loop as a multiplex of two, three, or four duplex channels by using the high-frequency carrier current system, which has been developed to a high stage of commercial efficiency since the introduction of the thermionic valve. The system is at present comparatively expensive in capital costs, and cannot compete with the multi-core light conductor cables previously referred to; but where long overland distances have to be covered, and the cost of physical circuits is necessarily very heavy, the system is economically applicable. It has been worked experimentally over the short cables between Great Britain and the Continent; but the factors which limit the radius of communication in telephone transmission at "audio" frequencies operate more severely against high-frequency carrier current transmission.

From what has been said in this brief summary it will be evident that the problem of commercial telephonic communication between Great Britain and America, a subject that has often been discussed among telephone engineers, presents many difficulties, and it must be admitted that no solution is yet in sight. Communication by wire, plus wireless, is possible, even if not immediately practicable, but cannot so far be regarded as an adequate commercial and economic proposition. Sooner or later, however, the dream must come true.

High-Speed Telegraphy.

High-speed telegraphy was the term applied in years gone by to such systems as the Wheatstone Automatic, wherein signals on the line were controlled by a perforated paper tape passing through the transmitting apparatus at a speed ranging up to 600 words per minute, but in practice working at from 150 to 350. Nowadays the term covers also any system in which on one circuit the number of telegrams carried is considerably above the usually accepted number for ordinary hand signalling; such, for instance, as a multiplex system, in which several operators, each working at hand speed, use the line for the fraction of a second, in turn with each other, resulting in a high rate of line signalling, and the dispatch of several messages practically at the same time, so far as the sending and receiving operators are concerned.

The highly-skilled Morse operator of 30 or more years ago is tending to die out because of the fact that most main telegraph lines, or trunk circuits, are worked by machine telegraphy of one kind or another, and there is not now the opportunity to obtain nor the need for the high degree of skill that existed at that time.

Skilled Morse transmission has now to a large extent been replaced by the typewriter form of keyboard, and skilled reception has been replaced by machine printing in Roman characters, either on a paper tape or on a telegraph form.

Where working by the Morse code is still desired on long or important lines where traffic is heavy, the transmission is effected by the previously-mentioned paper tape, prepared on an alphabetical keyboard perforator, and the reception is in the form of a similar perforated tape which, in passing through a second machine, selects the required letters and prints them in Roman type.

It speaks eloquently for the ingenuity of telegraph men that they have succeeded in devising mechanism to overcome the inherent disadvantages and difficulties of the Morse code for use as a machine-printing telegraph system, and we honour more particularly the names of Gell and Creed in this connection; the former for his typewriter form of tape-perforator, and the latter for his receiving perforator and tape-printer. The later designs of the Creed apparatus, in which the pneumatic power portion has been finally abandoned and replaced by electric power, have a far-reaching advantage which will probably result in a considerable extension of the use of the apparatus.

We then come to the modern Multiplex systems developed from the French Baudot system, which has been in use in France for some 45 years. It uses an equal letter five-unit code, which for manual transmission purposes is remarkably easy to learn. Reception on this system is in characters printed automatically on a paper tape, and the hardest part of the skilled work of the Morse operator is entirely eliminated.

A little more than 12 years ago the Engineering Department of the British Post Office duplexed this system, thereby obtaining double the number of channels per circuit compared with the circuits in France, *i.e.*, where the French obtained three, four, or six channels, the British obtained six, eight, and twelve. In the short period of 12 years the use of the duplex multiplex using the five-unit code has grown so extentively that it is now said to be carrying 85 per cent. of the long-distance United States telegraph traffic and some 40 per cent. of the British telegraph traffic. Its use has recently extended to our Colonies, and excellent results have been obtained in India and New Zealand, whilst Australia and South Africa are installing sets.

The great success of the five-unit duplex multiplex induced the German Telegraph Administration to adopt the five-unit code for their high-speed telegraph, which previously was worked by an eleven-unit code. This change enabled them to dispense with the costly and cumbersome photographic reception and to obtain direct ink-printed reception in Roman characters. The system is known as the "Siemens High-speed Automatic." A large number of sets have been constructed and brought into use on the Continent of Europe. The system has its limitations, but gives excellent results.

For main line working we have therefore three possibilities:—

(*a*) Duplex Wheatstone (Morse code), with Creed reception and printing.
(*b*) Duplex high-speed (5-unit code).
(*c*) Duplex multiplex (5-unit code).

All three systems use alphabetical keyboard perforators, and obtain reception in printed characters, but the first and second differ considerably from the third. In systems (*a*) and (*b*) all tapes have to follow in turn through one transmitter, and the reception is all on one receiver; whereas in system (*c*) each keyboard has its own transmitter through which the respective tapes pass regularly, and practically continuously, without having to wait their turn; while the reception is obtained on an equivalent number of receiving instruments of the page-printing or continuous tape types.

The various successful duplex multiplex systems using the five-unit code are all the same in principle, and differ only in details, chief of which are the following:—

(*a*) The allocation of the five-unit code combinations to the various symbols.

(*b*) Type of reception, tape- or page-printing.
(*c*) Method of maintaining "unison."
(*d*) Method of driving the apparatus.

Steps have already been taken with a view to obtaining international uniformity in the allocation of five-unit code combinations to the various letters of the alphabet, &c., in order to avoid duplication of plant and its additional cost and maintenance charges.

The different methods of maintaining "unison" are not of very great importance so long as they are effective and not troublesome to maintain. This applies also to the methods of driving the apparatus.

The type of reception is, however, of great importance, as it involves certain variations in the method of operating, in the design and construction of the keyboard perforators, and in the printing mechanism.

This question of page-printing *versus* tape-printing is an old one, and while great improvements have been made from time to time in the apparatus for page-printing, it is still not sufficiently satisfactory to warrant its general adoption. Continual endeavours are being made to overcome its disadvantages, and in time, no doubt, it will justify its greater first cost and higher maintenance charges.

The five-unit equal-letter code has the very great advantage of requiring much less complicated apparatus, both in the keyboard perforators and in the receiving mechanism, than that required for the unequal-letter Morse code; and when required for use as a direct hand-signalling system it is far more easily learned and entails much less manual exertion from the operator than does Morse working. Hence we may look forward to a further extension of this system, to be limited only by the economic factor of maintenance compared with available traffic. Where the traffic for disposal does not warrant the cost of supplying and maintaining machine telegraphs capable of large output, a simpler and less costly type of machine becomes necessary, reaching eventually the simple telephone circuit with its comparatively low first cost, low maintenance charges, and low operator costs, for dealing with a few messages per hour.

There are very strong and notable advocates of the high-speed automatic system, as compared with the duplex multiplex, but experience has shown that the latter is generally more expeditious, regular, reliable, and economical for dealing with ordinary commercial and private telegrams; while the former is particularly good for such work as trans-Atlantic cable service, long-distance wireless, and for newspaper work. These fields are, however, being invaded by the five-unit duplex multiplex systems, and time alone will show which system possesses the particular advantages which result in ultimate survival.

Modern multiplex systems are possessed of very great flexibility. The various channels of communication which they furnish need not all be placed at the disposal of two terminal offices, but can be readily made available for the service of other offices by extension on supplementary circuits according to the requirements of traffic. It is permissible to anticipate that methods of temporarily switching these channels one to another, in the same manner as telephone trunk lines, may be developed, and that much of the labour and delay involved in the reception and retransmission of telegrams at intermediate offices may thus be eliminated.

Looking still further forward, we may consider the possibility of an entire change in the method of telegraphy, in which perhaps telegrams may not be dispatched word by word, but by the quasi-photographic means already shown to be practicable for the transmission of drawings and pictures. Presumably such messages would be charged for, not by the number of words they contained, but by the area of paper occupied by the telegram, either written or typed. In that case the received telegram would be more or less a facsimile of the original, and would require no counting of words nor corrections. Such a system would simplify the work of both sending and receiving, and the treatment of telegraph messages would become almost as simple as the handling of a letter or postcard. At present this method is rather slow, complex, and costly, but improvements are being made in all three directions.

ELECTRICITY IN MEDICINE: ITS PROGRESS DURING THE LAST TWENTY-FIVE YEARS

By E. P. CUMBERBATCH, M.A., M.B. (Oxon.), M.R.C.P. (Medical Officer to the Electrical Department of St Bartholomew's Hospital; Past President of the Section of Electro-Therapeutics of the Royal Society of Medicine

The past twenty-five years have seen notable advances in the uses of electricity for the treatment of disease. Great progress has been made not only in the application of new methods of electrical treatment, but in the elucidation of the changes which electricity can bring about in the body. Perhaps the most striking results which have been obtained in recent years are those derived from currents which oscillate with high frequency, but the knowledge which has been gained of the changes which electricity produces in the tissues and the ways in which they are brought about represents the greatest advance, not merely in the past twenty-five years, but in the entire history of electro-therapeutics. The acquisition of this knowledge has had far-reaching effects. We can speak with some degree of certainty of the mode of action of electricity in the treatment of disease. Of the cases which resist treatment by simpler methods we can select those which electricity is likely to benefit, and can speak with more certainty of the results which are likely to follow. The outcome of this has been a gradual change in the attitude of the medical profession towards medical electricity. The scepticism, not to say contempt, with which the majority of the teachers of medicine regarded electrical treatment is passing; electro-therapy is now a recognised branch of medicine, and its value is realised.

Up to the beginning of the present century electrical treatment was mainly empirical. Physicians prescribed it for patients whom they could not cure, without any knowledge of the likelihood of procuring good results from it. Hospital patients who had failed to obtain relief in other departments were sent finally to the electrical department, in the hope that they might obtain some benefit there. The faith of the public in treatment by electricity was responsible for the existence of charlatans, and electro-therapy fell into disrepute. The time is still in the memory of a few when a doctor was regarded with suspicion if he practised electrical treatment. The past twenty years have seen a marked change. With the development of knowledge of the method of action of electricity in the treatment of disease, it has become possible to state, with some degree of certainty, the maladies which electrical treatment is likely to benefit. Although there is still the tendency in hospitals to prescribe electricity for any kind of obstinate or incurable disease, the electrical departments can show a far better "balance sheet" of success and failure. The recognition of the value of medical electricity was consummated in 1919, when the University of Cambridge established a Diploma in this subject (and in radiology). This Diploma in Medical Radiology and Electrology is the first of its kind that has been instituted, and it is interesting to note that Paris, which has a still more ancient University, has followed the example of Cambridge. A complete course of study for the examination for this Diploma has been organised at Cambridge and at the Medical Schools of London and other Universities. Be-

fore this, there had been no organised course of study, and those who wished to learn medical electrology and radiology had to acquire their knowledge mainly by their own efforts.

The extrication of medical electricity from the confusion of unscientific empiricism may be said to have commenced at the beginning of the present century with the publication, between 1900 and 1903, of a series of masterly researches by Dr. Stephane Leduc, Professor at the Medical School of Nantes, on the principles of the migration of ions and their practical application to the living body. Leduc demonstrated the possibility of the introduction of ions through the skin into the living tissues by means of the constant current, and showed that certain diseases could be treated successfully by this means. He explained the method with such clarity and practised it with such precision that doubts were dispelled, and the form of electrical treatment now known as "ionisation" came into existence and has since been practised with great success. The advantage peculiar to the introduction of ions by the constant current is the thoroughness and uniformity with which they are introduced. If a solution containing ions is placed in contact with the skin, the ions do not diffuse through the latter, while the diffusion into the skin is extremely slow. But when the current is made to pass through the solution into the body, the ions migrate through the skin and below it. Every portion of the tissue, however minute, in fact, every cell, is permeated with ions. If a solution containing ions is injected from a syringe it forms a local "puddle," which is quickly absorbed into the circulation. If the solution is taken by mouth, it is distributed to every part of the body. Some examples may be given of treatment of disease by ionisation. Ulcers, sinuses, and cavities infected by pus-forming bacteria will often fail to heal when antiseptics are placed on the surface or into the cavities. Bacteria which lie below the surface are not reached by the chemical intended to destroy them. But ions of zinc, which possess strong germicidal powers, can be made to migrate below the surface by means of the current. They destroy the bacteria, and healing takes place. Rodent ulcer, which is a peculiar form of malignant disease of the skin, can, in some cases, be destroyed by means of zinc ions. By means of the current, the ions can be made to permeate every cell of the malignant tissue and destroy it; the deal tissue separates, and healing takes place.



Photo. [Vandyk.

E. P. Cumberbatch.

There is another peculiar form of malignant ulcer which attacks the cornea of the eye and, if unchecked, spreads over the entire surface, and causes perforation It is most difficult to treat by other methods, but can usually be healed by the method of zinc ionisation.

In addition to his exhaustive investigation of ionisation by zinc, Leduc made a careful study of chlorine ions and salicylic ions. Chlorine ions possess the power, when introduced by the current into scar tissue, of softening the latter and loosening the adhesions which it causes and restoring mobility. Salicylic ions have the power of relieving pain in many forms of neuritis. Many other ions are used now in electro-therapeutics, and possess special healing properties when introduced by the current. Treatment by ionisation was widely practised during the late war, and the value, not only of this form, but of other forms of electrical treatment, was shown incontestably to those who were inclined to be sceptical as to the powers of electro-therapeutics.

The constant current is now frequently used for the destruction of diseased or abnormal tissue. The destruction is not due to any mysterious power of electricity. As a conductor of electricity, the body behaves as an electrolyte, and when a current is passed through it by way of metal electrodes placed in contact with the moistened tissue, new chemicals are formed around the electrodes. These chemicals possess caustic properties and will destroy the tissue in the vicinity. If ready-made caustics are used, they act only on the surface, and the destruction cannot be confined to the desired region. But if the constant current is used, the caustic chemicals are made to appear in the exact spot desired, and their amount can be accurately controlled. If the electrodes have the form of needles, the caustic action can be produced below the surface. This method has many useful applications. If an eyelash grows on the under surface of the lid, thereby causing intense irritation, a fine platinum needle can be inserted into the hair follicle and connected to the negative pole of a battery. A minute current is made to flow, caustic soda is formed from the tissue ions in just sufficient amount to destroy the root of the hair, and the latter can be lifted out. The same principle is applied in a method used with success by Dr. Axel Reyn, of Copenhagen, for the destruction of lupus of the mucous membranes.

There are many other methods of applying electricity for the treatment of disease—some of them old, others relatively modern. Static electricity has been used in medicine for 170 years, and it is doubtful whether any form of treatment has been associated with more charlatanism. But it possesses undoubted therapeutic value when applied in the right way to the right maladies. Brush discharges from powerful static machines (the so-called "static breeze") have long been used for the treatment of general debility, with success in some cases, with failure in others. It is now known that the main effect of the static breeze is an elevation of the blood pressure. When directed on the surface of the body, it produces a reddening of the skin and a strong stimulation of the sensory nerve endings in the latter. These effects persist for some hours. A rise of blood pressure is the physiological sequel of the stimulation of the sensory nerve endings in the skin. If, therefore, the patient has a low blood pressure, treatment by the static breeze is indicated, and the symptoms which accompany it will disappear. On the other hand, if the patient's blood pressure is high, the static breeze is more likely to aggravate the symptoms. During the late war electrical treatment was often sought for neurasthenia. The blood pressure in this disease is usually lower than normal, and the static breeze gave the most benefit.

High-potential discharges from a wire brush or through the so-called vacuum electrodes will often heal sluggish infected ulcers. This is due to the formation, by the discharge, of ozone and oxides of nitrogen from the atmospheric gases. These have powerful germicidal action. The stimulation of the sensory nerves is followed

by the dilation of the vessels supplying the region of the ulcer, and healing is aided by the influx of a larger supply of blood. The administration of sparks from the static machine, or the application of the so-called static wave current, causes sudden violent twitches of the muscles. If there are adhesions in the region of the muscles and pain is caused by movements which require the action of these muscles, this form of electrical treatment will loosen the adhesions and restore free, painless movement. Long-standing lumbago is often relieved by this treatment. The sudden tugs of the muscles produced by the electrical discharge are readily borne if applied correctly, whereas slow contraction produced by other methods would cause intolerable pain.

The last ten years have seen great progress in the medical uses of high-frequency currents. The physiological and therapeutic properties of these currents were carefully investigated during the closing decade of last century by that distinguished pioneer, d'Arsonval, Professor at the Collège de France, Paris. Their method of action was, at first, not understood, and unscientific persons used them for all kinds of obstinate maladies. After a few years, the saying: "la haute fréquence est la haute finance," expressed the opinion of the medical profession in France regarding treatment by high-frequency currents. During the early years of the present century it was shown by German workers that these currents were able to raise the temperature of the parts of the body which they traversed, and that the heat would become intense and even intolerable if the oscillations were sustained and the strength of the current sufficiently great, *viz.*, two or three amperes. The apparatus which had previously been used for medical purposes provided weak currents of unsustained oscillation, and these produced no sensation in the body, or, at most, trivial warmth. It was gradually established that the production of heat was the essential action of high-frequency currents in the treatment of disease. Heating of the body by high-frequency currents differs in one essential particular from all other methods of heating: the heat is actually generated inside the body along the path of the current, whereas in the other methods the heat is supplied "ready made," and has to penetrate from the exterior. But as the tissues are very bad conductors, the heat does not spread below the skin. In other words, *surface heating* is produced, while, by the high-frequency currents, *deep heating* is produced. Machines capable of yielding currents of high amperage and sustained oscillation are now used, and in recognition of the all-important action of high-frequency currents, the treatment is now known as *diathermy*.

Diathermy is a valuable method of treatment of new growths—both innocent and malignant. By adopting a suitable technique, the temperature of the growth can be raised *en masse* until it undergoes heat coagulation. It gradually separates, and the residual space is quickly filled with healthy tissue, and healing is rapid. In this method of treatment there is no cutting or scraping or bleeding or the attendant risk of dissemination of the growth. The effects on the patient are surprisingly small. There is no shock after the diathermy, and even if the operation is extensive, the patient is able to sit up or leave bed on the day after, and can usually leave hospital in two or three days. Diathermy was introduced into England in 1909 by the late Dr. Lewis Jones, and the first operations were performed in the Electrical Department of St. Bartholomew's Hospital. At first the tendency was to reserve diathermy for the treatment of growths which were too advanced for surgical removal. Even in these cases the patients were made comfortable, and life was considerably prolonged. In more recent years, cases regarded as operable have been treated, and still better results have been obtained. If early cases are treated, we may be able to produce cures. For those very intractable papillomata which grow in the interior of the bladder, diathermy is now recognised as the method of treatment *par excellence*. Bleeding is stopped, the growths are destroyed, and do not recur. The non-surgical uses of diathermy, while less dramatic, are none the less effective. The therapeutic effects of heat have been known for centuries. These have been the effects of surface heating, but deep heating can produce results which surface heating is unable to effect.

From the foregoing brief sketch it will be realised that electricity owes its therapeutic value to its power of producing definite chemical, thermal, or mechanical effects in the tissues, and that cure is the result, direct or indirect, of these effects. The establishment of this truth represents the work of the past twenty years, and has opened out a new era for electro-therapy as a scientific branch of medicine. But much still remains to be done. The links which connect the immediate changes produced by electricity in the tissues with the ultimate therapeutic effects are in many cases obscure or unknown. We are ignorant of the way in which the constant current procures relief in disease of organs which lie deeply, beyond the range of effective penetration of ions from the exterior. There is a migration of the tissue ions, but we do not know what relation it has to the cure obtained in some cases, or why failure attends similar treatment in apparently similar cases. Sinusoidal and faradic currents possess therapeutic powers, but beyond the fact that they stimulate muscles and nerves, there is little known of the series of changes which connect the stimulation with the therapeutic effects. The solution of these and other problems will be aided by the study of the physiological action of electricity on the living tissues in health. Pharmacology, the study of the action of drugs on the body in health, is necessary for the intelligent use of drugs in disease. So also is the study of the action of electricity on the normal body necessary for the intelligent use of electricity in disease. Much physiological research has been done on excised muscles and nerves, but what is wanted is further investigation under the different conditions of the intact body. The future should see the physiologist working in conjunction with the practitioner of electro-therapy. The help of the physicist is becoming more and more necessary for the elucidation of the problems connected with the physics and electro-technics of medical electricity. Team work by the medical electrologist, the physiologist, and the physicist would do much to unravel the problems of medical electricity, and to benefit suffering humanity.

The next few years will see a widening of the field of electro-therapy, a much more general adoption of electrical treatment by the medical profession, and the entry of a much larger number of medical men into the field of medical electricity. They will see the establishment in the hospitals of departments devoted entirely to electrical treatment. At present some hospitals do not possess electrical departments, while in others the custom is to practise medical electricity in the same department with radiology or other branches of physio-therapy.

Each of these subjects is large enough for the complete attention of a single head of a department, especially if a medical school is attached to the hospital; and if they are united in a single department, one of them receives the chief attention, so far as original investigation is concerned, while the other remains stationary.

This brief sketch would not be complete without paying a tribute to the memory of one whose labours were almost entirely responsible for the advance in this country. The late Dr. Lewis Jones, England's greatest medical electrologist, was given charge of the Electrical Department of St. Bartholomew's Hospital in 1890, at a time when medical electricity was almost entirely neglected by the profession. An able physician and neurologist, he gradually separated the maladies which could be benefited by electricity, and out of chaos and confusion he established order. He showed how the treatment should be applied, and explained how it acted. Ionisation, diathermy, and diagnosis by condenser discharges were introduced into this country by him, and were first practised in his department at St. Bartholomew's. The therapeutic value of sinusoidal currents was established by him. His death, in 1916, was untimely, but his work had laid the foundation on which is being reared a British School of Medical Electrology.

SOME CONSIDERATIONS CONCERNING CABLES.

By B. WELBOURN, M.I.E.E.

The premier position that has been taken by this country in the manufacture of insulated cables is traceable to several causes. We were the pioneers in submarine telegraph cables, and their satisfactory working gave our engineers a firm belief in their ability to produce cables for all purposes as and when they were demanded. Again, the Board of Trade and general public feeling were opposed to the use of overhead wires for the distribution of electrical energy for many years after electric lighting and other schemes were being adopted. This attitude naturally fostered the development of insulated cables for power purposes, until they have reached the high state which prevails to-day. On the telephone and telegraph side, progress has been no less marked, especially with multiple twin transmission cables.

In the first ten years of electricity supply, underground cables were usually insulated with gutta-percha or rubber, and these in turn were supplemented by vulcanised bitumen and by impregnated paper, while some interesting examples of bare copper strip in conduit systems still survive. For interior wiring, rubber-insulated cables have been, and still are, chiefly employed, although many examples of the successful use of paper-insulated cables are to be found.



Photo by] B. Welbourn. [Elliott & Fry.

Practice in underground power cable work has now crystallised to the extent (1) that the use of vulcanised bitumen cables is chiefly confined to collieries, and (2) that paper-insulated cable is used for all voltages of 3,000 and upwards and, on new schemes, is usually employed for all pressures. The paper-insulated lead-sheathed cable was first made available in this country in 1890-91 through the enterprise of the Brothers Atherton, at Prescot, and it has since been adopted extensively in all countries. In this country it received a great fillip through Dr. Ferranti's enterprise in building the well-known 11,000-volt concentric Deptford to London cable; this was supplemented in 1896 by a lead-sheathed paper-insulated cable supplied by the B.I.W. Co., which has been in continuous use ever since.

The next important move came in 1905, when the Newcastle Electric Supply Co., on Mr. C. H. Merz's advice, decided to install an extensive transmission system of 20,000-volt, 3-core cables. The satisfactory experience with these paved the way for the development of 3-core cables to work at 33,000 volts between phases, and one can confidently say that these are so successful that 3-core cables for higher working voltages will be available when the need for them arises. The use of overhead transmission lines with 3-phase voltages of 66,000 V and 110,000 V will bring a demand for cables for negotiating railway and Post Office crossings, &c. The latter pressure certainly suggests single-core cables, and there can be no doubt that they can be used on earthed-neutral systems in short lengths. The use of single-core high-voltage cables in long lengths has not been favourably regarded in this country because of the inherent difficulties; and the experience lately reported from the European Continent are not likely to encourage engineers to "look for trouble" here at any early date.

It is not, perhaps, too much to claim that the reliability of cables has been the backbone of electricity supply in Great Britain in that they tided over the situation at one period when extensive scrapping and renewals of generating plant were in progress. This reliability of the mains systems has, in general, been due to various causes:—

1. Good cables, particularly those with paper insulation.

2. Careful design and workmanship on joints and the use of expansion joints in subsidence areas.

3. Great attention to the details of laying and subsequent maintenance.

4. The gradual elimination of the practice of installing d.c. networks and the increasing use of a.c. distribution — particularly 3-phase, 4-wire.

5. The care taken not to overload the cables, and thus to restrict the working temperature of safe limits.

6. The study and application of the measures which are required to prevent electrolysis of the lead sheathing of cables from stray currents.

7. The use of armoured cables laid directly in the earth, wherever practicable, and as far as possible the elimination of cables drawn into ducts.

8. The design and application of automatic apparatus for the instantaneous elimination of faults between phases and to earth on high-voltage cables.

9. The increasing attention paid to keeping down dielectric losses to low values over the whole working temperature range of high voltage cables.

10. The fact that nearly all engineers have adopted the dielectric thicknesses which have been published by the British Engineering Standards Association from time to time and have not been misled by statements of foreign origin as to the thinner dielectric thicknesses which might be used. In the current phrase, British engineers have preferred "Safety first."

As evidence of the reliability of networks—especially a.c. networks—which have been properly designed and constructed, it can be stated with certainty that one a.c. system, laid down 20 years ago, has never had a fault on it, and another, of about the same age, has only had two faults, both of which were due to mechanical failures at a railway crossing.

In addition, it is well known that the most progressive cable manufacturers in this country have been constantly engaged in working out improvements, many of which have already been adopted in current practice. Their individual work is being supplemented by the research into the heating of buried cables, which is being conducted by the Electrical Research Association, whose first report was published in the *Journal*, I.E.E., Vol. 59, No. 298, February, 1921, and fully discussed.

Having thus briefly stated the present satisfactory technical position and the causes that have led up to it,

we are now at liberty to adopt the Editors' motto for this Special Number and "Look Forward." What are we to look forward to? How soon will the present post-war bad trade period pass away and make increasing demands on our electricity supply authorities? When it does, will they be ready with plant and mains, and will the money market provide the wherewithal?

One hopeful sign is that it is the common experience of the supply authorities that there is no indication of suspension of the demand for new electric lighting consumers to be connected up. One authority is connecting up regularly at the rate of 170 new consumers per week, and the laying of a new distributor cable brings in fresh applications by the handful. The main reason for optimism, however, is not to be found in our own country, but in other countries, such as Holland, France, Canada, the U.S.A., &c., &c., where it seems impossible to keep abreast of the demands. Without going into many wearisome statistics, let us consider the following few facts. In California, which has a population of only 3,426,536, the number of consumers was 843,011 at the end of 1921, with a connected load of 2,959,413 h.p. The total investment of the supply authorities was $448,669,330 (say, £100,000,000 sterling), and the sales were 2,662,653,511 kilowatt-hours, or 777 kW-hours per head of population, *i.e.*, about five times greater than the corresponding figure for London and Greater London, including the kW-hours used for transportation service. In Chicago, with a population of 2,700,000, the total kW-hours in 1921 were 1,928,271,940, or 714 per head, while the number of new consumers added in 1921 alone was 62,287. In Toronto, with a population of 400,000, the number of consumers has increased in the last 10 years from 12,000 to 80,000. As the number of water services in that city is 110,000, that figure probably represents the possible number of consumers before saturation is attained. Similar figures could be produced for New York, Boston, Montreal, &c., &c., and from them all it would seem that electrical engineers in our country can look forward to a boom at no very distant date. The plain fact of the matter is that electricity has become a daily necessity in some other countries and is rapidly becoming so here. What we need to do is to develop the "electrical habit" and to cater for it. In addition, there is coming to our aid the general recognition of the wasteful methods by which we are using up our chief natural and irreplaceable asset—COAL—and impatience with the pollution of our atmosphere, with the consequent destruction of our health and our buildings, &c. In fact, conservation of coal is as necessary to our national well-being as pure air is to the health of our densely-populated country.

Let us assume, then, that a better time is coming and that the demands on the electricity supply stations will be comparable with those already mentioned. How will the situation be dealt with? The gas interests are deeply entrenched in this country, and they possess ample funds, for the most part, with which to put up a big fight if necessary. Why fight, however? Would it not be possible for the electricity interests to do as they have done to a considerable extent in Holland, America, and Canada, and recognise that the gas people can handle a good deal of the long-hour heating load? The electrical interests will have their hands full with the rapidly-developing industrial power loads, electric lighting and domestic utility loads while they are waiting for the slow but sure conversion of the railway companies to suburban and main-line electrification.

How are the dense loads of the future to be catered for, bearing in mind that in many of our towns the streets are narrow and tortuous and are already congested with gas and water pipes, electric cables, sewers, &c.? The problem can be considered from various points of view, including transmission and distribution.

1. In country districts, overhead transmission at 66,000 or 110,000 volts will be employed, and will probably suffice for the distances over which trunk lines will be economical, although 150,000 volts or higher may become practicable as our atmosphere becomes cleaner.

2. Inter-urban supplies will probably be given by underground cables at the highest economical voltage for which cables can be built.

3. The pressures at domestic consumers' terminals are not likely to be raised above the present 250-volt limit.

4. Extra room will be required in the streets of towns for cables. The difficulty of finding sufficient space for them in the streets of many of our cities is already well-nigh insuperable. It seems obvious, then, that different methods will have to be employed, and it seems worth while to examine what can be done with cables.

A. There will probably be two distribution voltages:—
   (*a*) 33,000 or 44,000 volts for some years to come, with the hope that some higher-voltage cables will ultimately be available for general use.
   (*b*) A subsidiary pressure at the generator voltage, which will thus avoid in part the use of step-up transformers.

The main 33,000-V, &c., cables will preferably be run as ring mains to connect sub-stations together, and they will be controlled by instantaneous automatic protective apparatus. The subsidiary mains will be worked at 3,000, 5,000, 6,000 or 11,000 volts, and will form local rings or direct supplies. It seems to be evident that there must be a reversion to a modified form of the old house-to-house idea, with frequent transformers.

B. Where the loads are dense, it will not be practicable to multiply low-voltage distributor cables, and it seems to follow that fewer cables at one of the subsidiary pressures mentioned in A (*b*) above will be used, and that the use of low-voltage cables will be reserved for short-distance work, for suburban streets, &c.

Under our conditions, it seems to be inevitable that a.c. must largely displace d.c. distribution, especially as the loads increase.

C. Where and how is street-space to be found for the cables and what type of cable is to be used?

In country districts and in suburban streets, it has been well established that a properly armoured cable laid directly in the earth gives the best all-round results, but this type is not always suitable for use in congested streets. The time is already with us in many streets when cables can no longer be laid amid the existing maze of pipes, &c., and they cannot be laid beneath them because of the need of accessibility. The situation needs vision, courage and bold measures. In one town, in which the municipality owns and operates the electricity, tramways, water and gas undertakings, a large culvert has been constructed under the main street to contain all the chief cables and pipes. A similar scheme is suggested as being suitable in many other towns, and although the expense is no doubt great, it will become greater the longer it is postponed. Here is a chance for the electric supply industry to help in giving really useful work to the unemployed. The heat from the cables would have to be got rid of, and some experimental work would be needed to settle how far this could be done by ventilating shafts and how far it would be necessary to circulate air by motor-driven fans. The whole problem needs "ventilation," and perhaps the Editors will invite discussion on it.

Mention was made earlier of 33,000-volt, &c., transmission cables, and there may be those who are nervous of employing them after having experience only of cables up to 11,000 volts. In the first place, there have been many years of altogether satisfactory experience with 20,000-volt, 3-core cables. Experience with 33,000-V cables has not been so considerable, but there is every reason to believe that those in use are proving reliable, while switchgear manufacturers have standardised their designs for that voltage. In fact, the switchgear situation seems to be the chief difficulty in the adoption of 44,000-volt 3-core cables, which some manufacturers now consider to be feasible. A very satisfactory feature in the production of high-voltage cables in this country has been the attention which has been paid to the reduction of dielectric loss to values which are nearly negligible. This augurs well for the development of higher-voltage cables in the future, as there can be little room for doubt

that high dielectric loss and self-destruction of the cable are synonymous terms. As illustrating the lead that this country possesses in the manufacture of 33,000-V cables, it may be stated, from information just to hand from America, that such cable is now being produced and sold there under a guarantee for the power factor of the dielectric losses which is 100 per cent. higher than has been realised here on a large commercial scale.

The thermal resistance of paper-insulated cables has been brought into much prominence by the values published in the B.E.A.I.R.A. Report, already mentioned. The values obtained for so-called 20,000-V cables showed a high degree of excellence.

Emphasis is laid on these features of modern three-core cables to bring out the point that they are very reliable, when properly installed, and that there is, therefore, much less need now to lay spare cables in the interest of "security of supply" than there was in the earlier period of electricity supply. The cable makers are thus contributing their quota to the development of the supply business and are making it possible for the authorities to use the minimum amount of street space.

Much interest has been felt in the tendency in some other countries to use single-conductor cables for high-voltage transmission work over long distances, but, in view of the information that has reached this country about the resulting troubles, it does not seem likely that the practice will be adopted here until the technical problems have been more fully investigated and until it has been shown that the limit has been reached in three-core cables. The single-core cable cannot be armoured for a.c. transmission work, and some means of satisfactory mechanical protection must be provided for it. It would seem that the chief reasons for attempting to make use of such cables are:—

1. The long lengths in which they can be made.
2. The simplicity of the joints.
3. The thickness of dielectric that can be employed.
4. The larger blocks of power that can be transmitted.

In the past it has been obligatory under the Board of Trade Regulations to pressure test all cables after installation before putting them into commission. Many years' experience in this practice goes to indicate that the testing is unnecessary with modern cables and jointing methods, and that the money spent over it is usually wasted, even at the highest voltages. With long lengths of 20,000- and 33,000-volt cables the prescribed a.c. pressure test is impracticable because of the large kVA required, with the result that resort is made to d.c. testing with Delon and Kenotron apparatus, which cannot be so searching as a.c. tests, because no dielectric loss is developed other than that by conductance.

The nomenclature of cables also needs reconsideration. The Board of Trade regulations state that all pressures above 3,000 volts shall be deemed an extra-high-pressure supply. Our ideas of "extra high pressure" have progressed much since the 1909 revision. Overhead lines are at work in the U.S.A. at 165,000 volts, and others are under construction for 220,000 volts. In this country 11,000 and even 20,000 volts are coming to be considered as being really distribution pressures, and it might not be inappropriate to suggest that the term "high pressure" should be extended to include all voltages below 30,000 V, and that extra high pressure should be reserved for all higher voltages.

The manufacture and methods of installing balanced multiple twin cables for telephone transmission have undergone very considerable improvements since 1912, when the General Post Office commenced their new scheme of underground transmission. The different types of cables, together with the results obtained by loading the physical and phantom circuits with Pupin coils, have been fully described in the Post Office "Journal." These records indicate the great reduction in the sizes of the conductors which has been found to be practicable, particularly since thermionic valve repeaters have been brought into use. One result has been that a largely increased number of pairs of conductors can now be placed in a lead sheath of given diameter. From the user's point of view, the main results of the use of balanced underground cables are the much greater reliability of the service, especially in stormy weather, and the "silence" of the lines

Historical Note.

Much prominence has been given this year to records of early electrical history in this country, but so far I have not seen among them any specific statement regarding the work done in England on dielectric loss in insulated cables. It will not, therefore, be out of place to take this opportunity of putting on record that the subject received early consideration in this country, particularly in Mr. W. M. Mordey's paper on "Capacity in Alternate Current Working," read before the I.E.E., January 10th, 1901. In the discussion, Mr. C. P. Sparks gave important information regarding the practical tests which he had made on installed underground cables while, when replying, Mr. Mordey recalled a statement made by Mr. James Swinburne 10 or 11 years earlier at the Physical Society regarding dielectric loss in the Deptford paper-insulated 11,000-volt cables.

ELECTRICAL MACHINERY AND TRACTION.

By Prof. STANLEY PARKER SMITH, D.Sc., M.I.E.E., Assoc.M.Inst.C.E.

About the beginning of the present century the electrical trade in this country was in an interesting, though unsatisfactory, position. England's supremacy had already been successfully challenged, partly, it must be confessed, in consequence of her failure to keep abreast of developments. Compared with the large electrical firms abroad, ours were generally small, while technical directors were almost unknown. Moreover, many large foreign firms had established manufacturing branches in this country, and others had established active selling organisations. In face of this fierce competition, bad trade was all that was needed to make the position appear hopeless.

Under such adverse conditions it is surprising that developments should have prospered in this country at all. Yet progress was made, and instead of yielding place to large foreign combinations, British firms united and grew in strength, with the result that at the present day Great Britain possesses on the one hand manufacturing firms able to compete successfully against all rivals, and on the other hand schools holding the foremost rank in the training of engineers.

The trend of development in heavy electrical engineering has ever been greatly influenced by the battle between alternating and continuous current—a scientific conflict as perennial as the political conflict between the French and the Germans. In the early days of electric lighting, the single-phase alternator and stationary transformer formed an important stage, and gave ample opportunities for trying out various values of x, where x denotes the frequency of supply. As commutation phenomena began to be understood and the troubles associated therewith overcome, continuous current forged ahead. The position of continuous current became more firmly established by the spread of the three-wire system with the increasing demand for power on the one hand, and on the other by the advent of the carbon brush, and the commutating pole.

During this active period of continuous-current development, alternating current had likewise moved for-

ward. Already the limits of continuous-current supply were being reached on account of the voltage restrictions imposed by the commutator, and there was sufficient inducement to direct attention to alternating current, particularly where the utilisation of water power was concerned. Here, again, phenomenal success was achieved, though unfortunately this country was not the leader. The lack of water power and the wide distribution of coalfields in Great Britain retarded development considerably. Though in the construction of alternators and induction motors this country can now claim to be in the forefront, high-voltage transmission plant has made more progress abroad than at home. If, however, the pride of place cannot be given to us in the development of alternating-current work, and if alternating-current theory was not as popular at one time in our schools as in those of other countries, the pioneer work done in connection with steam prime movers well deserves mention.

The steam turbine came into practical use at the time when continuous-current generators were yet in wide demand, and the resources of the electrical designer were severely taxed. For a long time the difficulties of commutation in the continuous-current turbo-generator seemed almost insuperable, and few progressive firms escaped without serious loss. Nevertheless, success was achieved; but just as 1,000-kW units became feasible, other methods of producing continuous current became available. By a strange coincidence, Parsons, the pioneer of the steam turbine, developed reduction gearing for large powers. A still greater rival than the geared dynamo, however, was the rotary converter. With the successful development of the turbo-alternator and the 50-cycle rotary converter, the much-feared continuous-current turbo-generator went out of fashion, and it is now only in demand for ship lighting or other special services. The rotary converter, as we know it, is largely a British product—foreign influence in this connection has had but little useful or permanent effect.



Photo by] S. Parker Smith. [Elliott & Fry.

The increasing demands for electric power could only be satisfied by the large unit and high-voltage transmission. This gave a further impetus to alternating-current work, and a blow to the comparatively small c.c. generator. But with the possibility of generating alternating-current energy, there at once arises the demand for alternating-current motors. To convert into continuous current is a compromise that will be avoided where possible. This demand, however, again raises the conflict between alternating and continuous currents, and brings us to the problems of to-day.

When we consider the influence which the electrification of railways may have, very conflicting views are met with. Ignoring the views of those who are definitely allied to certain interests, there remain facts which are hard to explain. The development of the high-voltage continuous-current system is being advocated with the same ardour as the development of the single-phase system. While Switzerland, Germany, Austria, and Sweden use the single-phase system at 15,000 volts and $16\frac{2}{3}$ cycles, Great Britain, France, Belgium, and Holland officially advocate the 1,500-volt, continuous-current system. Whether railway electrification will ultimately influence the decision of alternating *versus* continuous current, time alone can show, but any extensive development of electric traction will have a marked effect on the electrical industry, owing to its magnitude.

Closely allied to the problem of alternating-current generation and transmission is that of power-factor correction. Now, while the induction motor solves the motor problem in the majority of cases, it aggravates the power-factor problem. It is the complications which arise in solving these difficulties that re-direct attention to continuous current. The plain induction motor cannot give economical speed control, and the manifold devices for obtaining this require in many cases commutator machines. Also certain devices for improving the power-factor entail the use of commutators. On the other hand, the progress made with alternating-current supply has been so extensive and the success achieved has been so considerable, that any rival system which ousts it will have to be sound in every respect.

Having considered briefly what has been achieved in the past, we may now attempt a glance into the future. For this purpose the several types of machines may be reviewed separately in connection with some of our unsolved problems.

The continuous-current machine offers such remarkable advantages — particularly as a motor—that it is hard to imagine how we could do without it, especially where speed control is required. In cases where the load conditions are very severe, a compensating winding, to neutralise armature reaction, may be added. But while it may be said that the control of winding engines and reversible rolling mills has been satisfactorily solved technically by the Ward-Leonard continuous-current system of speed regulation by voltage control, commercially the solution is far from satisfactory. The need of a converting set to change the three-phase into continuous current, and of a heavy flywheel to reduce shocks to the system arising from load fluctuations and to enable the motor to cope with peak loads, renders the system costly, complicated, and wasteful. Thus for large reversible drives it has become an urgent problem to find a means of utilising economically the electric energy in the form in which it is supplied. Already, however, we may hope to regard the flywheel as obsolete in this connection. Nothing could better demonstrate the backwardness of electricity supply than the need of a flywheel to reduce shocks. With the advent of the large supply network, the flywheel, slip regulator, &c., ought to vanish; and it ought not to be long before the entire converting set becomes obsolete.

With regard to the low-voltage, continuous-current generator, the unit in the near future will either be coupled to a water turbine, or will probably be one of a suite of machines geared to a steam-turbine. The speeds of such dynamos will give frequencies exceeding 50 cycles per second, necessitating special arrangements for suppressing eddy currents in the armature conductors; shrink rings will be necessary to strengthen the commutator; and the average voltage between commutator segments will have to be pushed to high values. In the more distant future the commutator may be superseded by other—possibly stationary—devices.

Passing on to alternating-current generators, it may be said that the turbo-alternator has now established its position, and it is possible to consider what direction future developments will take. Hitherto attempts to increase the size of the unit have become almost a craze, but this is not likely to continue. At last the demands of the turbine maker appear to have been satisfied, for the output which he can now get brings him to a fairly flat part of his consumption curve. Moreover, it is unlikely that the station engineer will need much larger sets than are now available. If 100,000 kilowatts be a satisfactory station load from the efficiency standpoint, obviously 25,000-kW sets are more suitable, particularly as regards spares, than 50,000-kW sets. The near future, then, may well see a greater demand for 25,000-kW sets at 3,000 r.p.m. When, however, 250,000-kW stations become feasible, the 50,000-kW unit may be in place. While for the 3,000 r.p.m. machine the solid rotor is likely to become more and more universal, it is not easy to predict any standard construction for large 4- and 6-pole rotors. But the last word has not yet been said about the large 2-pole rotor. Casting, forging, annealing, and tempering such large masses of steel still present many difficult problems, as does also the cover for securing the rotor end-windings, to the steel maker.

It may not be out of place to say a word about cooling, as this has become one of the limiting factors in large machines. As yet, air has been the predominant cooling medium, though water has been tried both for stator and rotor cooling. It is doubtful whether water will prove a satisfactory solution. On the one hand, there is always the danger of condensation under certain conditions; on the other hand, there is the danger of leaky joints. Over and above all, there is the question of cost—will a water-cooled machine prove cheaper than an air-cooled machine? As regards air-cooling, a knotty problem arises. Town air is dirty, and must be cleaned before use for ventilating machines. Without going so far as to say that both dry- and wet-air filters have proved failures, the fact remains that numerous attempts are being made to dispense with them. A system now coming into use consists of the circulation of the same air through the machine and a cooler. The heat removed from the air by the cooler may then be utilised for heating feed water, &c. It is likely that the use of this method will be extended, for it possesses the further advantage that, the quantity of cooling air being comparatively small, it is unlikely that much damage would be done to the machine by the cooling air in case of fire. Nevertheless, it is probable that other cooling media will be experimented with, in order to reduce the large volume of ventilation channels at present required in the machine.

One direction in which further improvements will be sought in large machines is in discovering means for reducing eddy-current losses in the armature conductors. Unless steps are taken to suppress these parasitic currents, excessive local temperatures may result and the safety of the machine be endangered. Following A. B. Field's classical analysis of the losses caused by the slot-field, numerous means have been devised for reducing eddy losses to a permissible value. In general, most of these devices entail a loss in rigidity of the conductors, and much work remains to be done to ensure the safety of the stator winding under all conditions, normal and abnormal. Likewise, strange as it may sound, core construction will improve as time goes on. Not only will greater use be made of high-resistance steels manufactured to satisfy practical needs still more than at present, but greater care will be taken in handling the plates and building the cores.

In order to see what direction future developments may be expected to take, we may consider what matters give rise to anxiety at the present day. As stations increase in size and networks extend over greater areas, the importance of reliability increases rapidly. Engineers seek to safeguard their systems in two ways—one by means of protective devices, the other by installing plant that will not break down. The latter ideal is the right one, and even if it be an unattainable ideal, it is probable that greater safety will be secured in this way than by the extensive use of protective devices. It is likely, therefore, that future machines and transformers will reveal sounder design, better workmanship, and a higher factor of safety than those to which we are at present accustomed. This must not be regarded as conservatism, nor as covering up faulty design with ample material. A cooler and stronger generator becomes all the more essential as the system grows and develops in importance. Generating plant must be made to withstand whatever may occur, without the aid of complicated protective devices. The idea of an interruption of service being caused by a machine fault must become as abhorrent to the manufacturing as to the operating engineer.

Coming to the induction motor, we find on the one hand a machine much liked by the user, because there is no commutator to give trouble; and disliked by the supply authority, because of the low power-factor. One solution of this difficulty is already in evidence—the synchronous-induction motor. The phase advancer is another solution. It is when speed regulation is needed that the real difficulty begins. Avoiding the use of a commutator entails loss and an undesirable speed-torque characteristic. To use a commutator robs the induction motor of its charm of simplicity. Nevertheless, the commutator will have to be accepted in one place or another to meet some requirements. Either an alternating-current commutator motor must be used, or an induction motor with an auxiliary speed-regulating set. For small and medium powers, it would seem that, in addition to the several types of variable-speed induction motor as developed by Hunt, Creedy, and others, there would be an assured future for the three-phase shunt motor with double movable brushes (due to Schrage) and various types of single-phase shunt and series motors. For raising or lowering the speed of large induction motors over a limited range, an auxiliary set consisting of a three-phase commutator machine coupled to an induction machine (due to Scherbius) is finding increasing use. Further, as an alternative to the inefficient and costly Ward-Leonard conversion, the plain induction motor with resistance control is gaining in favour, despite the rheostatic loss.

The rotary converter next demands attention. Will it survive, or will it be ousted by the mercury rectifier in the same way as it ousted the continuous-current turbo-generator? At least this can be said: if a static converter should eventually prove a successful rival, it will not be because satisfactory rotary converters could not be built. Except for flashing over on short-circuit, the rotary converter may be said to be a satisfactory machine; while means for preventing flashing over have already gone a long way to ensure safety. Its potential rival, the mercury rectifier, is just emerging from the experimental stage, and may have a great future before it.

Had the mercury rectifier been commercially developed before the single-phase series motor had become a thoroughly satisfactory machine, it is possible that much less would have been heard of the single-phase system for traction. Actually, however, the single-phase series motor has progressed so rapidly that these motors are now being built for larger outputs for traction than are continuous-current motors.

Enough, however, has been said to show that, both for general purposes and for electric traction, the battle of the systems is being waged as fiercely as ever. Rapid developments are seen on all sides. No sooner does the mercury rectifier render it possible to equip automatic sub-stations without moving machinery, than the automatic sub-station with induction generators on the one hand, and the open-air transformer sub-station on the other hand, remind us that neither system has reached the end of its resources.

Many investigators are at work, and it is certain that the successful developments of some of the projects, *e.g.*, the ionic conduction of large currents, would have a profound influence on the electrical industry.

THE FINANCE OF THE ELECTRICAL INDUSTRY.

By J. S. HIGHFIELD, M.I.E.E., M.Inst.C.E.

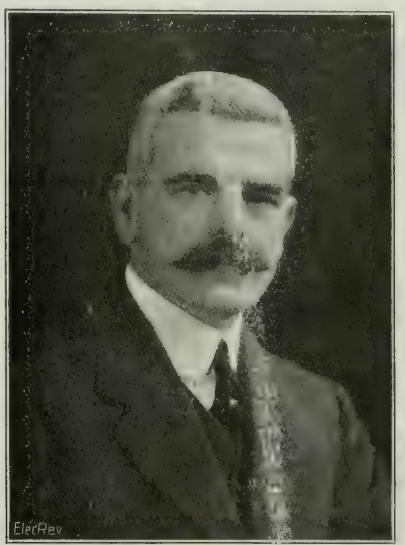
It is a great pleasure to congratulate the Electrical Review on attaining its fiftieth year of useful work. It has served the industry well, and it is pleasing that in recent years the important part filled by a well-informed Press has been better understood. I am convinced that the technical Press should keep in the closest touch with the needs of the industry and that it should be given every help and assistance in its work. The late Mr. Gatehouse, whom I am glad to remember as a good friend, did valuable work in this direction. I often wish that in every issue a really popular article could be inserted in technical papers written with the object of interesting the ordinary man and informing him in the simplest terms about the electrical industry. These articles should advise him how electricity can serve his ends, giving particulars of first cost and annual cost of new apparatus. The articles should explain and describe in plain terms interesting matters about power stations, wireless matters, and, in short, any matters relating to electricity. I believe a weekly article of this sort would tend to enlarge circulation and would benefit the industry to making better known its applications.

It is manifest that all money that comes to the electrical engineer comes from the public who buy his wares, and the important matter is first and foremost to increase the number of those who use electricity and at the same time to show how it can be employed to the best advantage so that each may increase his use of it.

The ordinary householder is usually very ignorant about the right means of using coal, gas, or electricity; there are any number of people to advise him, but usually each one can help in only a limited sense.

The applications of electricity are continually increasing, but it is not yet a universal source of household energy, and I am glad to note that many electrical engineers are interesting themselves in the problem of domestic heating and lighting in all its aspects. I am sure that the more they establish confidence in their ability to deal with this problem as a whole the better will it be for themselves and for electrical engineering generally.

The increased interest in the commercial aspect of electrical engineering, fostered by such bodies as the Electrical Development Association, is doing good. Before the war the chief argument with the public was often one based on cheapness. Electricity was sold below cost price. Municipal undertakings were working with too small margins, and company undertakings were paying inadequate dividends and starving reserve. Manufacturers were selling plant at prices that left no adequate profit. Consequently, salaries were too low, and there was insufficient money for development. All the money to pay for plant, to pay for raw material, and to pay wages and salaries comes from the consumer, and if prices are unnecessarily reduced it follows there is less money for all these purposes. On the other hand, if prices are maintained at too high a level, the demand is restricted. The proper balancing of these two opposed principles is the most important problem to be solved in business. During the war the increased cost of all commodities resulted in corresponding increases in the price of electricity. The reductions in cost of commodities during the past year, together with more economical working, have resulted in a considerable increase of prosperity in electricity supply. The beneficial result is that the industry can now raise capital with relative ease, and is making progress in consequence. Reductions in prices are being made, and electrical supply engineers for the first time in their lives are now in a position to "discard from strength." I hope that prices will not be wantonly reduced, but will be reduced so that the increased trade that should result will lead to larger profits and to money being available not only for increasing the prosperity of electrical engineers, but for research and development, so that with the improvements resulting, the cost of production can be steadily reduced. To run any business at a profit continuously requires much skill and prudence; to use the profit properly, when earned, requires more prudence and equal skill, and I hope electrical engineers will take good care to see that they do not throw away any profit by unnecessary reductions in price. The result of such foolish action is necessarily to restrict development, and in the long run the public must pay a higher price.



J. S. Highfield.

In asking me to contribute to this Jubilee Number, a request with which I was delighted to comply, the Editors suggested that I might deal with certain technical developments that may be of growing importance in the future. I would gladly have done so, especially as there are many most interesting matters that require discussion. I am sure, however, that at the present time the financial aspect is of the first importance. All these developments require capital, and capital is created from profit; it is the accumulation of profit. For the first time for many years electricity supply is earning profit, and if by prudent care the profit is maintained and increased the future of the electrical industry is assured in all its branches, for the profit earned in electricity supply provides the sinews of war for the development and manufacture of improved machinery both small and great; without the profit this development is impossible.

During my years of office as President of the Institution of Electrical Engineers I have met in the most delightful circumstances members of the Institution and other engineers in all parts of the country. I have been very much struck with the great feeling of confidence in the future in spite of many depressing facts, and I have been very pleased to note the wonderful loyalty to, and pride in, their profession, and the interest taken by so many in general affairs. I think the growing interest of engineers in general affairs is all to the good, and that the remarkable growth in the membership and influence of the Institution during the last ten years has helped and is due to this interest in wider responsibilities.

ELECTRICITY SUPPLY IN THE UNITED STATES.

By FRANK W. SMITH, President of the National Electric Light Association.

There are certain marked differences of electrical practices between England and the States which it is necessary to call to mind, and if I seem to glory in the accomplishments of the American companies, it is not with any thought of being boastful or of disparaging what has been done elsewhere, but with a consciousness that from those to whom much is given much is expected.

In any comparison between electrical practices in Great Britain and in the States one must always bear in mind the differences between the divisions of the race in temperament and in habits, the greater density of population that obtains in Great Britain and the much vaster territory covered by the United States. In the States the electricity supply companies are privately and to a very small degree only municipally owned. Membership in the National Electric Light Association, however, is confined exclusively to privately-owned utilities, and the extent to which private initiative and enterprise dominate is indicated by the fact that the privately-owned utilities produce 97 per cent. of all the electrical energy generated by electric public utility undertakings of all kinds. The 110,000,000 inhabitants of the United States are scattered over an area of 103,000,000 square miles, whereas the 41,000,000 inhabitants of Great Britain occupy 88,000 square miles.

We have just celebrated in the United States the fortieth anniversary of the first electricity supply undertaking, September 4th, 1882, being the beginning of Edison service in New York City. In an acknowledgment to Mr. Thomas Alva Edison, in commemoration of that event, the New York Edison Co., over the signature of its president, Mr. N. F. Brady, made the following statement:—

"What has been achieved in the past will continue to constitute a series of stepping stones to still greater accomplishment in the future. No effort will be spared to secure this result. Nothing else would fulfil our obligations to the people of this city. Nothing else would be in keeping with the spirit that has pervaded the life work of the great man whose name we are privileged to bear, and to whom we desire to express our feeling of deep and lasting appreciation and indebtedness. We wish him many years of life and health, and of continued service to his fellow-man."

To-day the United States possesses over five thousand operating companies serving approximately fifteen thousand communities, and the total rating of these stations in round numbers is fifteen million kW. The output of electrical energy from these stations last year was forty-three thousand million kilowatt hours. The investment in electricity supply undertakings approximates one thousand million pounds sterling, and the securities are held by over 1,600,000 investors. The number of investors is rapidly increasing.

Political ownership in the States is not unlike political ownership elsewhere. Experience has proved in America what certain of your own statesmen have found to be a fact in England, that it is more difficult for Government to save a shilling than to spend a million. For that reason we have clung tenaciously to Anglo-Saxon tradition and fought all encroachments of bureaucracy. We have resented all political interference and insisted on freedom for self-development. Through the sale of our securities to our customers we have brought about real public ownership as distinguished from political ownership, and retained all the advantages common to private enterprise. The National Electric Light Association has hundreds of committees, comprising thousands of experts, at work on the problems of the electric light and power industry. These men contribute freely of their experience and time with one definite object in view—perfecting and lessening the cost of electric service. No one company could command or afford such an array of talent, and competition between electricity supply companies being a thing of the past, it is evident that the deliberations of these experts are as frank as they are constructive. I know of no other industry where such interchange of experience and knowledge is so wholehearted and complete, and which privately-owned manifests so much solicitation and concern over the public weal.

In all but two of the States of the Union, the electricity supply undertakings are subject to regulation by State public service commissions, which exercise supervision over the service, the rates charged therefor, and in many instances the money invested therein. The electricity supply companies being granted a monopoly in their respective territories, regulation follows, of course, as a natural result. With possibly a dozen exceptions, there is but one electricity undertaking in every large community, and it is not unusual to find one company supplying the needs of hundreds of communities.

We have had in the States for many years so-called super-power stations, and in the interests of economy and reliability the vast networks fed from these super-power stations have been interconnected. The combined area of England, Scotland, and Wales is approximately 88,000 miles; the area of California exceeds 158,000 square miles. In that State there is an interconnected transmission network extending from Oregon, on the north, to Mexico on the south, traversing the entire State. In the South-eastern section of the Atlantic seaboard there is also a vast interconnected network extending from North Carolina into South Carolina, Georgia, Alabama, and Tennessee, involving the systems of over half-a-dozen electricity supply companies, which are thereby enabled to interchange electrical energy to the mutual advantage of themselves and the communities they serve.

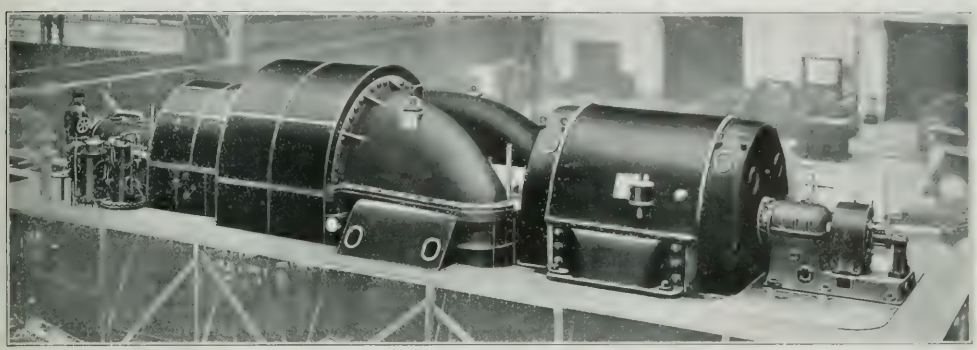
Generating stations in the States are naturally large and efficient, making use of every labour-saving device known in the mechanical arts. Some generating stations are to be found with ratings as high as 400,000 kW, with single-cylinder turbo-generating sets rated at 62,500 kVA, and compound turbo-generating sets rated as high as 75,000 kVA. In these mammoth stations a kilowatt hour of electrical energy is produced from less than one and one-half pounds of coal, and due to the size and character of the units the saving in labour is considerable.

In recent years financial considerations have grown so important as to largely subordinate problems of engineering. Notwithstanding the enormous expansion of the electric light and power industry in the United States, where for the past twenty years it has maintained unbroken a record of doubling its output every five years, the industry could acquire still larger loads if it could obtain readily and cheaply the necessary funds to take care of the business. Thus, the financial problems are of paramount importance.

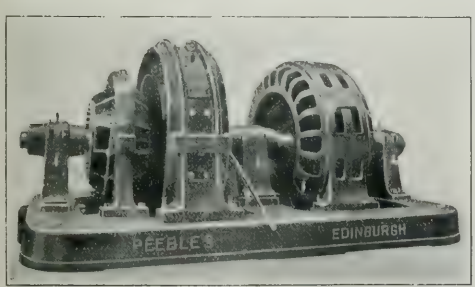
Briefly, the foregoing seem to the writer to be the outstanding features and the impelling motives of the electricity supply companies of the United States. There is a much greater difference between electricity supply practices in America and England than is generally supposed, but the writer has attempted to restrict his observations to American practice, leaving it to the Britons to make whatever application they may wish. Happily, a cordial friendship has always existed between American and British engineers, and this will no doubt long continue. We in America are conscious of the fact, however, that what is possible in one country may not be possible in another, due to different social and political conditions. There is no doubt that each can learn much from the other, but whatever changes are made in the future must necessarily conform to the habits and traditions of our respective peoples.

SOME BRITISH MANUFACTURES.

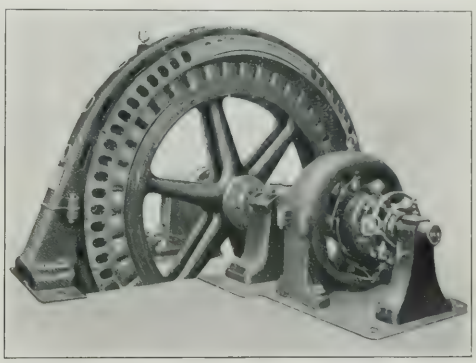
The changes which have taken place during the past half-century have been so vast, and embrace so many factors wholly unknown and unimagined in 1872, that to institute comparisons between the state of the art then and now would be futile. Doubtless the advances that will be made during the next half century would be no less startling, could we but see them; that privilege will be denied to most of us, but at least we may place on record some examples of British manufacturers' achievements, which our successors, fifty years hence, may perhaps think it worth while to reproduce in contrast to the practice of that far off day. The collection will serve also to indicate in some small measure the versatility and capacity of British manufacturers. They are now prepared to cope with any conceivable demand for electrical materials and apparatus. Admittedly, it makes no pretensions to completeness in respect of either the products illustrated or the makers represented; to attain that end would require not four pages but a thousand. The collection therefore has been limited to a few typical examples of plant, such as in some cases are obtainable from several sources in this country.



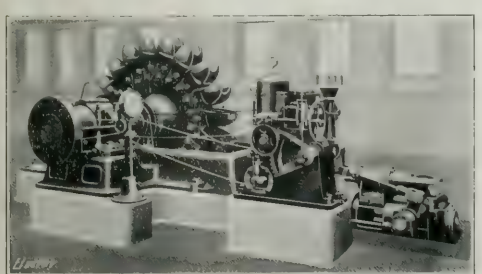
Turbo-generator.—Parsons reaction turbine, designed for steam at 180 lb. pressure superheated to 572° F., and for an exhaust vacuum of 28½ in. Direct coupled to Parsons 3-phase alternator (50 cycles, 6,600 volts); economical and continuous maximum rating, 20,000 kW at 1,500 r.p.m., 0.80 power factor. Constructed for the Shanghai Municipal Council, China, and shipped (with alternator completely wound) this year, by Messrs. C. A. Parsons & Co., Ltd.



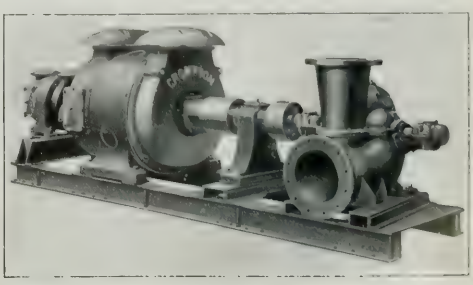
Motor-converter.—Built for Sydney by Messrs. Bruce Peebles & Co., Ltd., converting a.c. to d.c.; rated at 2,000 kW.



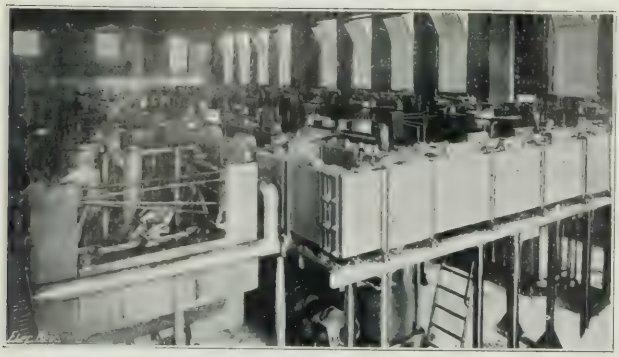
Alternator.—Three phase alternator and exciter, built by the Electric Construction Co., Ltd., for direct coupling to a Diesel engine.



Pelton Wheel.—Installed at the British Aluminium Co.'s works, Kinlochleven, by Messrs. James Gordon & Co., Ltd. Head, 890 ft.; speed, 300 r.p.m.; wheel diameter, 81 in.; jet, 5 5/16 in. The largest turbine in Great Britain.



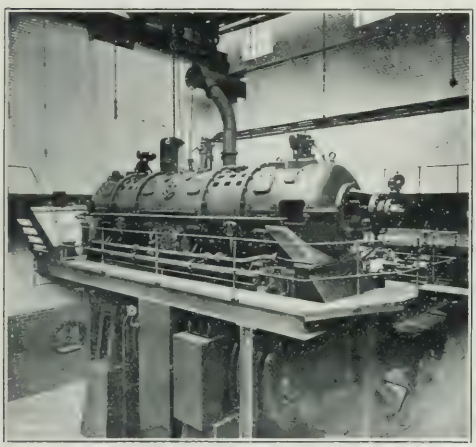
Mine Pump.—A 100-V, 100 kVA, 3-phase, [illegible] r.p.m. motor and pump, raising 3,000 gals./min. 40 ft., built by Messrs. Crompton & Co., Ltd. Induction synchronous motor, specially arranged to raise power factor [illegible] from 0.7 to 0.9.



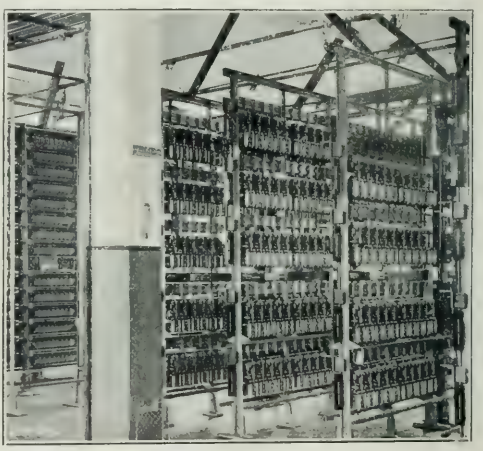
Ironclad Switchgear.—Switch-room at the Dalmarnock electricity works of Glasgow Corporation, equipped with ironclad switchgear by Messrs. Reyrolle, Ltd.; 20,000 V; rupturing capacity of each switch 1,500,000 kVA; remote control.



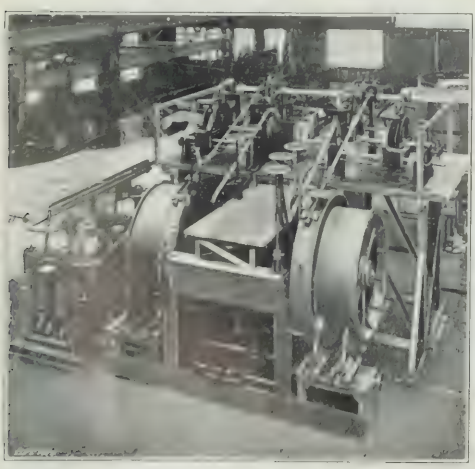
Storage Battery.—Installed at Eagle Street sub-station, London, by the Chloride Electrical Storage Co. Each cell weighs 2¾ tons and gives 8,000 A for 35 minutes; capacity, 12,000 Ah.



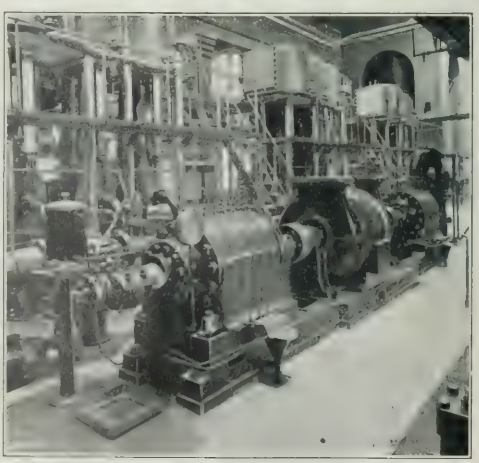
Turbo-generator.—A 3,000-kW, 3,000 r.p.m. Brush-Ljungström set installed at Ipswich Corporation Electricity Works, by the Brush Electrical Engineering Co., Ltd.



Automatic Telephone Exchange.—Part of a 6,000-line full automatic exchange supplied to Winnipeg, by Messrs. Siemens Brothers & Co., Ltd.—the first large automatic exchange exported from England to Canada.



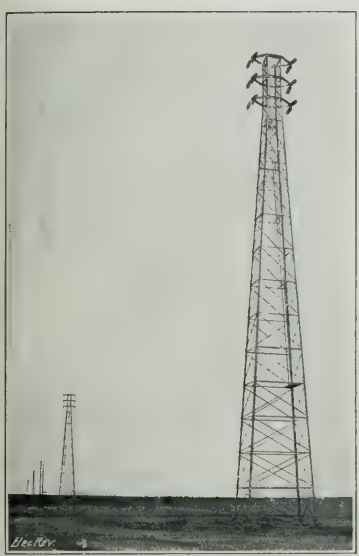
Cable Shears.—[illegible] laying gears supplied to the Great Northern Telegraph Co., Ltd., by Messrs. Johnson & Phillips, Ltd. [illegible] 22[illegible] h.p., hauling 25 tons.



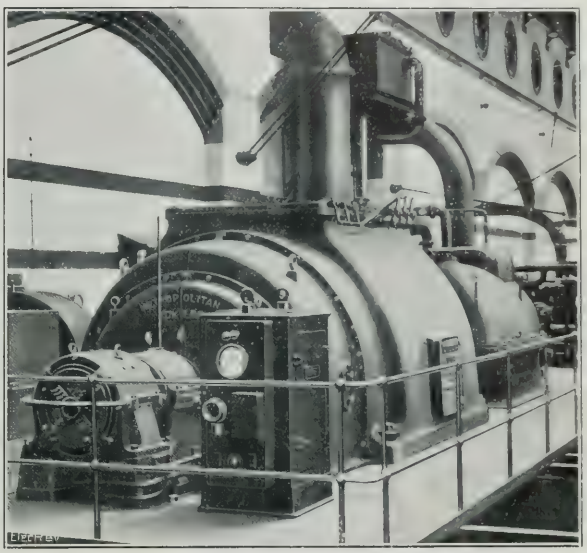
Hydraulic Pumps.—One of three sets of pumps supplied to the London Hydraulic Power Co., by Messrs. Mather & Platt, Ltd. Duty 500 gals./min. at 800 lb./sq. in. Motor of 440 b.h.p., 6,600 V, 3-phase, 50 cycles.



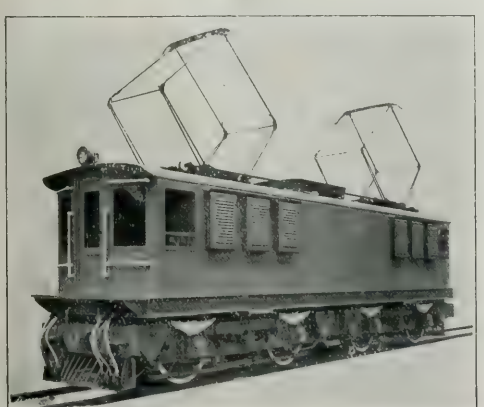
Telephone Exchange.—Switch-room at the Clerkenwell Post Office Telephone Exchange, London, equipped throughout by the Peel-Conner Telephone Works (proprietors, the General Electric Co., Ltd.). Ultimate capacity, 10,000 lines.



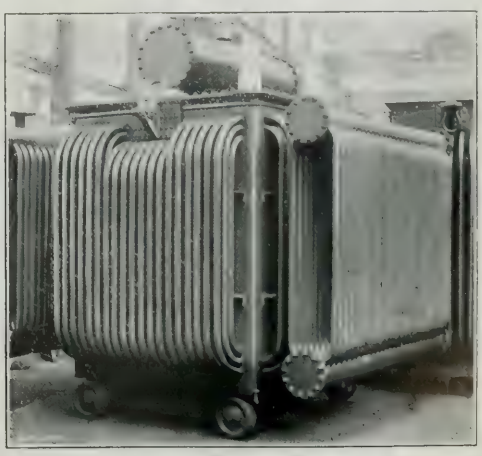
Overhead Line.—Crossing the River Blyth, Northumberland, on steel towers 106 ft. high. Two three-phase circuits, 20,000 V, 40 cycles, 0.1 sq. in. conductors. Installed by the British Insulated & Helsby Cables, Ltd.



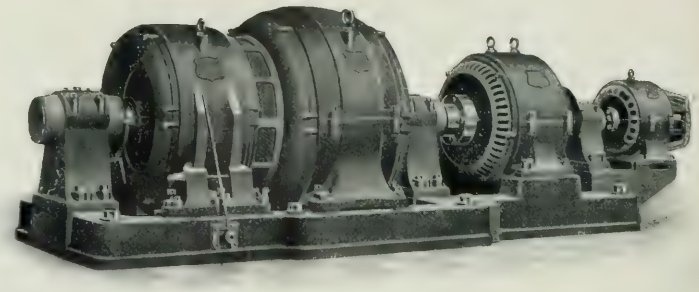
Turbo-generator.—A 12,500-kW, 3,000-r.p.m. set supplied by the Metropolitan-Vickers Electrical Co., Ltd., to Liverpool Corporation; fitted with Baumann's multiple exhaust, which reduces diameter of disks and peripheral speed 25 per cent., whilst allowing the output obtainable from a single cylinder to be quadrupled.



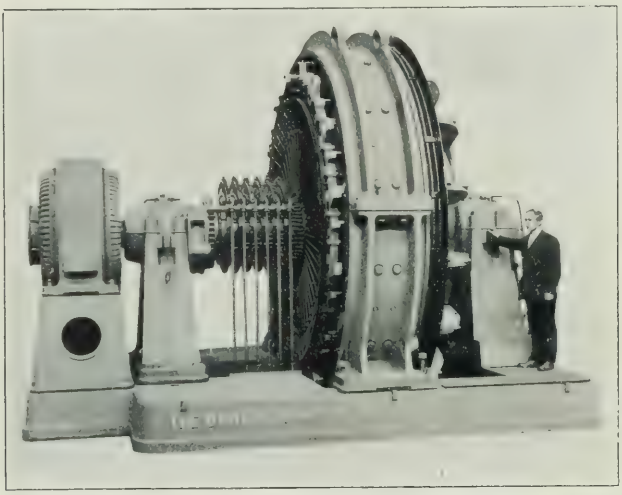
Electric Locomotive.—Built for the Midland Railway of New Zealand by the English Electric Co., Ltd.; equipped with four 1,500-V, 170-h.p., d.c. motors.



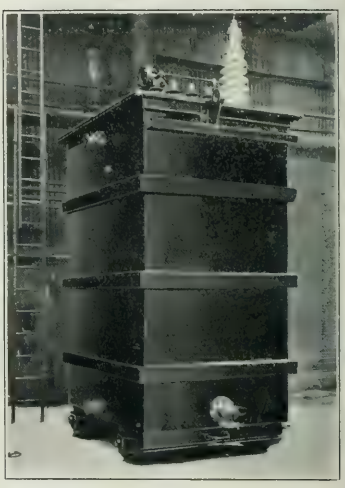
Transformer.—One of four 3,333-kVA, 50-cycle, self-cooled transformers being supplied to Barcelona by the British Electric Transformer Co., Ltd.



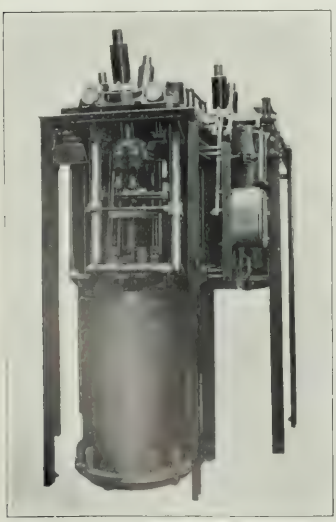
Frequency-changer.—One of two 600-kVA sets supplied to the City of Guelph, Canada, by the Lancashire Dynamo and Motor Co., Ltd. Each set comprises a "Lancashire" self-starting synchronous motor coupled to an alternator (with rocking stator), a d.c. traction generator, and an exciter.



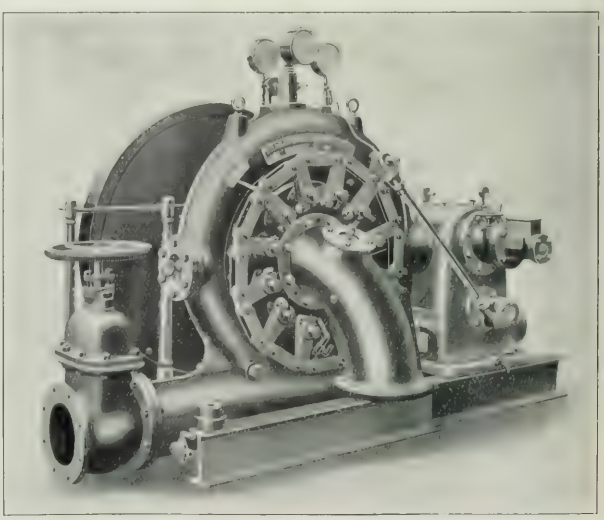
Rotary Converter.—One of four 25-cycle, 4,500-kW machines supplied to the Victorian Railway Commissioners, Melbourne, by the British Thomson-Houston Co., Ltd., for heavy traction service; 1,500 V, 3,000 A, 187.5 r.p.m.; 9,000 kW for one minute. Started up with self-synchronising induction motor and connected to d.c. bars within 1½ minutes. Largest built in Great Britain.



Transformer.—One of seven 4,000-kVA transformers for a 110,000-V, three-phase transmission system, Mangahao, New Zealand, built by Messrs. Ferranti, Ltd. Weight, 21¼ tons.



Circuit-breaker.—Built for Manchester Corporation for group feeder control, by Messrs. Ferguson, Pailin, Ltd. Rupturing capacity, 1,000,000 kVA; 2,000 A, 33,000 V, 3-phase; each pole in separate steel tank.



Turbine.—One of two sets supplied for Dorrigo, New South Wales, by Messrs. Armstrong, Whitworth & Co., Ltd.; spiral type.

SUBMARINE TELEGRAPHY.

By Commander ROLLO APPLEYARD, R.N.V.R., C.B.E., J.P., M.Inst.C.E.

"The mighty future is as nothing, being everything: the past is everything, being nothing."

From time immemorial the accepted method of celebrating anniversaries has been to recall the scattered incidents relating to the theme, and to string them into a story for the instruction or amusement of those who will listen. In the ordinary course of events this method would have been adopted to proclaim the present jubilee. It would have indicated how a periodical which started on its famous career on November 15, 1872, pursued its way for half a century, ever with a hand to help and a voice to cheer those who laboured truly to establish the electrical industry. With characteristic delicacy, however, the Editors have abandoned for this occasion the historical plan; they desire that the world shall be reminded that the electrical industry has not yet lost, and must never lose, the youthful spirit that is its heritage. Here, then, though our thoughts may occasionally turn to the work of the telegraph engineers and electricians who were the pioneers, let us not speak too much of years.

"They have wakened the timeless Things; they have killed their father Time;
Joining hands in the gloom, a league from the last of the sun.
Hush! Men talk to-day o'er the waste of the ultimate slime,
And a new Word runs between: whispering,
'Let us be one.'"

Bygones shall, so far as possible, be bygones, dismissed with the knowledge that the history of applied science, and indeed of applied art, has no page more brilliant or enchanting than that upon which is recorded the birth, the growth, and the achievements of submarine telegraphy.



Photo by] [J. C. Beresford.

Rollo Appleyard.

It must be confessed that, in contemplating submarine telegraphy, it is easier to pass in review from what *was* to what *is*, than to travel in anticipation from what *is* to what *will be*. In either case, however, the transition leads and has led the investigator step by step, effort by effort, through that fascinating region of research, partly physical, partly mental, that broadens out from the sunset-edge of things accomplished, and extends from what is known to what did or will happen. Submarine telegraphy illustrates, moreover, that the one demand held by natural science against the investigator, within this region of discovery and invention, is that he shall watch and measure and refuse to drift. To advance, he must try to take his bearings and to ascertain his distances, even though his rods and clocks conspire with the ether to delude him. Above all, upon the plane of what is reasonable, possible, or probable, he must ever appeal to experiment. If the experiment is made and studied, though it may seem to fail, the endeavour itself disturbs contact with what is known, and simultaneously from the world of the unthought-of a new notion springs into existence and flashes across the gap of ignorance to be recognised as an increment to knowledge.

In submarine telegraphy there is no evidence that we are approaching the limit of what can be accomplished by observation, measurement, and experiment. Nevertheless, although materials and phenomena associated with the subject are particularly appropriate for research of that character, and although theory is well advanced, the process of development, so far as appertains to the cable in actual use, is remarkably slow, both as regards design and construction. Attention is frequently directed to new principles applied to telegraph instruments, to improved methods of signalling, and to the threat of the supersession of cable-telegraphy by some other form of message-transmission, but why is there so little change in the accepted design of the cable itself? The explanation must be sought in the fact that mechanical, as well as electrical, requirements have to be fulfilled, and that the existing form of cable is comparatively satisfactory in both respects at the price. Any modification of design that entails increased cost has a hard struggle for acceptance, unless it can be proved to bring about either increased durability or increased efficiency of transmission. Future designers will study this problem not merely by seeking to develop the conductor, the dielectric, and the mechanical protection of the cable, but also by endeavouring to proportion the inductance and leakance so as to secure rapid and well-defined signals. A prophet might hazard the opinion that their success will depend upon their chemists as well as upon their mechanicians.

So far as the conductor is concerned, the conclusion arrived at by Matthiessen that pure copper had higher conductivity than any of its alloys deprived future research students of many happy days of investigation. On the other hand, it directed the efforts of copper-wire manufacturers to the need for purity, and as they have already been successful, much further progress along this line is difficult to imagine. The chaos of the coinage, and the creation of paper money, may be followed by such a deluge of silver that the metal market may suffer a complete change. The best that could happen would be that pure silver should thereby fall in relative value so as to be comparable in price with copper. From such a substitution, an improvement of about 5 per cent. in the speed of transmission through cables might be expected to arise, and the increased revenue resulting therefrom is perhaps the only shred of hope for the recovery, on balance, of some of the world's losses.

Next in importance to purity is care in annealing the wire for the conductor. Wire-makers have vied with one another to obtain the softest product, and although finality may not have been reached, they have left the research student a giant's task to produce a better result. It is to be observed, however, that although

the copper wire is carefully annealed before it enters the stranding machine, there is always the chance that it may be subjected to stresses during the stranding process. If, in the future, the design of the machine were so far improved as to remove these stresses, the corresponding gain in transmission might be of the order of one-half per cent., but it would scarcely be greater.

An astute observer, examining the stranding machine in quest of possible developments, might carry out a research upon the sticky compound that unites the centre wire to the outer wires of the strand. By filling up interstices, this compound renders the strand more or less free from air-cavities, which would be disadvantageous in subsequent operations. As the compound is of the nature of a dielectric rather than a conductor, it obviously would be more useful outside than inside the strand, provided that a conducting substance could be devised as a substitute to eliminate air. The proportion of compound within the strand varies considerably in different strands, but in some instances it is a substantial amount, attaining, perhaps, 1 or 2 per cent. of the weight of the copper. This astute observer will at once suggest that the strand should be passed through a bath of molten solder, or other metal, instead of compound, and then through a die to secure a smooth metallic surface and a circular section. Unfortunately this operation would deprive the strand of its flexibility, and it would add materially to the cost. The experiment would, however, have the useful effect of causing renewed inquiry to be made into the merits and demerits of replacing the strand by a single solid copper wire of circular section.

It is recognised that a solid wire would have decided advantages. An approach to such a conductor has been obtained by lapping copper tapes round a central wire. As compared with a strand of normal design, a certain degree of flexibility is thus lost, and the copper of the tapes is probably more severely stressed than is that of the ordinary outer wires in a normal strand during the operation of stranding. This form of conductor is a suggestive, though imperfect, step towards a design giving the lowest electrostatic capacity and the least electrical resistance for given weights of copper and dielectric.

In addition to the advantage of flexibility, a stranded conductor has the merit that, in the event of the disruption of one of the component wires of the strand, the others may be expected to maintain continuity. It might, of course, be argued that a single wire of seven times the tensile strength would be less liable to disruption. Further, with currents of high frequency, the distribution is likely to be more uniform over the section in the case of a strand than in the case of a solid conductor; but for telegraphic currents, from the electrical standpoint, the single wire would probably have preference, because of the reduction in diameter of the conductor as a whole as compared with a strand of the same material of equal resistance, and the consequent diminution of electrostatic capacity. Future electricians will be trained to calculate these relative merits and demerits to a nicety, and if they decide that a single wire of circular section would be electrically as good as, or better than, a strand of equal weight, and not inferior mechanically, they will call upon the mechanicians of their day to dispose of the difficulty of increased rigidity. They will discover, incidentally, that the rigidity lurks not only in the conductor, but in the specification, and that it is easier to remove it from the one than from the other.

Those who have struggled with difficulties of this character will find entertainment in contemplating what awaits those who are to carry on the work. It can be truly said that if the surmounting of these electrical and mechanical obstacles gives to future workers as much satisfaction as it gave to the pioneers of our day, the newcomers will be happy labourers in a field of surpassing fascination. As we are here upon ground that is entirely hypothetical, let it be supposed that the newcomers decide in favour of a single-wire conductor. Developments would probably take the form of improved means for straightening and annealing the wire before covering it with dielectric; for large wire with bends in it would lead to a decentralised core, and would be intolerable. With such a conductor, special arrangements would be necessary during the covering process to ensure that the dielectric forms a symmetrical coating sufficiently firm to enable the core to be wound upon the machine-drums without deformation of section. At this stage the electrician will in fact begin to worry the mechanician for a core with a "good centre," and it is probably at about this time that the mechanician will seek assistance from the chemist. If they succeed, an advance will be made towards efficiency and economy.

The time-honoured method of applying the dielectric in three separate coats, with compound between each, has already been departed from on several occasions, and ingenious machinery has been devised for reducing the process to a single operation. This suggests that, in the future, it may be possible to reduce the amount of compound between the coats, or even to eliminate it, so as to have the advantage of a homogeneous covering of the best material for the purpose of transmission and durability. Here, again, however, there will be objections to any change in the specification.

From whatever aspect an attempt may be made to develop the submarine cable, the inventor, the economist, and the electrician will meet at a point, and that point will always be the joint in the core. Any modification of the conductor, dielectric, or sheathing that imperils a joint must be rejected. Now, the jointer is of all men the most conservative and the most despotic; of applied science, art, and industry he is the consummation. Nevertheless, a wise captain will not allow him to control the cable-ship, and a prudent manufacturer will not allow him to oppose all developments. He has to be told that the dielectric of yesterday is not the dielectric of to-day. His skill, however, is considerable, and it will enable him to modify his procedure, if necessary, to meet the requirements of the future. With each change of design or dielectric a set of experimental joints must be made and tested.

A change in the material used for the dielectric of submarine cables is, to many of us, difficult to contemplate. Does not every text-book tell us that it is gutta-percha? Closer acquaintance with the subject, however, introduces us to a number of varieties of the gum, the choice products of Pahang, Johore, Bulongan, Sarawak, Bagan, Sarapong, or Macassar; and experience tells us that each variety is subject to surprising divergences of quality. The truth is that time and avarice have degraded the old market. One important result has been that balata from Venezuela has competed against the products of Singapore with considerable success. A further consequence has been that the process of deresinification has been developed, and that the resulting dielectric has very favourable characteristics, especially with regard to electrostatic capacity. The manufacturer to-day has thus considerable latitude, and the prospect of further development is as hopeful as it is enticing. During the next half-century it may confidently be expected that still lower electrostatic capacities will be obtained, and that this will constitute one of the most direct lines to improvement in core construction. Chemistry will seek new victories, but the jointer will continue to decide the issue.

The total effect of modifying the material and cross-section of the conductor, and of carrying out an extended research on the dielectric, might be to improve transmission to the extent of, say, 25 per cent. in fifty years. This would be a fine achievement, but the pace would be far too slow to satisfy the research student. Let him therefore begin with the core as it is, and press on with the development of a new type. The first step will be to extend his measurements. Inductance and leakance must be determined for his core, as well as its resistance and capacity, for a range of frequencies, and

his task will be to proportion these four quantities to produce the best effect. He will probably be obliged to introduce inductance into the core, either as a continuous lapping of iron wire over the conductor or as a series of separate "loading" coils, in which respect submarine telephony has already outstripped telegraphy. And to these four quantities he must add four others: the cost, the joint, the specification, and the durability.

The addition of inductance will demand close attention to the question of durability. The gutta-percha in the core of a submarine cable requires to possess a certain amount of moisture to prevent rapid deterioration, and this amount may vary from about 1 to 3 per cent. A lapping of very thin iron wire over the conductor might, for protective and electrical reasons, need to be treated with some kind of varnish. This would increase the cost; and the varnished metal may be less effective than plain iron wire, because of the space taken up by the varnish.

Attention has here been directed to the cable itself rather than to instruments or to methods of transmission. Several considerations lead to the belief that study of the cable is the most helpful line of approach to the future. Fortunately, the barrier of conjecture that stood in the way of research in this direction has to a great extent been removed by devoted work in the realms of theory by men whose labours will be more appreciated in the next fifty years than they have yet been. It is denied to us to-day to retrace our steps or to recall the names of those who have performed this service; we are pledged to look forward, and it must suffice to record that recent work by mathematicians has reduced the complex theory of submarine telegraphy to practical arithmetic, thus leaving the field of investigation free to be dealt with in the laboratory and at the cable-station.

Success will depend upon applying the improved apparatus of the present and the future, to overcome the inherent limitations of design and construction of the cable. The first limitation seriously affecting the addition of inductance is that a submarine telegraph cable has but one insulated conductor. A telephone cable has two. Again, in telephony it is possible roughly to average the frequency of the vibrations corresponding to speech; but in telegraphy, which employs a more or less broken sequence of transient and irregular impulses, it is hardly safe yet to assume a definite mean frequency. In submarine telegraphy, therefore, resonance is elusive. As we cannot tune our harps we must console ourselves with the drums. Nevertheless, it is reasonable to suppose that in another decade or two, from the transmitting, receiving, relaying, rectifying, magnifying, and translating apparatus of to-day, including the wondrous thermionic valve in a developed form, will be evolved a comparatively simple system of signalling through telegraph cables which, in combination with a developed type of core, will lend itself to the conditions necessary for an approach to the distortionless circuit. The moment, in fact, appears to be fast approaching when the cable will be designed and constructed more nearly as a component of the apparatus —as the arrow to the bow.

In view of the multiplicity of conditions that determine the life of a submarine cable, as it enters the ocean and chafes on the shore over merciless tide-swept rocks, or as it gropes its way along the ribs of the earth towards the quiet ooze, miles deep, and creeps slowly up the treacherous slopes into the fish-haunts where trawlers grapple, or finally, as it regains the shallower levels where anchors threaten to claw its sides, the endeavour to predict what the future may reveal in the development of sheathing, laying, and picking-up, is in vain. All that need be said about it is that, thanks to the ingenuity and virility of our race, these problems are, for the purposes of the immediate future, sufficiently solved. The chances are that the operations will remain substantially unaltered for the remainder of the century. Let us therefore use every effort to ensure that in this respect what Great Britain has won, Great Britain shall hold.

THE PRESENT AND FUTURE OF POWER-STATION EFFICIENCY.

By W. M. SELVEY, Wh.Sc., M.I.E.E.

All engineers will join in the congratulations due to the Electrical Review on the occasion of its Jubilee. The progress made during this period, in which the Review has held its familiar position in the ranks of the now great electrical industry, has been described in a fascinating manner in the Jubilee number of the *Journal* of the Institution of Electrical Engineers.

It is perhaps interesting, and perchance it may be profitable to review the present, and grope vaguely into the future. We may be quite certain that to have reversed the process, as did H. G. Wells in his "Time Machine," and to have announced to the people, the educated people, of fifty years ago what are now commonplaces of electricity, would have been to evoke howls of derision or accusations of insanity.

Any real vision of the future is therefore likely to receive the same fate to-day, unless it should seem so utterly fantastic as to be treated as good fiction, when it might achieve the worse fate of becoming a "best seller."

The scientific world has recently been exercised with the physiological matter in the address of the President of the British Association, Sir Charles Sherrington, at Hull. There is an analogy between the way in which the "nerve" conductors grow outwards from the brain, and the way in which our power stations are stretching out their feeders. A survey of the present shows that the more advanced in efficiency the power station becomes, the farther does it stretch out. It is a cumulative process. The stretching-out is at first an expense and a loss, but when the firm attachment is made, then the feeder becomes a means of sending back an encouragement, a fresh power to the brain, which enables it to improve its efficiency, to grow, and then to send out fresh feeders; these in turn again strengthening the brain centre.

Having evolved the complete organism, in the case of the human being, the brain then acquires the power of joining and acting with, for mutual help and encouragement, other similar organisms. So also our advanced power station is the first to come into contact with other power stations, and a similar effect is produced.

Ultimately we arrive at the political body, the State, and so may we imagine in the future, the physical connection of all stations, separated by that interval of distance which best suits the necessities of the areas they serve.

Similarly, as in human life, the more advanced stations will act as mentors and leaders to the smaller stations in the system, and ultimately a balance will be attained between mere size and average convenience. This process is already slowly going on, and will be accelerated only when the Force residing in Help and Example is fully felt in the completely joined-up "National System."

Comparing the more advanced with the less is to realise that without any radical departure in efficiency, the raising of all to an equally strong position would make just the difference shown between the possibilities of the caveman and the power of the organised nation.

Electricity is still severely competing with "isolated

combustion" in every walk of life, and has perhaps only attained 15 per cent. of its possibilities to-day. While the isolated and small power station has a heavy task to compete with the isolated steam plant, yet it is doing it slowly; on the other hand, the most advanced power station has a heavy task to compete with the large efficient isolated plant. Yet both are winning, and when the large station takes over the burden of the small station, in the very giving of help, it receives fresh power to deal with its own competitors. Let us examine just a little the difference between the large and the small.

The figures for high-pressure steam generated and interheated have been given in the writer's address to the North-Midland Centre of the Institution of Electrical Engineers. It is not necessary to refer in detail to the figures and diagrams there given, but they do show that a diagram efficiency of 40 per cent. is possible.

Boiler efficiency we know under steady conditions can now be maintained at 85 per cent. Turbine efficiency is still improving, and the writer sees no reason to change the opinion given in Merz and McLellan's paper so long ago as 1904 that ultimately 85 per cent. will be obtained. Then there is the margin for station use, operation and machine load factor losses to allow for, which for steady loads may be as low as 7 per cent., and need not be higher than 15 per cent. in any case in the future for a large station.

These factors multiplied together give $0.40 \times 0.85 \times 0.85 \times 0.85 = 24.57$ per cent., which is the prospective figure announced by Mr. Ferranti at Ilkley (I.M.E.A. Convention, 1920).

We are much in need of a "standard" coal, and it would clarify discussion much if each figure quoted of "pounds of coal per unit" were given in terms of standard fuel. The fuel is at present bad compared with what it might be if all collieries washed their coal, but if we take "11,500 B.th.u. per lb. as fired" as standard coal, then the efficiency of 24.5 per cent. will be equivalent to a heat consumption of 13,930 B.th.u. per unit and a coal consumption of 1.21 lb. per unit, giving with coal at £1 per ton a coal cost per unit at the station of 0.13d.

Now if a study is made of the *Electrical Times* records and a rough curve plotted between the output and the "coal costs," it is easy to see how undertakings with low costs have been in increasing measure enabled to collect business. It does not require much prevision to see how the snowball effect will operate as large stations grow all over the country. And they will grow, in spite of many obstacles, "fightings within and fears without." The sort of economic pressure outlined will act, if with glacier-like slowness, also with equal certainty.

Each large station, by the effort of its establishment, will draw strength to itself, and everywhere around us the start is being made. Manchester, Birmingham, Sheffield, Rotherham, Blackburn, Glasgow, Edinburgh, Leicester, as well as the North-East Coast Companies from which the text of the parable was taken, have developments of a size and character calculated in time to draw the line of the comparative level at a higher altitude.

Another and striking aspect of the present, and one which is full of hope for the future, is the way in which the smaller stations and their organs of plant are rapidly improving in efficiency, small sets coming within 20 per cent. of the efficiency of the largest sets. This is especially apparent in isolated industrial districts like Lincoln and Peterborough and Luton, where it must be some years before complete articulation with the main system can occur. Each such case strengthens the industry as a whole, and assists materially in another direction, on which much could be written, namely, that of mass production of cheap and reliable apparatus.

In the foregoing it has been argued that the highest efficiency in sight for a large power station worked at a high load factor is about 24.5 per cent., and that if this efficiency were equally obtainable at many of the principal centres in the country, many of the desires of electrical engineers would be realised. It has also been pointed out that the force of example has led the smaller centres to expect and attain efficiencies which come wonderfully close to the larger schemes. These matters are probably worth a little closer examination.

Let us briefly consider first the problem of the steam cycle used.



W. M. Selvey. [Simpson's Studios

As far as our knowledge goes at present, it does not appear that high pressure alone presents any striking difficulties, the limitations are still in the direction of temperature.

The small and middle size concerns which are typified in many minds by having generating sets, say, of 3,000 kW and 6,000 kW capacity, may now be associated with 265-lb. and 350-lb. pressure, and in favourable cases with 28.5 in. and 29.1 in. vacuum, and with 688° F. total temperature.

The cycle efficiencies in these cases are 33.9 per cent. and 36.4 per cent. The various organs cannot, of course, realise such high efficiencies as in the largest concerns, and it is doubtful whether anything but the ordinary steam cycle should be attempted (except in one particular, which will be referred to later). It would be possible to-day to obtain turbine sets of these sizes with efficiencies of 70 per cent. and 73 per cent. at the alternator terminals were it demanded.

The boiler would naturally be a smaller unit, and the steady efficiencies obtainable may be put at 78 per cent. and 81 per cent. for the corresponding sizes. The remaining figure for the general losses must be put at a higher value than before, because the smaller concern can seldom command the load factor and such-like favourable conditions, but it may be fairly taken as 25 per cent. and 20 per cent. respectively.

Thus we arrive at two general conditions of—

The smaller concern using 3,000-kW sets,

$$0.34 \times 0.70 \times 0.78 \times 0.75 = 13.9 \text{ per cent.},$$

and the moderate-size concern using 6,000-kW sets,

$$0.36 \times 0.73 \times 0.81 \times 0.80 = 17.0 \text{ per cent.}$$

These are not figures realised to-day, but ones which might be realised for a new plant designed to-day under favourable conditions where sets of such size seem to be of the right capacity for the load in sight for the next decade, and which are therefore isolated from large industrial centres.

Translating them into terms of the suggested

"standard coal" of 11,500 B.th.u., they signify coal consumption of 2.14 and 1.75 lb. per unit, and with coal at £1 per ton, coal costs of 0.23d. and 0.188d.

In order to avoid any misunderstanding by the reader who reads rapidly, it is necessary to emphasise that these are not figures to be expected from every station that already has sets of a size such as we are considering. They are figures representing possibilities in the future for plants designed to take the fullest advantage of the experience gained with the plant of maximum size. The note to be struck is one of hopefulness for those engineers who feel that they have only a moderate-sized cake to bite at. There may be many such who have a decade of uphill work before them, without any hope of sharing the larger developments except in the way indicated.

One more matter may be mentioned about the cycle. Workers on the theoretical problem of air as a working fluid for use in a gas turbine are well aware that only by very complete regeneration can they hope to approach the efficiency of the "Carnot cycle." The temperature-entropy diagram for steam is well known.*

It is quite obvious, from a consideration of that diagram, that the higher the pressure of and therefore temperature of evaporation, and consequently the lower the degree of superheat, the nearer the centre part of the diagram approaches the Carnot cycle, the less important is the region to the right, and the more important the region to the left. If the heat supplied to the water can in any degree be obtained regeneratively by the heat rejected from the steam, then, although the Carnot cycle is not followed, the Carnot efficiency is approached. As long as all the heat of the middle portion is rejected at the lowest temperature, then regeneration is impossible, but if a small portion is rejected not at t_{vacuum}, but $t + \Delta t$, then this can be used to regenerate the water from t to $t + \Delta t$. Then, if a further small portion is rejected at $t + 2 \Delta t$, this can also be used to regenerate the water further. Theoretically, if this is done in an infinite number of stages with complete efficiency, not the Carnot cycle, but the Carnot efficiency, is approached.

Such a scheme has been effectively applied for one stage on a well-known make of turbine, and can be carried several stages further by what are known as successive "bleedings," a horrible "Americanese," which, however, hits the mark. Three stages are involved in the latest projects.

There is, however, another practical consideration. Much of the heat at present used in the left-hand part of the diagram is supplied by the gases leaving the boiler, and as the pressure rises this heat increases.

To throw it away would nullify the profit of the regeneration, and the only course open is to again adopt the regenerative system and return it to the air used for combustion. Although a moderate amount of air heating of from 100° F. to 130° F. (*i.e.*, about 3 per cent. of the total heat) is probably quite feasible on the usual machine stoker, it becomes a grave question whether 10 to 15 per cent. of the total heat can be thus dealt with unless by some radical departure, such as the use of powdered fuel. This suggests, however, a line of progress which, no doubt, has received the most careful consideration by those responsible for the latest developments. Much of the substance of these schemes, if successfully developed, can again be applied in a lesser degree to the smaller concern. Comparing the possible results from the smaller stations in the future, there seems, therefore, much hope for drawing the competitive level higher and higher every year.

There are, of course, undertakings operating with turbines of 1,000-kW and 2,000-kW size, but these can be looked on as being in a transition stage. There are remaining a large number of isolated concerns whose total output can only be expected to be about 500 to 1,000 kW. These are at present operated by small reciprocating steam engines often non-condensing.

* See fig. 1, p. 38, *Journal*, Inst. E.E., Vol. 58, No. 286, December, 1919.

There is also an outlook for these concerns by the use of oil engines. There are two main lines known popularly as the Diesel and semi-Diesel types. The cycle efficiency of these engines is extraordinarily high.

According to an analysis of performance by Sir Dugald Clerk, a fair result for a 500-h.p. Diesel engine is:—

Mechanical efficiency, 77.6 per cent.

Indicated thermal efficiency, 39.9 per cent.

Brake thermal efficiency, 31.2 per cent.

Since the mechanical efficiency is low, the brake thermal efficiency falls off rapidly at low load, which indicates the desirability of a series of sets of increasing size to deal with the bad load factor of small concerns.

The efficiency of much smaller engines of the same type is well maintained. The following figures may be of interest as representing results commercially attainable to-day.

Fuel consumption of small Diesel engines in pounds per b.h.p.-hour:—

	100 h.p.	150 h.p.
Full load ...	0.45	0.44
¾ load ...	0.47	0.46
½ load ...	0.54	0.52
¼ load ...	0.73	0.69

The brake efficiency corresponding to these figures, taking the oil as having 18,000 B.th.u. per lb., is:—

	100 h.p.	150 h.p.
Full load ...	31.4	32.1
¾ load ...	30.1	30.7
½ load ...	26.2	27.2
¼ load ...	19.4	20.5

The efficiency of semi-Diesel sets is very similar to the above.

The cost of all small prime movers of any type is proportionately high. The total costs of running these engines cannot be compared yet with those of the larger steam stations. Not only is the capital cost high, but the fuel cost is high. At the present time the cost of fuel oil is about £4 12s. 6d. a ton for a material of calorific value (lower) of about 18,000 B.th.u. per lb.

Recent estimates for a small output gave the following interesting figures:—

Total Generation Costs—Price Per Unit Sent Out.

Load.	170-kW Diesel.	50 kW Semi-Diesel.
Full ...	0.572d.	0.705d.
¾ ...	0.662	0.825
½ ...	0.865	1.09
¼ ...	1.495	2.05

Included in these costs are—

(*a*) Depreciation and interest.
(*b*) Waste, stores, renewals, and repairs.
(*c*) Fuel and lubricating oil.
(*d*) Cooling water.
(*e*) Labour.

At or about half load, the fuel cost is approximately half the total cost.

While such figures show that many of the small steam concerns, which will have to carry on alone for a number of years, can effect much progress by the use of such sets, a consciousness may still remain that reductions may and should be hoped for.

As an outlook for the future, it is not beyond imagination to expect processes for obtaining a greater oil yield from coal, especially should it be found possible to carry it in solution. Research seems to be feeling its way in this direction. It is already known that oil may be made to carry solid carbon, if sufficiently finely divided, and workers are busy endeavouring to get more and more of the coal content in liquid form. These may ultimately be chemical and not necessarily simple distillation processes.

Finally, in some cases there may be found a use for the exhaust heat from the small reciprocating engines. This may be utilised for warming buildings, heating baths, and providing cheap hot water for public wash-houses.

Thus, even in the smallest concern, there is room for progress, effort, and hope.

THE DEVELOPMENT OF SMALL WATER-POWERS AND LOW FALLS.

By Prof. A. H. GIBSON, D.Sc., M.Inst C.E., M.I.Mech.E.

The physical characteristics of a country determine whether its potential water powers shall be mainly available at sites each giving a comparatively large output or at a large number of sites of small individual capacity. In such a country as Great Britain the rivers in general have too gradual a fall, and the streams of the steeper ground carry too little water to permit of the large development of water power at any one site. On the other hand, there are innumerable sites scattered throughout the country, on all but the most sluggish rivers, at which small water powers of from 10 to 200 h.p. might readily be developed.

As a general rule, in all the older industrial countries the early manufacturing communities were grouped around the more easily available water-power sites, and extensive use was made of such power, notably for the production of textiles and for milling. The development of the steam engine and of railway transit, the growth of the size of factories beyond the capacity of the installed water-power plants, and the improvements in methods of manufacture necessitating a steadiness of drive which could not be furnished by the water-wheels then employed, led to the abandonment of the majority of such installations. During the last decade, however, there has been a general revival of interest in these small water powers. The improvement of the water turbine and the great development of electrical appliances have been largely responsible for this revival, which has been accelerated by the great advance in the cost of fuels of recent years.



Photo. [Lafayette.

A. H. Gibson

As an indication of the situation in one particular area, it is of interest to note that in 1920 there were 600 water-power sites in the West Riding of Yorkshire at which between 16,000 and 17,000 h.p. was being developed, and 132 sites at that date still unused for power purposes.

Some approximate idea of the water power likely to be available from the small rivers of this country may be deduced from an investigation of the Wiltshire Avon in 1919 on behalf of the Board of Trade Water Power Resources Committee. The size of the catchment area of this river (674 sq. miles) is fairly typical and the rainfall about the average for England. From this area an aggregate output of 650 kW is already, or is being, developed, while the investigation showed that the total possible output is about 3,000 kW, or 4.4 kilowatts of continuous 24-hour power per square mile of catchment area, which, if applied to the whole area of England, would give an aggregate continuous output of 220,000 kW. These figures relate to installations which are designed to utilise the natural flow of the river, unregulated by storage.

From the nature of the case, low-head installations are only to be found on rivers or streams of small gradient. This in general renders it impossible to conserve the wet seasonal run-off for use in dry seasons, since not only does the small head necessitate a very large volume of storage, but, owing to the flatness of the gradients, such storage would usually cause the submergence of a considerable area of land. Moreover, the seasonal fluctuation of head due to the varying level of the storage reservoir would be a large proportion of the average working head, and would not be conducive to high efficiency in operation.

For these reasons, if a low-head installation is to form the sole source of power, it can only be rated with reference to the capacity of the site under the conditions giving rise to minimum output. In many cases this is determined by the amount of water available under dry-weather conditions. Often, however, owing to the banking-up of the tail water under flood conditions, the working head is so reduced as to render the output a minimum at such times. If thus designed for minimum flow conditions, any excess water at other seasons is wasted. Where, however, the installation can be used in conjunction with a steam station a much more liberal allowance of plant is economically advisable. Much depends upon local circumstances, but, as a general rule, it will pay to install such a turbine capacity as may be kept running at full power during the wettest six months of the year.

Although storage in the broad sense is not feasible, it is often possible to provide such modified storage, or pondage, above the site as will enable the daily flow during the period over which the plant is idle to be impounded for use during the working day. In this way, with an eight-hour working day, the output in horse power may be trebled.

In a few modern installations in this country, designed for factory service, in which even this modified amount of storage is impracticable, the turbines are allowed to run continuously and perform the duty of pumping water up to an elevated storage reservoir in the vicinity, from which it is supplied to a series of high-head turbines developing the motive power as required. Although this involves the provision of two sets of turbines, as well as of a pipe line, centrifugal pumps, and an elevated storage reservoir, experience shows that where the physical characteristics of the site are suitable, such a scheme is economically feasible.

Modern developments in turbine design have done much to render low-head development economically more attractive. The earlier turbines for such heads were essentially low-speed machines. The governing mechanisms were crude and the difficulties in the way of accurate speed regulation great, and although their speed was not too low to permit of the direct driving of mill machinery, it necessitated a comparatively expensive generator if used for electric driving.

During the past ten years, however, new types of runner have been evolved, which permit of speeds at least three times as great as were common in the past being attained with satisfactorily high efficiencies, and this has rendered commercially possible the development

of many comparatively large low-head schemes. Investigation and invention on these lines is actively proceeding, and it is probable that the low-head turbines of the future will show still more marked improvements in simplicity of construction and in speed over those in use to-day.

Developments in turbine governors have also enabled the problem of accurate speed regulation to be satisfactorily solved, and in this respect the low-head turbine plant is little inferior to the modern steam plant.

As a compensation for its disadvantages, the simple low-head scheme has the advantage of being comparatively cheap to construct and maintain. Such head works as are necessary are not expensive, and no pipe line is required. For high efficiency, however, especially with the modern high-speed type of runner, very careful design of the turbine setting is necessary, especially as regards the draught tube, in order to prevent undue losses at discharge.

Of recent years several schemes have been suggested for reducing the loss of power due to the reduction in working head in a low-head plant, due to raising of the tail-race level in times of flood. In one of these, the Moody ejector turbine, a cylindrical gate at the top of the draught tube admits pressure water to the draught tube in times of flood. This, by its ejector action, reduces the pressure in the draught tube, and tests show that in this way the capacity of the turbine may be increased appreciably. In another arrangement advantage is taken of the fact that if the water passing over a waste weir of suitable design, in times of flood, is discharged into the tail-race, it forms a standing wave, and that the surface level at the up-stream side of this wave is lower than the normal level without the waste weir in operation. In this way the tail-race level at the point of discharge of the draught tube may be reduced, and the working head increased. While these schemes are as yet rather in the experimental stage, they offer very distinct possibilities, and their successful development will largely increase the economic value of many low-head schemes.

As already indicated, in order to make the best use of the average small water-power scheme, it should be used in combination with a steam, gas, or oil-fuel plant, whose maximum capacity should be such that it will augment the minimum seasonal output of the hydraulic plant up to the capacity necessitated by the demand.

The best method of operation of such a combined plant depends largely on the relative capacities of the two sections, and on whether any appreciable amount of water storage is available. Where a steam plant is installed, and where the water power is large compared with the steam power, it will in general pay to operate the steam plant continuously, since for maximum economy such a plant requires to operate at more or less constant load corresponding to full load on one or more units. On the other hand, if the water power forms a relatively small proportion of the whole, it should be utilised to its full extent wherever possible, the steam plant taking the peak loads. For intermediate conditions much depends upon the load factor and generally upon local circumstances.

As an excellent example of the economy rendered possible by the co-operation of a steam and a hydro-electric station, the power plant of the Chester Corporation may be cited. Here the capacity of the steam plant is 1,240 kW and of the hydro-electric section 635 kW, under a head of 9 feet. This section works under difficult conditions owing to the fact that the river is tidal and is unregulated, and the working head varies from 1 ft. to 9 ft. From statistics quoted in the final report of the Board of Trade Water Power Resources Committee, it appears that its mean effective annual output during the 7.5 years ending in March, 1921, was 220 kW. The average number of hours run per annum was 8,323, or 95 per cent. of the maximum possible time, and the units generated were 1.83 million kWh. During this period the steam plant generated 2.05 million kWh per annum. During the five years ending in October, 1918, 51 per cent. of the total energy sold was generated by the hydro-electric plant. Had this energy been generated by a steam plant operating under average conditions similar to those actually obtaining, the additional fuel consumption would have been 3,950 tons per annum, equivalent to 18 tons per kW generated. The average annual costs of the hydro-electric section, including sinking fund and interest on capital, amount to 0.293d. per kWh generated, while the corresponding costs of the steam plant amount to approximately 1.05d. per unit. The corresponding costs per kWh sold were approximately 0.35d. and 1.45d.

A somewhat similar example of the use of a comparatively small hydro plant is afforded by the power plant of the Salisbury Electric Light and Power Co., Ltd. This has a total capacity of 600 kW, the normal maximum output of the hydro-electric section being only between 30 and 35 kW. During the ten years 1911-20, this section averaged 8,200 running hours per annum, and generated 120,000 kWh per annum, the mean effective annual output being 23.2 kW, or 66 per cent. of the maximum output. During the same period the steam station generated 571,000 kWh, or only three times as much as the hydro-electric section. The saving of coal due to the latter station is estimated at 530 tons per annum, equivalent to 22.8 tons per kW per annum.

Owing to the fact that the cost of an electrical transmission line, per unit of power transmitted, increases very rapidly as the power is diminished, the distance to which it is economically possible to transmit the output from a water-power installation diminishes rapidly with its size, and the output from the average small power scheme must be absorbed at a comparatively small distance from the site. This renders the isolated small power economically useless except for strictly local purposes.

Where, however, a number of such powers are not too far apart, they may be linked by short spur lines into a common transmission line, and the aggregate output may then be sufficiently great to warrant the cost of transmission to some considerable distance. In this manner, the entire output of a small river might readily be absorbed, at a number of small stations at physically favourable sites between its uplands and the sea. Such a scheme has been outlined by Mr. S. E. Britton, M.I.E.E., electrical engineer to the City of Chester, for the development of the River Dee between Chester and Llangollen. The length of river between these points is 47 miles and the fall 220 ft. It is suggested that this reach of the river could be most economically utilised by the erection of sixteen weirs and hydro-electric stations at various points. The heights of the proposed weirs would vary from 7.5 to 14 ft., and in one case a head of 37 ft. would be obtained by the use of a short pressure tunnel. Fifteen of these stations would be equipped with turbines of the same size.

It is estimated that in this way approximately 60 million kWh could be generated annually, equivalent to an average output of about 6,820 kW. The total cost based on the experience of the cost of installation of the Chester hydro-electric station, with an addition of 70 to 100 per cent. on various items to meet the increased charges ruling at the time of the report, including transmission lines but not wayleaves, is estimated at £72,240, or only £10.6 per average kW. It is suggested that a district extending from three to five miles on either side of the river, of an area of 200 sq. miles, might be served by this scheme, the average annual power delivered being about 5,460 kW.

For the successful working of such schemes the stations must operate automatically to reduce the cost of superintendence, and they must be simple and robust. In one system suggested by Dr. Steinmetz, each turbine is coupled to an alternator of the induction generator type, which will supply current to the mains in proportion to the water power available, up to the limits of its capacity. The necessary starting arrangements are simple, and may be controlled from some distant point, or the starting and stopping may be arranged so as to

be regulated automatically by the level of the head water. One of the stations is a controlling station, and supplies the magnetising current for all the small alternators. The others are of the simplest type, consisting simply of a building to house the turbine and generator. The only supervision required is a periodic visit to each unit to attend to lubrication and to clear the intake racks.

The essential features in such a scheme are the cheapness and simplicity of the stations, the low cost of supervision, and the large proportion of the potential water power which may be utilised under favourable circumstances. It may be developed gradually, station after station being added as the demand grows, so that the initial financial outlay need not be large. The electric mains not only act as collectors, but are equally valuable as distributors. All the small towns, villages, and farms in the area may readily be linked on to such a system. If the system is in the neighbourhood of a large town having a central steam station, if this be linked into the circuit many of the drawbacks due to the seasonal irregularity of the water supply may be avoided, while since the water-power stations usually give their maximum seasonal output when the total demand for power is a maximum, this appreciably increases the maximum capacity of the system as a whole.

Such a linking-up of a large number of the small water powers of the country in conjunction with one or more large steam stations promises to be a feature of the not remote future, and would appear to be necessary if the utmost use is to be made of these powers.

The general use of electrical power which it would render possible, especially in rural districts, would probably have a marked effect on the social life of the community. It would go far towards reviving and extending those small local industries which should form an essential feature of the ideal rural township, while the extension of its use in agriculture should do much towards making that industry both financially and socially more attractive. Commercially such undertakings may not appear to be of great importance, but as a factor in promoting the welfare of the community, economic and political, their influence can hardly be over-estimated.

OVERHEAD ELECTRIC POWER TRANSMISSION.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

Up to the present time, long-distance extra-high voltage power transmission systems are, broadly speaking, non-existent in this country. The principal reasons for the absence of such systems can be taken as being fundamental to the country and to the inherent conditions. Due to advances made in the science of electric transmission engineering, steam and hydraulic power plant and their auxiliaries, transmission will be more generally used in the future. The writer contemplates that we are almost on the threshold of a new era of power transmission work which will be brought about by the development of water power; by the concentration of and consolidation of large steam plants; by electrification of railways; and by a more confident outlook and effort in meeting competition at the load centres respectively.



W. T. Taylor.

Due mainly to growth and to the more rapid changes and to advancing knowledge of the design of power transmission lines, no fixed set of standards has so far been universally adopted. As a matter of fact, all manufacturers and designers of importance are not quite ready (as it were) to "pool" their structural designs, &c. However, there is reason to believe that more attention will in future be directed toward the universal adoption of standards for all lines at the more ordinary voltages. At the present time the transmission voltage range is very wide. In this country, taking 11,000-volt transmission lines as the ordinary low-range limit—using the term "transmission lines" in its broadest sense—the maximum voltage range is nearly 4 to 1, whereas in America (U.S.A.) the maximum voltage range is nearly 20 to 1, or five times greater than the maximum operating voltage in this country. However, the writer ventures to predict that, within the next ten years, we shall have long-distance overhead power transmission lines in this country operating at 100,000 volts or above. The voltage of to-day is 1,000 times higher than it was 40 years ago, *i.e.*, from 220 to 220,000 volts.

One important *future* transmission power problem in this country will be bulk power supply. The change will mean that the characteristics of the load will be different, and therefore the load of each electricity supply undertaking should be definitely known, because the bulk-power supply company engineers will have to keep before them the opportunity of improving the system load factor by diversity of demand or by actually high load factor service; and that a more definite knowledge concerning power factor, load balance, and momentary and sustained peaks will become necessary to enable the engineers to determine the most economical transmission line conditions, &c. New penalty clauses will come into force with regard to damage that the bulk power customers will suffer if service is interrupted momentarily or for various extended periods. The more important transmission systems will have duplicate transmission lines and/or ring lines, and the line-circuits will invariably be on separate towers. All the more important load centres will be fed from two or more directions. The writer further ventures to predict that, eventually, power transmission lines in this country will extend from coast to coast.*

* The question of electrical limits of power transmission has little practical value in this country, for the reason that, if desired, we can to-day transmit electric power in bulk to distances well over 1,000 miles.

Transmission lines are usually located so that they traverse the less populous territory where their costs, and the penalties of accidents, are less severe. The principal governing factors in the design of the most economical transmission line are: carrying capacity, load factor, distance of transmission, specific cost of energy at the receiving end, and low annual expense on the capital invested. When the transmission line is to be designed simply from the viewpoint of the annual expense of the investment and the electrical energy losses in the transformers, the transmission line, and phase compensators, the total cost will be made up of the arithmetical sum of costs of energy losses, towers, conductors, and earth wire and telephone wires, insulators, transformers, converters (if any), switchgear, land and buildings, wayleaves, phase compensators, and miscellaneous. The cost due to the I^2R losses (for all big lines under reference) will be the predominating factor of the first cost, and its variation will have a direct influence on the total cost. In the design, transmission lines in this country will rarely be limited by the consideration of corona.

A carefully-designed transmission line should have the longest life consistent with reasonable first cost. One of the great dangers in making provision for future possibilities is that, because of the changes from year to year, there is no certainty that 12 years hence or even two years hence, we shall want to install the same design as to-day. The lay-out of the transmission system is of prime importance in ensuring a high degree of continuity of service, and in this regard future installations will follow the leading features of the best and most economical line location and correct line engineering. The development of many of the future large power transmission systems will, due to unalterable circumstances, virtually be a compromise between what is desired and what future circumstances demand and permit. Obviously, an exact decision of the type of transmission line, character of supports, total conductor, and earth wire capacity, &c., which will provide the highest *ultimate* economy as well as excellence of/or the best service, is perhaps impossible. The designer must, of course, determine as accurately as possible, the most economical voltage, the most economical span length between the towers, the most economical size of conductors, and the most economical phase compensation, and, the most he can do is to use good judgment (based on a broad and sound practical experience) in estimating future developments of this character.

For several reasons, great difficulty may be encountered in this country in obtaining easements covering the location of towers and suspension of conductors and wires operating at the said very high *future* voltages. So far, there seems to be no general standard by which the width of a right-of-way may be determined. Where two power lines are to be located over one right-of-way, it is desirable to have the lines far enough apart so that the towers of one line will not strike the other line on falling. In cases where it is important to use the right-of-way in the most economical manner, it would be best to use two-circuit towers having the conductors of each circuit arranged in a vertical plane on one side of the towers. On the other hand, a maximum width of right-of-way is required when conductors are arranged in a horizontal plane. In computing the side-swing, allowance must be made for swing of the suspension insulators; side swing of conductors should therefore be based on the longest span ordinarily used, and the extra width should be secured wherever exceptionally long spans are made.

The future line supports, for "first-class" installations, will consist of rigid (wide base) structural steel towers, the square or tripod latticed structural steel poles, the tubular steel pole, the concrete pole, and the semi-flexible pole. In the future, much less use will be made of wooden poles and structures on all first-class installations. In long-distance transmission lines carrying large amounts of electric power, the voltage of transmission is necessarily high and the size of conductors large; therefore, sufficiently strong and high structures are required for the line supports. Experience shows that structural steel is the most suitable and, in general, the most economical class of material to use for this kind of line supports.

As yet there is no established relationship between the span and sag, and the separation between conductors. However, because of the high stress at which the conductors may have to work to obtain the highest ground clearance and longest possible span with a given height of towers, specifications should be very rigid. Conductors must, of course, be spaced so as to provide sufficient clearance between adjoining conductors and between their supports. The most economical span of towers is defined by the cost of towers and insulators. The weight of a steel tower is very much dependent on the tension of conductors either in unbalance or in the deflection of the line. The failure of steel towers has almost invariably been caused by the buckling of main compression members. Future practice is sure to prohibit the use of any castings in the main structure of transmission line supports.

There is still considerable difference of opinion as to what should be taken as the maximum loading in designing a transmission line. Designers are at variance as to a proper estimate of the unbalanced tension. Two widely different conditions are assumed, namely: (*a*) that line supports should have a maximum possible unbalance in tension when the conductors are totally broken down on one side; (*b*) that line supports should have a small unbalance when a single conductor is broken on one side. Past experience proves that conductors very rarely break off totally on one side. It seems that (*a*) is too much on the heavy side, requiring thicker steel, while (*b*) leans too much on the lighter weight or thinner section of steel structure. As a compromise, it is possible that future designers will allow for one of (*b*) for every three or four of (*a*). The (*b*) type may take the place of dead-end or angle towers. In determining the design of towers, a good basis is to assume that sleet will form $\frac{1}{2}$ in. thick and weigh $\frac{1}{2}$ lb. per ft. run at the windage of 20 lb. per sq. ft. of normal plane area. Experience indicates that *heavy* sleet will not form when the wind pressure is high. In determining the mechanical factor of safety, it is necessary to assume certain properties of the factor as safeguarding each of the possible elements of danger, such as the error of design, workmanship, excess loads, deterioration of materials, and other considerations.

The weight of line insulators is dependent on the transmission voltage. In future transmission development, the suspension type of insulator will come into use. Up to the present time the pin type of insulator is used exclusively, and its use will continue for voltages up to about 66,000 volts, beyond which the suspension type of insulator will be exclusively used. In special cases, where a higher factor of safety is required, the suspension type of insulator may be used for very much lower voltages than 66,000 volts, but the relative cost will be greater. When considering the most economical span, the insulators tend to make it longer than the most economical span for the towers alone. The rated voltage principally defines the cost of insulators, while the cost is mainly dependent on the weight of insulators. For a given line, a wider right-of-way, a higher tower, and a longer cross-arm is required for the suspension type than the pin type of insulator. The cost of a suspension insulator string for a given voltage* is dependent on the number and the size of units, and is a minimum for a certain number and size. The writer points out these important considerations because they are applicable to designs yet to come into practice in this country.

Without a shadow of doubt, future long-distance

*The suspension insulator string should preferably be guarded and shielded in such a way as to increase the capacity and decrease the voltage stress on those units of the string near the line-conductor so that these units can withstand the excess voltages due to switching, &c.

transmission lines will, universally, operate at the highest commercial or permissible voltage. In this respect it is interesting at the moment to note, in the technical Press, the relative merits of the lately-installed 220,000-volt* system, and, incidentally, the writer would like to remark that eleven years ago he predicted the operation within ten years of such a transmission voltage.

The near future is likely to see a change in the empirical formula, expressing the most economical transmission voltage, for the reason that it omits the important factor, *specific cost of energy*. The amount and cost of power to be transmitted is a very important factor in determining the economical transmission voltage.

In the writer's opinion, the transmission system and voltages in common use—without in any way neglecting the introduction of new systems, such as the so-called "transverter" system—will be the three-phase, high-pressure transmission from generating stations to sub-stations or to other generating stations, or to both, for interconnection of power systems, at voltages of 20,000 to 100,000 volts or above, and three-phase intermediate distribution from generating stations to sub-stations or generating stations, or both for interconnection of power stations at about 6,000 volts to 20,000 volts. The above-mentioned transmission lines may be run for short or long distances, and may be tapped at any desired point. In the distant future we shall see the whole of the industrial parts of this country connected with a large network of interconnecting transmission lines between load centres, and these load centres will be supplied from local and super-steam stations and steam stations at the mines, and hydro-electric stations from sites situated both very far and relatively near the said load centres. The continuity of service will in consequence be well assured, and the necessity for spare plant will be greatly reduced, far beyond what can be obtained from any source of power supply in existence here to-day. The successful operation of these interconnected transmission systems will require complete co-operation of load dispatchers in control of the system operations.

Always when in doubt, install the higher-voltage system, which will, in the course of time, justify its adoption by reason of future growth not always apparent at the time the choice is made. A fairly common mistake has been the under-estimation of the ultimate demand for power and the consequent adoption of far too low a transmission voltage.

Looking well into the distant future—with particular reference to certain of our Colonies—the mechanical elements of design with the *very high* voltages will involve structural strains of a magnitude not hitherto encountered. The insulation and the separation of conductors will offer new features; the voltage regulation will require large equipment of an unusual type. The total losses on the line may make up a load on open-circuit sufficient to burn-out, due to overload, any one or perhaps more main generators, group of transformers, or converters, unless special conditions of using reversed field excitation, &c., are used.

As the total cost of transmission is practically inversely proportional to the power factor of transmission, more attention than is now given to present-day electric power systems must be devoted to the matter of the most economical phase compensation. Obviously, phase compensation is economical when the efficiency of transmission is improved and the annual expense of the system per unit of energy is decreased thereby. Large transmission systems such as we shall have in future will not be able to give satisfactory service without synchronous machines (condensers), and voltage control will not be accomplished satisfactorily at the generator alone. For successful operation of the lines anticipated, it will be necessary to have practically a uniform voltage along the line not only for one load, but for all loads. By maintaining constant voltage along the line, troubles, such as voltage rise due to dropping loads, and insulation strain, will be reduced. Synchronous condensers (distributed along the line) will have a tendency to act as automatic magnetic brakes against increases in voltage. In all cases, voltage regulation is greatly impaired by low power factor, and the efficiency of the line will depend on the amount and power factor of the load. When the power factor is not very low, the advantage of installing synchronous condensers, for lines *not* carrying large amounts of power, is questionable. The installation of synchronous condensers not only requires a certain amount of investment which is high, but the machines and transformers also consume energy to operate them. Moreover, the total energy consumed has to be transmitted over the line.

In the opinion of the writer, the use of earth wires should be encouraged, as their use is effective in reducing the higher induced voltages sufficiently to bring them close to the value which high-voltage apparatus and line and transformer and switch insulators can safely withstand. The *proper location* of the overhead earth wires is, obviously, above the power circuits, and not below them, which is the common practice in this country.

Lightning, switching and other phenomena cause disturbances on the line conductors. Lightning may affect all the line circuits simultaneously, but if circuits have different routes, simultaneous lightning troubles are not likely. In the opinion of the writer, the proper value of a section or length of iron wire as line conductor installed at the terminal ends of extra-high-voltage power lines as a protection against lightning and short-circuit current is not understood as it should be. By virtue of the higher reactance of such lines it might be possible in some cases to obtain sufficient reactance without the addition of current-limiting reactance applied in other ways. This is a question requiring investigation.

For long spans, where the strength of hard-drawn copper is not sufficient, the copper-clad steel wire is sure to find a ready application, and, in certain cases perhaps, the steel-cored aluminium cable may be used. At the present time copper-clad conductor is on the market which has a strength 150 per cent. greater than copper conductor. The limiting of short circuits is most desirable where aluminium conductor is used. The skin effect is quite appreciable in aluminium and copper cable with a steel core. Where conductors are supported on the same plane or in vertical order, the line current may be considerably unbalanced under no-load conditions. At the present time there is no recognised standard or basis for conductor calculations, with particular reference to the *maximum* and *average* values of power, voltage and power factor, &c. In the calculation of voltage loss for all the overhead extra-high voltage (a.c.) power lines now operating in this country, the simple impedance method, which neglects the electrostatic capacity of the line, may be used. It will give sufficiently accurate results for all practical purposes. The accuracy will depend largely upon the length and voltage of line, frequency and power factor. The total impedance drop should always be distinguished from the voltage drop. In the case of long lines (over and above 50 miles) the methods likely to come into general use are the different forms of hyperbolic functions and the convergent series. Many different graphical solutions for voltage drop and power loss are sure to be employed.

A transmission line is subject to damage maliciously done or due to accident, but, neglecting those, the writer considers that, at the present time, the weakest link in the complete transmission system is the insulator bushings at the line end and on extra-high-voltage transformers and switches.

Many years have gone by since the writer first recommended the delta-star connection (star on the transmission-line side) with neutral point earthed as the best all-round transformer connection: this practice is still recommended as the best.

* See *Journal* Inst.E.E., Vols. 46 and 47, 1911. On p. 167, Vol. 47, the writer stated: "I do not hesitate to predict that during the next ten years transmission lines will be operated at above 200,000 volts, but as to the ultimate voltage for practical operation of our lines I am unable to express an opinion."

THE HOMECOMING OF ELECTRICITY.

By J. W. BEAUCHAMP, M.I E.E., Director and Secretary of the British Electrical Development Association.

Characteristic of "The Review," as of the industry for which it has spoken for half a century, is the request that contributors to this issue should look forward rather than dwell upon the past.

The layman who loses no opportunity of observing that "electricity is in its infancy" is a stock jest amongst us, but we have perhaps been unfair to him; intuition rather than judgment, and an outlook unobstructed by knowledge of detail, may have revealed the truth that our business is always in its infancy in some direction or other, renewing its youth continually; the triumphs of the telegraph and telephone have become commonplace, electric lighting and power a necessity, and to-day we invade the field of heating, to-morrow, perhaps, to tap new sources of power, and again find electricity the readiest means of using them.

It is of particular interest at this moment to consider the infancy of electricity in relation to the home—it may promise something more than the saving of a little work; in rescuing the Englishman's wife from the dungeon beneath his castle in which she has lived so long, we are perhaps setting in motion a far-reaching social change, one which may give us the benefits sought by the constructive communist whilst preserving that individuality of life so dear to us, and probably essential to the fullest development of the human being.



J. W. Beauchamp.

The engineer of a large supply undertaking belonging to a municipality regarded as a model of local government, has recently stated that: "Electrification of the home is capable, even within the limits imposed to-day, of producing a demand for electricity far greater than all the other fields at present open to us."

In considering the electrification of the home, it is of interest to start not at the generating station or the mains, but in the house, and to work backward and outward, regarding the home as a unit or focus of social life, the family, its life and welfare, as the real object of the activities of the world, for scarcely anything is done which is not in some way or other designed to improve the individual, to make his life safer, fuller, and more productive of contentment to himself, and of benefit to the community as a whole.

Installation Work.—Much has been expected from the various surface wiring systems which have been brought out to reduce cost and to give us the cheapness and flexibility of "Continental wiring" without falling below the measure of safety which seems desirable in this country.

Although there are to-day many systems, so far nothing strikingly novel has emerged in this direction, nothing which can be described as a departure in principle, so there is still room for the ingenious inventor who can forget everything that has been done and approach from some new angle the problem of feeding millions of lamp points and outlets.

In Dundee some house wiring has recently been carried out by using one of the standard surface cables and running solely upon the walls of the building, along picture rails, and in similar positions, the lighting being effected by brackets and indirect illumination from the ceiling, heating and cooking from outlets on the walls in the usual way.

There is perhaps nothing very new about this method, but it contains a new idea, as the whole of the wiring installation is carried out in the vertical plane, and not in the horizontal; neither ceiling nor floor is interfered with—a valuable and distinct departure.

Those who carry out installation work to-day should use every endeavour to increase the number of outlets provided in houses and other buildings—this is of importance, and will become more so as tariffs are simplified, enabling any appliance to be attached to any part of an installation which has sufficient capacity to supply it.

A little trouble in selling extra outlets to consumers when installation work is in hand will bring a good reward to the contractor and the supply undertaking; the lack of ample outlet facilities is one of the most serious checks on the steady sale of appliances, which should be possible from time to time to every consumer.

Our wiring rules have been slowly hammered out, and apparently are never to be complete; the immediate future will probably see further modification of them, rather in the direction of setting up different standards for different classes of work, and in that way reducing the average stringency of installation requirements.

It is becoming obvious that electricity is so very much safer than any of the media which it replaces that we have unnecessarily hampered its development by insistence upon a standard for work of all classes which might well be modified in relation to the character of the buildings, the positions being treated, or to the amount of responsibility upon the installation when in use.

Lighting.—The lamp of to-day is cheaper than before the war, a testimony to the enterprise of the British lamp maker and to the immense demand which the world makes upon him at the present time; working as he must with costs perhaps 75 per cent. higher than in 1914, he now offers a modern lamp, in itself a triumph of the manufacturer's art, at less than pre-war figures, and when one analyses the cost of electric lighting, comparing the amount spent on lamps with the amount spent on electricity over a term of years, it becomes obvious that there is little to be gained by small economies in the buying of lamps concerning the manufacture and history of which one may be uncertain.

It is also worth while to bear in mind that the great lamp business of this country has done, and continues to do, a large amount of advertising: primarily intended to sell lamps, it has also had a most beneficial effect upon the industry as a whole. You cannot advertise lamps without telling the advantages of the electric light, and you cannot tell that story without, by inference, reminding the public of the advantages of electricity for all purposes. In this way the lamp makers' advertising has been valuable, and has brought to all sections much business not directly connected with the sale of lamps.

Electric Cookery.—This is becoming a subject by itself, almost with a literature of its own, and in the past two years development has been extremely rapid, resulting in figures and experience which show this business to be most desirable and unaccompanied by

many difficulties which were at first anticipated in connection with it.

The apparatus has been improved out of all recognition, and although there are hints of new and radical departures in method, the electric cooker may, with small improvement and slight variation, become a standard line almost immediately.

The most practical method and the safest for pushing the heating and cooking load at the present time is for supply undertakings, without waiting for further development, immediately to engage themselves in the business in a more or less modest way according to their conditions.

There can hardly be any supply undertaking which cannot find a dozen or so of consumers so situated on its network that a cookery supply is possible, and this should be put in action at the earliest moment. Experience will be gained, the manufacturer of cookers encouraged, and within a short time each engineer will know for himself exactly what the modern cooker can do, what it means to him in revenue, and in demand upon his plant and cables. To say that it will be an agreeable surprise is only to generalise from the increasing stream of experiences which come to hand.

In any case where it is not able to grapple with the domestic cooking business at once, a supply undertaking may well direct its attention to commercial cookery, the provision of apparatus in restaurants and other places where food is prepared on a commercial scale; the load factor of such apparatus is high, consequently its first cost is less alarming to the buyer, and experiences already gained are so promising as to show that in many operations quite a good price per unit gives every satisfaction.

Already notable success has been achieved in the cooking of pastry, frying of fish, roasting and boiling of meat, poultry, &c., for sale as cooked food. This is a line of business worth exploring. The apparatus is often so clean and attractive as to make a valuable shop or window display and generally impart a high-class air to the business.

There are great possibilities in this field of commercial cookery; already a great deal has been done on the Continent in the baking of bread and biscuits on a large scale, and within recent weeks an American bread oven of a novel type has been put into use here and illustrated in the technical Press.

The use of electricity for baking bread should offer a desirable night load to the supply undertakings.

Electric Fires.—The popularity of the electric fire grows so rapidly that in some cases the resulting load is embarrassing, but this need not be the case where full electrification takes place; a mixture of "occasional" fires and steadily used cookers produces a desirable load factor, but there may be a few cases where the cleanliness and advantage of the electric fire lead to such a considerable use during cold weather as to produce an embarrassing short-hour demand unassociated with any great annual revenue.

Recently, however, engineers with a considerable load of this kind have stated that the so-called "cold snap peak," although noticeable, is not sufficiently serious to deter them from pursuing the business, and it will probably disappear in the general rising of the load curve which is now taking place owing to the increasing variety of uses of electricity.

In acute cases it is worth while to consider whether the time has not come to deal with this difficulty by means of heat accumulation.

Water Heating.—The difficult problem of heating water by means of electrical energy has already been tackled with considerable success.

For small quantities the quick-boiling kettle and the various types of geyser are in extended use. Beyond their range, however, comes the possibility of heat accumulation, and already a good deal is being done in districts where an off-peak or night rate is in force.

It is well worth while at the present time for the supply engineer to give careful attention to this question of heat accumulation and night rates, and to call upon the manufacturers to produce suitable apparatus, and in the same way the maker of heating and cooking appliances might devote some of his time to the design of the essentially simple appliances necessary for this purpose, both for the heating of water and for the warming of rooms.

In the latter case we have perhaps to meet the principal and rather important drawback with the accumulation stove, that it gives off heat in the convective form, which is not popular or likely to become so in this country, but there seems no reason why a combination of the heat-accumulating convective stove with radiant elements should not be successful, putting upon the night-rate supply the heavy work of storing heat energy for warming the air of the room to a reasonable degree and making available also a moderate amount of radiant energy for use at will, by the occupant of the room, at ordinary rates and as a supplement to the cheaper energy taken during the night.

Although this problem is not new in England, its possibilities have been obscured by the feeling that it would hardly be practicable to sell electricity for heating on a large scale from any thermal generating station; but it is quite clear, from inspection of the load charts of power stations, even in industrial areas, that there remain possibilities of supply for heating in this way, the more so as the cheapness of electricity supply for all purposes must depend increasingly upon improved load factor.

It has become obvious already that supply schemes and long-distance transmissions under modern conditions and at present prices are hardly possible at the load factors generally obtained in residential districts, and can only be entirely satisfactory when the costly investment is loaded up to a high degree.

Power in the Home.—Here we have a field which neither gas nor fuel can touch; electricity alone makes it possible to bring mechanical aid to the labour of the home.

Already the vacuum cleaner is a commonplace item of domestic equipment.

The washing machine is selling in this country in an encouraging way, and many homes use electric motors for small tasks, such as polishing, driving sewing machines and fans, &c.

From one district a report comes of the brisk sale of central suction plants in homes of moderate size, the motor and exhauster being placed in the basement and the house piped with outlets in each room.

Here at least is a valuable line for the contractor to explore, and this may gradually bring us to the stage where mechanical power in the home is provided by one fixed electric motor rather than by a multiplicity of small ones carried about, one on each piece of apparatus.

It may sound fantastic to suggest turning the scullery into an engineering workshop, but it does not seem impossible to devise some simple countershaft with a motor which would look after the suction cleaning all over the house and be easily geared to a washing machine, boot or plate polisher, or other small apparatus.

Design and Construction of Apparatus.—Great strides have been made in the construction of domestic electrical apparatus; considering alone the heating and cooking appliance, it may be argued that it is little different in essence to-day as compared with ten years ago, but in fact the changes have been great. To make practical and "fool proof" appliances has not proved so easy as appeared at first, and the design of the modern cooker covers considerations with regard to the transmission of heat, expansion, and contraction, the production of alloys and insulating material—all of which together make the difference between an electric cooker and a mere box containing heating elements.

In addition it has been necessary to study practical details of importance to the user.

The equipment, as we know it, represents the needs and

the thought of the supply engineer, the manufacturer, and the cook, but still there are pieces of apparatus so essentially simple that the makers have not always thought it necessary to improve in details as the years go by—when it becomes necessary to carry out repairs one may still find nuts stamped out of sheet metal and tapped so badly that it is impossible to secure good contact without damaging the element wire; there is in some cases also room for improvement in design, temperature gradients across connections between heating element and conductor are too sharp, bolts and strips corrode too rapidly, and offer difficulty in carrying out repairs. Continued attention to these points is desirable, the more so as such improvements are generally inexpensive.

It is perhaps hardly safe to mention the question of plugs and connectors, the lack of interchangeability, and the necessity in many cases for more mechanical treatment of the terminals, and of the joints, generally too numerous, between the actual conductor wire of the installation and the element wire in the fire or other appliance.

There is still room for improvement in these accessories, and in connection with electric heating apparatus it may be taken as an axiom that if anything can possibly get loose in the course of working, it will certainly do so. It would not be unfair to say that many so-called cooker and fire faults which, in the mind of the consumer, are debited to the electric method, are really due to small and avoidable failures in connection with cords, wiring accessories, &c.

Influence of Electricity on Home Design, Cost and Maintenance.—A good deal has been said about the influence of electricity on the cost of running a home; certainly too much has not been said—the economy, particularly over a long period of time, is very remarkable. Not only are furnishings, fabrics, and even the clothes of the occupants made to last longer, the latter perhaps a two-edged consideration with regard to the housewife, but all these things remain in better average condition. Few people change expensive items of furnishings and equipment until they have come to such a condition that it is no longer pleasant to look at them by day or by artificial light, but where fires are cut out of the home and dirt is removed by sunction, the freshness and general condition of the equipment can be maintained over a very much longer period.

The influence, however, of the electric method is most marked on the first cost of building; taking an area where at the present time—and there are many—rates for electricity supply are sufficiently competitive with gas or coal, it becomes possible to restrict the use of fuel to one, or perhaps two, points, and to enjoy the advantages of electric light throughout, heating in most positions, cooking daily, and electric power for a good deal of the cleaning work.

Here we get a set of conditions which, if put fairly before the architect when drawing his plans, enable him to reduce the first cost of the building and also give him a great deal more freedom in designing.

The gas suppliers in connection with housing schemes have already pointed out the considerable saving which they can effect by the wider use of gas and by the provision of small flues within the brickwork of the walls in place of the usual full-size chimneys.

We can go much further than that, cutting out flues altogether, and leaving the full space of the room available, dispensing with fenders and fireplace furnishings, and at the same time allowing the occupant the use of inlet and outlet ventilators at the floor and ceiling of the room, which gives him more control over the air supply than is possible with the usual ventilation through the fireplace or gas stove.

ELECTRO-FARMING AND ITS FUTURE.

By R. BORLASE MATTHEWS, A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

When the goddess of fruitful harvests, Demeter, smiled upon Persephone, her daughter, the fruit ripened and the corn grew twice as quickly as at any other time. In this more utilitarian age, people look for aid to something more tangible than a mythological goddess, if they want to make two blades of grass grow where one grew before. It is to electricity that the farmer will have to turn during the coming decades, whether he desires merely to continue farming or wishes to wrest from the soil a living as good as, or better than, if he had followed any other walk of life. At the present time it would seem that a pretty healthy imagination is required on the part of most folk to visualise the agriculturist employing electricity to any extent. Engineers at any rate ought to have a good imagination, so this change in methods in the world's oldest—and still the largest—industry ought to be more easily assimilated by them than by the ordinary man-in-the-street. Talking of imagination reminds the present writer, who had the privilege of being one of Professor Perry's students, of the great stress that that gentleman laid upon the need for imagination as a most important part of an engineer's education. In the quaint way familiar to those who knew him, he pointed out how necessary it was for an engineer to read novels—of course, good ones—to help to train his imagination. To this end he insisted upon each of his students—who were apt to get far too engrossed in their technical studies—reading at least two novels per term. In order that there might be no excuses, he even provided a library of novels for the purpose. Since the readers of this article are obviously gifted with healthy imaginations (or else they would not be perusing this journal), the task of discussing with them the possibilities of the future of electro-farming will not be difficult.

There is something very fascinating in probing into the future. It is one of the great human weaknesses, as is evidenced by the large army of palmists, phrenologists, crystal gazers, fortune tellers, and the like. So when those mysterious plural personages, "The Editors" of the Electrical Review, asked the author to write a few notes on the future of electric farming, he said that apart from prophecy being a dangerous matter, it would be a very interesting task, though more in accord with the work of such masters of the scientific futurist novel as H. G. Wells or Jules Verne, or even old Moore of Almanac fame. However, "The Editors" very kindly pointed out that most people in course of time forgot a prophet's faulty prognostications and only remembered his successes. (It is to be presumed that when time proves a modern prophet to have scored a success, he nowadays gets his Press Agency to hammer the good news well home.) Though prevailed upon to act the amateur prophet, the writer does not propose to take too many liberties or too many risks. Experience has shown him that no future development comes eventually into continued existence, unless it is based upon sound scientific and mechanical principles. So few people have turned their imaginations to the possibilities of electro-farming that it is commonly regarded as an insignificant matter. They are, however, apt to sit up and take a little notice, when their attention is drawn to the fact that to-day, in this most industrial age, there are more men engaged upon agriculture than in any other single occupation in this world. Now if almost every other industry has taken considerable advantage of electricity, it does not take a prophet of much standing to prognosticate that one day farmers as a class will follow the example of other industrialists.

In the past, farming, on the whole, has not been

treated very seriously. Generation after generation of farmers has been contented to jog along on the lines of their forbears. And this perhaps is not to be wondered at, when the penalty of departing from precedent is apt to be so great, in the form of the loss of crops off many acres, or the loss of valuable stock. Again, the farmer has always been favoured with cheap (or seemingly cheap) labour—and it is well known that there is no deterrent to progress so great as cheap labour in industry. A farm is not like a factory, for the turnover is regulated by seasonal laws of Nature which cannot be modified to any really appreciable extent. The nearest simile in electrical work is that of the central electricity supply stations. These undertakings can never provide extraordinarily big profits, because the conditions of their service are such that they cannot turn their capital over often enough.

Another obstacle in the way of the electrification of farms is that there are, as yet, very few places where suitable electrical apparatus can be purchased. So far, the electrical engineer has not co-operated to any serious extent with the agriculturist. Thus, if a progressive farmer wished to-day to equip his farm electrically, he would have very great difficulty in doing so effectually, efficiently, and economically.

However, it is the business of this article to talk of the future, when of course these pioneer difficulties will have been swept away.

Farming a few decades hence will be very different from what it is to-day. Then as much will be known by farmers of the bacteriological and chemical conditions of the soil as is known by engineers to-day about the complex nature of steels. Electrochemical treatment of soils and electrochemical manures (to-day in their experimental stages) will be employed as a matter of course. The farmer is a notorious grumbler about the weather and most other things. In the near future, weather will have less and less effect upon his success, for he will be able to circumvent the weather by carrying out his work in spite of it. Illustrations of this are the making of hay and curing of sheaves of corn, in the actual ricks, instead of out in the fields. (This work is already being carried out on a full-size commercial scale on the author's farm.) By such methods the work can be performed, regardless of weather conditions, directly the crops of grasses or corn are developed or ripe enough to cut. Again, these crops will themselves be made to come to maturity in a minimum of time, and with a maximum of yield, by means of electrical treatment. (Already, to-day, 10 per cent. increase can be anticipated, with a possible gamble on a 50 per cent. increase.) Of course, the germination of the seeds will have been started in an electrolytic bath, so that when the process is carried further in the soil, a better plant and better fruit is obtained, which desirable result is further pushed on by the electric treatment. This electric treatment will, of course, be regulated in accordance with the weather. Under adverse weather conditions considerable use will be made of it, so that crops may not be set back, but will rather be caused to develop normally, in spite of the weather.

Prior to the sowing of the seed by means of electrically-operated drills, the cultivation will have been carried out by the aid of electric power. Naturally the crude plough of to-day, with its brute force method of attack on the earth, will have given way to electrically-operated implements on the principle of the engineer's milling machine (the precursors of these machines are already in existence). The cutting or working points of these tools will be so shaped and set as to operate on the earth at a maximum efficiency. Just as easily as metal cuttings flow away at the point of a high-speed steel tool, so will the earth particles flow away on the cutting points of the agricultural "ploughing" machine of the future—and the lubricant for the agricultural tool will be a discharge of electricity. (Already it has been discovered that an electrical leak on to a plough share facilitates its passage through the earth.)

After the preliminary "milling" of the soil, it will have to undergo an electric sterilisation treatment prior to the introduction of fresh families of the best types of bacteria most suitable for the particular crops to be grown. Electrolytic manures will also be introduced and mixed at the same time, until the whole field is the absolutely ideal life-giving material for the plants to be raised. Many fields will have permanent concrete bottoms laid a couple of feet under the surface, to prevent the stones and subsoil working up, and so altering the composition of the carefully prepared soil above. In seasons of drought, water would be sprayed over the crops at night by the aid of electrically-operated pumps, and automatic travelling suspended pipe lines.



[Photo by] [Elliott & Fry.

R. Borlase Matthews.

Just as the cultivation would be carried out by electrically-operated implements, so the reaping and harvesting implements would be similarly worked. In both cases, the machines will be electrically hauled over the soft ground by the aid of steel ropes. Some of these steel ropes will be provided with insulated copper cores to carry the current for operating electric motors on the implements, or from the master controllers on the moving implements to operate stationary electric haulage sets at the sides of the fields. Hedges between fields will have disappeared. Even now their maintenance is too costly; then the land will be too valuable. In the future, fences will not be required for the purpose of keeping live stock within bounds, for all stock feeding will be carried out in stables or stalls; yards adjoining will provide for daily exercise.

The feeding of the animals and the preparation of their food, the milking of cows, &c., will all be carried out by electromechanical methods. The necessary raw materials will be delivered at one end of the farm buildings, by means of a light electric railroad from the nearest main-line railway station; or from the farm itself, by the farm light electric railway to the same end of the buildings. All the machines, conveyors, &c., will be driven by direct-connected electric motors of one-third the weight and cost of present-day motors. At the same time the revolutions per minute will only be 60 to 150, to accord with the speed of the machines they drive. (A couple of these novel motors are already in existence in the author's farm experimental engineering workshop.)

A feature of the electric farm motors of the future will be their extreme robustness and simplicity. In

fact, all farm machinery in these coming days will be so designed as not to harbour dust, or be affected by falling dirt or rain. Every part of the equipment will be all of the absolutely fool-proof, press-the-button-and-we-do-the-rest type.

The main distribution of the electric current will be by means of bare overhead wires. Sub-circuits will be led off by means of special, easily fixed connections, through overhead straining block fuses, to those places

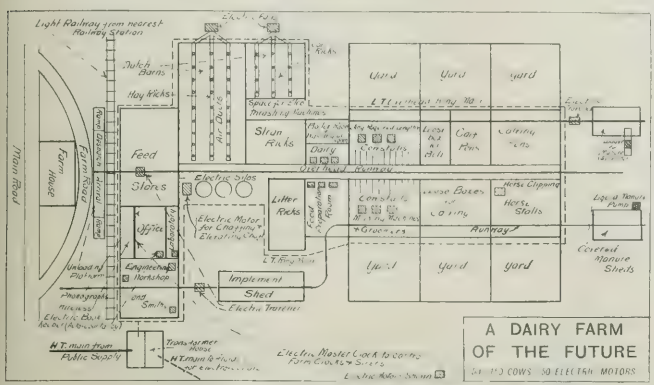


Fig. 1.—A Dairy Farm of the Future.

where electricity is required for use. The internal wiring will be carried out in toughened, protecting-sheathed wire—acid, alkali, and vermin proof. Screwless fittings (which automatically fix themselves when pressed against the bared wire) will be employed (these are already in existence on the author's farm), for in that day and generation, people will not be bothered with small fiddling screws or the high cost of labour for connecting the fittings of to-day to the circuit wires.

Water heating and the heating of foods will be carried out electrically by means of heat storage devices which use current in the off-peak hours.

The lay-out of the farm buildings will be designed by efficiency engineers. The average size of each farm will be much greater than it is to-day. Specialisation in products will also be a prominent feature, for the ultimate success of any business, farming included, depends upon the ability to carry it on in a better way, in some aspect, than any similar existing business. The intelligence of farm hands will be greatly increased, and likewise their wages. In fact, the skilled mechanic will be able to return to the land, for there he will find a good opening and a healthy life awaiting him.

In conjunction with the farm of the future, various seasonal rural industries will be incorporated. The nature of these industries will be such that they will lend themselves to winter work, and save the transport from the farm of products and by-products eventually needed on the farm. In this way, the load factor of each rural district will be maintained at an attractive figure. After all, farm loads cannot be considered in the isolated sense by the central-station engineer, because developments of the use of electricity on the farm itself will lead to developments in the surrounding district.

Of course, in the future, no farmer will think of obtaining a supply of electricity except from a central station. The central-station engineer of to-day is shy of the rural supply. He certainly must continue to be so, as long as he does not do his share in assisting the farmer by showing him how he can use electricity in agriculture. It is usual to say that the farmer is very conservative, and also that he has no money. Now, the successful farmer does not like the outsider to know what are his profits. But just watch him when he goes to a pedigree cattle sale: a recent sale of this nature averaged £1,100 each for 100 beasts, one or two selling at about £3,000 a head. A present-day tractor with a suitable plough and other equipment makes a hole in £500—there are now over 20,000 tractors in use in this country. A thrashing machine averages £500, and there are thousands in use. In good times a manufacturer will turn out 30 or so a week. Recently a German firm's output of electric ploughs, averaging £1,200 each in value, was 160 in one week. Hence the farmer to-day, in the aggregate, is finding huge sums of money for things which he knows will return him a profit. It is therefore easy to deduce that he will find the finance just as readily for electricity when he is convinced of its merits. But to assist him in this direction he needs co-operation on the part of the electrical engineer.

If every farm in this country were provided with the average electrical equipment of the best Continental farms and that of the author's farm, the energy supplied for farming alone in this country would far exceed the total consumed to-day for *all* other purposes. But the big electro-farming developments have still to come, as has been suggested above. This gives one furiously to think (to translate literally a French idiom). The whole question of electro-farming is already far more than well-worthy of consideration to-day; it should be vigorously and intelligently pursued.

In 1908 the present author contributed a series of notes on the commercial development of electricity supply undertakings to the columns of the Electrical Review. Therein he summarised his experience (gained prior to that date) that the best way to increase the load on a central-station supply system was by educating the public as to the possible applications of electricity in their homes and businesses. Looking back to that date, and observing the progress that has been made in central-



Fig. 2.—The Farmer's Method of the Future.
Testing the temperature whilst curing hay the electric way—without sunshine—on Greater Felcourt Farm, East Grinstead.

station supply in the intervening period, it must be realised that many of the proposals then discussed have since been put into practice. There has been, however, far too much dependence upon Father Time. The magnitude of the potential—though at that time generally unappreciated—demand is reflected in the large generating sets which are nowadays as standardised as the 500-kW and 1,000-kW sets of a decade ago. The education of the consumer has made them necessary.

Given sufficient time, electro-farming will develop to an even greater extent. But by following the self-same principles of education and co-operation, the development can be encompassed in a very few years from now. The choice of slow or rapid development lies in the hands of the central-station engineers.

THE PRESENT AND THE FUTURE OF THE ELECTRIC VEHICLE.

By F. AYTON, M.I.E.E.

Up to the present the demand for electric vehicles in this country has come mainly from municipalities for use in connection with the work of refuse collection. Electrics, in considerable numbers, are to-day employed for this purpose, and it can be asserted that, in practically every instance, they have demonstrated their superior economy and other advantages as compared with the alternative methods of collection, so much so, indeed, that cities like Glasgow, Birmingham, and Sheffield have gradually acquired fleets of significant proportions. The electric vehicle has also proved highly economical and useful in other departments of municipal service, *e.g.*, street watering, cartage of road material, gully emptying and cleansing, general carting, emergency service in connection with electric supply departments, tramways, and also for ambulance duty. Those who are aware how effectively the electric has made good in this sphere of utility can have little doubt, if any, that its employment is likely greatly to increase in the near future, for in the particular uses referred to, economy and reliability are cardinal desiderata.

While the adoption of electric vehicles for urban and suburban transport by manufacturers, merchants, tradesmen, and the like has not progressed to the same extent as it has in the case of municipalities, it is nevertheless the case that there are many firms using electrics and not a few possess fair-sized fleets, as, for example, Harrods, Selfridges, Boots, Whiteleys, Hay's Wharf Cartage Co., and many others, including several large breweries. There is also the example of the large railway companies—the Midland (with close upon 100 vehicles), the Great Western, Great Eastern, and others. There can be no question that electrics are used by business houses and by railway companies to the extent they are, solely because, for the special services in which they are employed, they offer the most economical and reliable form of transport. One can safely assert that the same considerations have guided local authorities in their selection of this type of motor vehicle for certain classes of work.

That the adoption of the electric vehicle has not made greater progress since the termination of the war is, in the main, to be ascribed to two causes: First, the large numbers of re-conditioned Government petrol vehicles which have been disposed of at low prices, and this during a time when, due to abnormal wages and cost of materials, the prices at which electric vehicles could be purchased were comparatively high; and, secondly, the lack of adequate charging facilities in different towns and cities.

The British-built electric can be bought to-day at about half the price which had to be charged for it in 1920 and 1921. It has frequently been asserted that the prices quoted for British-built electric vehicles were too high, and the suggestion has been made that they included an inordinate amount of profit. As an answer to this totally erroneous view, it may be stated, as an incontrovertible fact, that, in this post-war period, no British firm building electric vehicles has made any profit worth speaking of—indeed, it would be safe to say that most, if not all of them, have made losses on the business done. I would ask those who are so ready to assert that the first cost of the electric is too high to bear in mind (1) that, if the demand for this type was to any extent comparable with that for petrol vehicles, the manufacturing costs could undoubtedly be reduced and consequently the selling price, but at present the demand, by comparison, is small and consequently production upon a similar basis is out of the question; (2) that the useful life of the electric is at least double that of the petrol vehicle, and the operating cost, under equal conditions, appreciably lower after allowing for interest on outlay, depreciation, &c. Consequently, at the much reduced and very moderate initial cost of the electric vehicle ruling at the present time, it is one of the best possible investments where short-distance haulage is concerned.

Owing to the enterprise of certain electricity supply undertakings, properly-equipped charging stations are in existence in a few cities and towns, but there yet remains much to be done by electricity supply authorities in providing such facilities before any considerable expansion can be expected in the use of electric road vehicles by the commercial community. It is to be hoped that those responsible for the management of electricity supply undertakings, now that they have got over most of the difficulties resulting from the war, will see their way actively to encourage the employment of electric vehicles, not only by the adoption of a reasonable tariff, which is very necessary, but by laying out the comparatively small amount of money required to provide permanent battery-charging service.

I can assert, from my past experience as a supply station manager, that the demand for energy for vehicle battery charging is well worth taking some trouble to cultivate. It can be made an off-peak load—a night-time demand occurring when the ordinary power user is not taking a supply and the winter evening lighting peak is well on the wane. It should be possible, in the case of most undertakings, to make this particular business a remunerative one by a charge for electrical energy of not more than 2d. per unit, metered into the battery at the correct voltage; a few undertakings, I understand, are now charging less than 2d.

There can be little hope, generally speaking, of getting electric vehicles adopted by business people, unless the local supply authority first of all puts itself in a position to give battery-charging service. It is seldom that a firm employing road transport for town work can be induced to make a trial of an electric vehicle if it necessitates the installation of charging plant. Once, however, a firm has made such a trial, it is usually the case that it is so convinced of the economy, reliability, and other advantages possessed by the "electric," that it proceeds to order more electric vehicles, and then, most likely, installs its own charging plant. Where public charging facilities exist in the locality, it is usually not difficult to persuade a firm to order a trial vehicle and then, of course, the electricity supply undertaking benefits by securing a further outlet for those profitable off-peak units. But this must be remembered by those in charge of supply undertakings who are anxious to cultivate this class of demand: facilities, more or less permanent, and most certainly adequate, must be provided before any demand can, in most cases, be expected. I am aware that there are cases where the supply authority has difficulty in providing charging facilities for want of space on which to erect a building in which the vehicles can stand during the night—the time during which charging is carried out. A covered place is certainly necessary for this purpose, and, for this provision, it is only reasonable that a garage fee be imposed upon the vehicle owner in addition to the charge per unit for the energy supplied. In Ipswich, for example, the garage charge is 16s. per vehicle per week, which is additional to the charges made for electrical energy (2d. per unit), supplying distilled water to the battery, cleaning, &c.

When it is not feasible for the supply authority itself to provide the charging station, it ought not to be a matter of difficulty to arrange with a local motor garage proprietor or an electrical contractor to provide such facilities, the authority loaning him the necessary motor-generator and switchgear at a merely nominal rental which, starting at almost nil, would rise, as the charging business grew, to a reasonable figure, the charge for energy being fixed at a specially low figure, so that, allowing for losses in conversion, it might be possible for the proprietor or contractor, as the case might be, to

secure a fair and sufficiently encouraging profit on the units used. In most cases it would, no doubt, be necessary to subsidise the firm during the early stages of building up the battery-charging business, and this would not seem unreasonable, having regard to the fact that it is very rarely that a business in a new line can be built up without a loss being made in the first year or so. To have electric vehicles running in any town is a very good advertisement for the electricity supply undertaking. Whether the charging service be provided by the supply authority, or indirectly, by the alternative just mentioned, it is essential that the staff of the supply department be willing and competent, in the early stages at least, to give advice upon the proper methods to pursue in the charging and maintenance of batteries. It is upon the sort of attention given to these matters that the success or failure of the electric vehicle depends. It is a simple matter for anyone with electrical training to become capable of giving such advice.

Up to now the limited radius of action of the electric, due to battery capacity in relation to battery weight, has made it the competitor of the petrol vehicle only when the latter is employed on service which comes within the sphere of the former. Actually, the main competitive form of transport in that sphere is horse haulage. Horse haulage is, however, rapidly being displaced by motor haulage in our large towns and cities. At the moment the substitution is by petrol much more than by electric vehicles, and at an operating cost considerably in excess of what it would be if the last-mentioned type were more generally employed.

No doubt the recent reductions in the cost of motor spirit will tend towards helping the further adoption of petrol vehicles for urban transport. Those, however, who are in a position to form a judgment upon the matter, know quite well that there cannot be any stability with regard to the prices of petrol, and that they are certain to rise again with any general revival of the world's trade. The oil resources of the world are limited, and it is a fact that, until the trade slump came, the demand for petrol was actually increasing at a much greater rate than new sources of production were being revealed.

It is noteworthy that, at the International Liquid Fuel Congress held in Paris a few weeks ago, M. Daniel Berthelot uttered a warning in regard to the world's petrol supplies. At the present rate of consumption he estimated that they would be all exhausted at no very distant date. He remarked: "The generation which has seen the rise of the petrol industry may yet see its fall." Another authority upon the subject, Prof. W. S. Boulton, in a recent address delivered in Birmingham, expressed the belief that "the natural oil age would be very transient." A shortage of petrol would therefore appear to be fairly certain in the near future, with consequently soaring prices. Such an eventuality is bound to have effect in extending the employment of electric vehicles, especially when one considers that the cost of electrical energy will in all probability, continue to decrease.

So far as the chassis, motors, and transmission are concerned, the design of the modern type of electric has reached a stage in which no startling change would appear likely in the next few years. Where improvement may very probably take place will be in the type of batteries, though it must be said that present designs of lead-plate and nickel-iron-oxide accumulators, as supplied by well-known makers, give very satisfactory service.

There are good reasons for predicting the employment of electric vehicles upon a considerable scale in the near future. It will, no doubt, be mainly in urban areas, but any improvement upon the present types of battery in the direction of increased capacity per unit of weight will widen the field of utility, and if, concomitantly with such improvement, we come to the establishment of the battery exchange system and sufficiently numerous exchange stations, it will undoubtedly lead to electrics being employed in rural or long-distance transport. With the improvement which is continuously in progress in road construction we may very likely see the electric entering this wider field of employment at no very distant date.

The immediate expansion, however, will be for urban and suburban delivery service. The horse is gradually being eliminated in this work, and the petrol vehicle will be found too expensive as his substitute. Gas-producer internal-combustion engine lorries may have a certain vogue, but it is doubtful whether, on account of the fumes emitted, they would be permitted, on any considerable scale, in towns and cities. Users of transport will eventually be forced to the use of electric vehicles on the score of economy in operating cost alone. A comparatively enormous field for development exists in connection with haulage and transport in our urban areas, and I look forward, with confidence, to also seeing large numbers of electric vehicles employed within the next few years in taxicab and private car work—it is something which is bound to come.



Frank Ayton.

Any consideration of the present position and the future of the electric vehicle must necessarily include a reference to electric trucks, those wonderfully useful and handy little vehicles, the employment of which has resulted in large savings in handling expense to the now considerable number of firms employing them. Their use is extending at a far greater rate than is the case with the road vehicle, and it will not be long before those who adhere to the hand-barrow method of moving goods and materials in and about factories, warehouses, railway terminals, docks, &c., will be looked upon as hopelessly out of date.

Battery Charging.—A new method of charging batteries for electric vehicles is described in the *Electric Vehicle*, which is claimed to reduce the initial outlay on charging equipment and also to obviate loss of power. A 5-wire balancer is used; unlike the motor generator, it does not have to transform the total energy consumed, but deals only with a small fraction thereof. When the load is balanced, it simply runs idle across the 110 V mains and takes little power, but is continually on the *qui vive* to see that no one leg of the 5-wire circuit gets a higher pressure than 110 V.

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THE FUTURE OF RAILWAY ELECTRIFICATION AND ITS CONNECTION WITH POWER SUPPLY AND DISTRIBUTION.

By SIR PHILIP DAWSON, K.B.E., M.Inst.C.E., M.I.E.E., M.I.Mech.E.

The electrification of main-line railways has been practically at a standstill in Great Britain since the last years of the war. Although the electrification of the North Eastern between York and Manchester and that of the Brighton Railway between London and Brighton has been discussed, no active steps have as yet been taken to carry them into effect.

Not so on the Continent of Europe, more especially in Central Europe, and it may prove a surprise to some people to find that the mileage of electrified main lines operated by electric locomotives is 3,240 miles on the Continent of Europe as compared with 2,030 miles in the United States, and that there are in round figures some 1,100 electric locomotives either running or nearing completion, in Europe, as compared with some 350 in the United States.

So far as Great Britain is concerned, electrification has taken place more especially in the case of purely urban railways operated by multiple-unit stock.

Tables I and II give a general idea of the work so far carried out or in process of completion in connection with main-line electrification.

It is not only in districts where water power is available and coal scarce that such works have been carried out, although this was the condition which was largely responsible for the electrification of the Swiss, Italian, Bavarian, and Austrian State railways.

Thus in the case of Prussia, the 110 miles of route between Magdeburg, Leipzig, and Halle is supplied with energy from a steam-driven station located on a brown-coal field which at present furnishes energy to the 62 electric locomotives required for the operation of this section of line. In Silesia, in the neighbourhood of Breslau, between [illegible] Königszelt and Görlitz, lines comprising [illegible] miles of route, and on which 77 electric locomotives are in service, are operated entirely electrically, and are supplied with current from a generating station [illegible] coal field.



Sir Philip Dawson.

TABLE I.

	Miles of main electrified route equipped	Electric locomotives in service
[illegible]	800	2
[illegible]	500	2
[illegible]	500	151
[illegible]	165	21
Sweden	280	17
[illegible]	2,240	792
Italy, three-phase	500	150
U.S.A., single-phase	630	126
U.S.A., d.c.	1,400	213
France, d.c. [illegible] and projected	400	138

Whereas France and Holland have decided to adopt 1,500 volts d.c. as the standard for their railways, Germany, Austria, Switzerland and Sweden have definitely adopted the single-phase system for the whole of their railways, with a line pressure of 16,000 to 17,500 volts and a frequency of 16⅔ periods. Italy has also adopted alternating current on a large scale in the form of 3-phase current at a line pressure of 3,000 volts and a frequency of 15 periods.

TABLE II.

Summary	Miles equipped or being equipped.	Electric cars running or on order.
Europe, single-phase	2,240	792
U.S.A., single-phase	630	126
Total, single-phase .	2,870	918
Europe, three-phase ...	500	150
Europe, d.c.	500	138
U.S.A., d.c.	1,400	213
Total d.c. (carried out and under construction)	1,900	351

It is interesting to note that Mr. Kolman von Kando, who originally installed the three-phase system on the Valtellina line between Lecco and Sondrio in 1900, and later acted as adviser to the Italian Westinghouse Co. at Vado Ligure, near Savona (now taken over by Brown, Boveri), is at present working on a split-phase locomotive which will collect current from a single-phase overhead conductor, although three-phase motors with a pole-changing device and operating in concatenation will actually propel the locomotives.

A further development which may very largely influence railway electrification is the Lenz gear, now undergoing successful tests in Germany. It is very efficient and simple, and does away with all mechanical gearing. Its use would enable synchronous single-phase motors to be used operating at 50 periods off a single-phase line.

The tendency so far in Central Europe has been to generate the current required for single-phase railways directly as single-phase current of low periodicity, both in steam and hydro-electric stations. The same thing holds good of the low-periodicity three-phase current required by the Italian State Railways.

The Swiss engineers strongly contend that under any circumstances, no matter what system of electric traction is adopted, the railway supply and the general supply should always be kept entirely distinct.

In the United States, on the other hand, whilst some single-phase as well as d.c. railways have their own generating plant, and whilst in some cases single-phase current is generated as such, there are many other examples of both d.c. and single-phase traction where the current for traction purposes is taken from a common supply station.

The conclusions arrived at in the report on a super-power system proposed for the region between Boston and Washington are all in favour of a joint supply for all purposes, including railway electrification, and similar conclusions have been arrived at in this country. With the spread of large networks of high-pressure transmission lines, such as are now rapidly being in-

stalled all over Central Europe, and more particularly in Germany, it is practically certain that for all the large extensions of railway electrification now contemplated and under discussion, the railway supply will be furnished from stations serving all demands.

The great spread of railway electrification in Central Europe is the direct result of the rise in the cost of fuel, the rise in wages, and the eight-hour day. These factors have upset all previous conditions of railway operation, and greatly increased the already considerable benefits to be derived from electrification.

Railway electrification in its turn will bring electric power within the reach of all, and into districts which otherwise could not have benefited by it. The farmer in Germany and Switzerland has not been slow to appreciate the benefits to be derived from the use of electricity, and it is true to say that there are few villages or farms in Germany to-day where electricity is not in general use for thrashing and many other agricultural purposes, as well as for lighting, and this even in the areas where coal is plentiful.

Germany, both during and since the war, has developed extraordinarily both the generation and transmission of electric power, and some of the more recent capital stations established in that country are given in Table III. It will be seen that there are various

Table III.

	Output in millions of kWh.	Plant installed in thousands of kW.	Plant on order or under c'nst'ction.	
Zschornevitz (Saxony) ...	754	128	15	BC
Trattendorf ,, ...		20	135	
Rheinisch Westfälische Elektrizitätswerke	749	112	362	C
				BC
Cologne Kraftwerk Fortuna	156	40	32	BC
Borkum Elektrizitätswerk Westfalen	172	44	10	C
Elektrizitätswerk Hagen, Westfalen	103	36	12.5	C
Hirschfelde (Saxony) ...	66	40	20	BC
Berlin City Electricity Works	198	195		C
Oberschlesischer Industriebezirk	405	84	—	C
Laufenburg (Switzerland) ...	309	50	—	W
Augst ,, ...	91	17	—	W
Walchernsee (Bavaria) (nearing completion)	—	110	—	W

B, brown coal; C, black coal, W, water power.

groups of large new super-power stations, some built on the brown-coal fields near Cologne and on the brown-coal fields of Saxony, and others operating on black-coal fields or worked by water power.

Thus at Cologne there are several stations located on the brown-coal fields, one belonging to the Stinnes interests (Rheinisch Westfälische Elektrizitätswerke) with one station, including three 60,000-kW sets, each comprising one turbo-alternator and one transformer, another the Fortuna Works, and one belonging to the municipality of Cologne with 16,000-kW sets. Then there are the two large stations of Zschornevitz and Trattendorf, located on the Saxon brown-coal fields, which transmit at 100,000 volts to Berlin nearly 100 miles distant with sets of 22,500 kW and 45,000 kW respectively, and the station of the Saxon Government with 20,000-kW sets; in addition there are the railway generating stations near Bitterfeld on the brown-coal fields supplying the Magdeburg-Halle-Leipzig line and the station in Silesia, near Galatz, on the black-coal fields supplying the electrified sections of the State railways near Breslau between Laubar and Konigszelt. Further, there are several stations located on the black coal of the Ruhr and Westphalia connected up with waste-heat stations.

There are, in addition, the large hydro-electric plants now being installed in Bavaria, which will shortly be completed. Most of these stations are, or are being, interconnected with a 110,000-volt transmission line, which will shortly cover the whole country and interconnect the brown coal fields of Cologne and the black coal fields of the Ruhr and Westphalia, with Hanover and Berlin on the one hand and with the hydro-electric plants of Bavaria and the Rhine on the other.

The brown-coal fields of Central Saxony are connected up with Berlin on the one hand and with the brown coal fields near Dresden, the black coal fields of Silesia and the water powers of Bavaria and the Rhine on the other.

There exists already a very extended network of high-pressure transmission lines all over the country which are, or will be, connected up with the main trunk 110,000-volt transmission system. How completely Germany is equipped with super-station transmission and interconnecting lines is shown in the map specially prepared for this article (p. 744).

If we examine the map of Central Europe in the light of the German progress of electrification, we see that it cannot be very long before the main-line railways between Berlin and Breslau will all be electrically operated. The financial results already obtained on the electrified lines are sufficient to warrant this anticipation, and plans for such extensions are either complete or in process of being completed. The same thing holds good as regards the lines connecting Breslau and Munich, which will link up the lines already electrified in Silesia with those of Bavaria. The whole of the Swiss Federal railways are now in process of electrification, and it will not be many years before the steam locomotive has entirely disappeared in Switzerland. In Czecho-Slovakia, too, great schemes are in hand to develop the water power and the brown and black-coal fields, and simultaneously to electrify considerable portions of the State railway. At no distant date we can therefore look forward to trains entirely operated electrically running from Berlin to Breslau, to Munich and Vienna, and from Vienna to Munich, Vienna *via* Innsbruck to Basle and Basle to Milan, Genoa, Ventimiglia and Pisa.

It will be noted that whilst water power will generate the current for the Austrian, Bavarian, Swiss, Swedish and Italian railways, it will be brown and black coal which will be utilised in the case of the Prussian and Silesian lines; whilst a combination of hydro-electric and brown-coal stations will be utilised in the case of the Czecho-Slovakian lines.

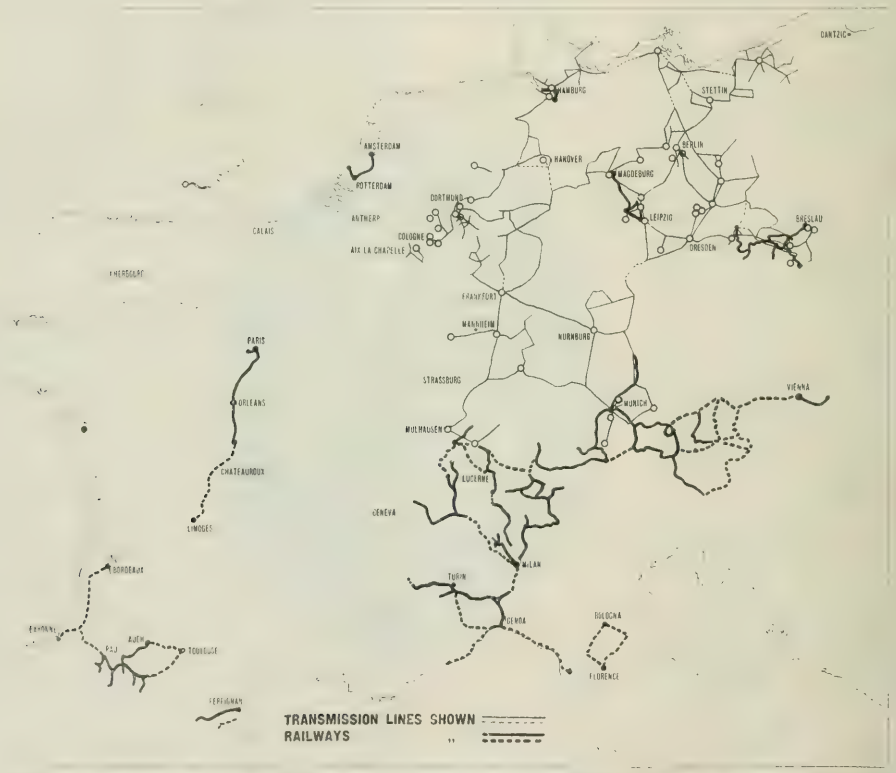
Although the low periodicity of 16 periods has been adopted for single-phase railways on the Continent of Europe, 25 periods has been quite successfully adopted, and on a very large scale, in the United States as well as on the Brighton Railway.

It is interesting to note that since the war, in Germany, Austria, Switzerland and Italy the policy of the Governments has been to encourage and proceed with the electrification of large portions of their railway systems, as well as with the construction of the necessary thermal and hydro-electric power plants and transmission lines, and with the building of the large number of electric locomotives required therefor. This has usefully employed a large number of skilled men, who but for this would have been without work. The contrary policy has been adopted in this country, where since the war electrification has been practically at a standstill, and largely owing to political causes and to the late Government's apathy may remain so for a long time to come.

The electrification so far carried out in this country has proved of great benefit to the travelling public, and has been most satisfactory to the shareholders, a fact fully admitted and stated over and over again by the chairmen and general managers of our railways. It has been shown that even with the increased cost of labour and materials, the electrification of such systems as the suburban system of the South Eastern, the suburban and main-line system to Brighton of the L.B. & S.C. Railway Co., and the suburban system of the Great Eastern would result in a return of from 10 to 18 per cent. on the capital expenditure involved thereby. The above electrifications would at once render not only possible but necessary the erection of two capital stations in the London electricity area which would materially assist in the supply of more abundant and cheaper electricity for all purposes, and which, having regard to this [illegible] output and satisfactory load factor could be operated at a profit, and show a handsome return on the large capital expenditure involved.

The preceding schemes have been thoroughly and completely investigated, so that had a decision to carry them out been arrived at, orders for a large portion, even if not for the whole, of the work involved could have been placed at once and would have given occupation to skilled workmen in all parts of the country. There would have been no difficulty in so dividing the various orders as to furnish work to a large number of manufacturers of locomotives, rolling stock, electrical equipment, boilers, piping, pumps, and accessories, coal and ash-handling plant, steam turbines, electrical plant and apparatus of all kinds, cables, rails, structural steel work, cement, &c., &c., all over the country, just at a time when our manufacturers are most in need of orders to keep their works going. But for reasons, the real cause of which it is difficult to get any satisfactory explanation for, the wise policy pursued in other countries of assisting to carry out work of Trade, in a recent report, referred to several water powers in the North of Scotland which might be well worth developing if an immediate sale could be found for a part, if not for the whole, of their output, and it is quite conceivable that the development of some of these might, in conjunction with the electrification of certain portions of the railways in the Highlands, prove an attractive proposition.

There are several examples in Central Europe where the study of railway electrification has been carried out in conjunction with proposals for new and improved waterways, the construction of which is dependent on utilising successfully the water power resulting therefrom. The most important of these schemes which has reached the stage of commencing to be realised is what is known as the Main Danube Canal, the financial success of which was to be brought about by disposing of the electrical energy produced by the hydro-electric



Map of Central Europe, showing Electric Railways and Main Transmission Lines, Completed and Projected.

which would have been of the greatest benefit to the travelling public, would have brought practically an immediate return on the capital expenditure, and would have given employment to tens of thousands of skilled British workers, has not found favour.

There are other equally sound and attractive electrification schemes, some of them sufficiently advanced to enable them to be taken in hand at once, such as the electrification of the North-Eastern Railway main line from York to Newcastle. Others not quite so advanced, such as the electrification of the lines round Liverpool, Manchester, Leeds, Bradford, Glasgow, and the South Wales coalfields, to name but a few instances, could be looked into with a view to enabling work on them to be taken in hand at no distant date.

There is another [illegible] in connection with which an investigation as to the possible benefits which might be derived from electrification should be undertaken. The Water Power Resources Committee of the Board

plant erected along the banks of the canal. The scheme was thoroughly investigated by a commission appointed by a "Studien Gesellschaft" created in 1917, representing the various German States, the German Government, the large cities through which the canal had to pass, and the large industrial and financial groups. The result of this very thorough investigation showed that the interest on the whole capital required for the construction of the canal and the hydro-electric stations would be provided by the profit made out of the electricity supply, and that the receipts from shipping passing through the canal would be additional profit.

The above scheme is the only one on which work has actually been started, but there are others, such as the canalisation of the Neckar in Wurtemberg and the Elb-Danube canal in Czecho-Slovakia, which have been carefully and fully worked out and which would incidentally enable a considerable amount of hydro-electric power to be developed.

The schemes referred to are similar to the project elaborated before the war by Siemens-Schuckert and the A.E.G. in Russia, whereby these firms secured the concession for canalising the Dnieper, which, when completed, would have enabled large craft to go from the Baltic to the Black Sea, and, incidentally, would have enabled hydro-electric power of over 250,000 h.p. to be developed, all of which would have been easily disposed of in the Donetz iron and coal regions.

France is proceeding with the electrification of her main lines, such as that now in process of realisation by the Orleans and Midi Railways, and is utilising and developing for this purpose the water powers to be found in Central France, on the Rhone, and in the Pyrenees. Incidentally, this will result in a transmission system in France such as exists in Germany, interconnected with the large steam super-stations recently completed in Paris and in the Lens district.

In Spain important main-line railway electrification schemes are under consideration. Holland and Belgium have also main-line electrifications projected or in course of realisation, which will depend for the supply of their electrical energy on thermo-electric stations.

Experience has shown that whilst in mining and industrial areas railway electrification may be an accessory to the installation of super-power stations, the contrary will generally be the case in non-industrial districts where the electrification of railways will dominate the situation, and render possible the establishment of economically-operated super-stations. This will result not only in benefiting existing consumers, but also in the supply of districts hitherto unprovided for, thus rendering electricity available for purposes such as agriculture and cottage industries, for which otherwise it could not have entered into consideration.

As far as railway electrification in Europe is concerned the future seems to lie in the extension of heavy main-line long-distance traffic, both passenger and goods, operated by means of electric locomotives.

As regards this country, there are still a considerable number of suburban electrifications to be carried out operated by multiple-unit stock; indeed, with about two exceptions, this is the only electrification in which we have so far taken any serious interest in this country.

There can be little doubt, however, that the future will bring about long-distance electrification also in this country, and this problem has to be looked at from quite a different angle and considered on a far broader basis than has hitherto been found necessary in considering local electrifications, such as those which for many years have been successfully running in this country. Far more attention will then have to be given to the experience and results obtained on the Continent of Europe, where heavy electrification is so extensively being adopted and is already working on such a large scale, than has been hitherto given or been necessary.

The operating conditions on a line like the single-track Rocky Mountains division of the Milwaukee, St. Paul, and Paget Sound Railway, with very few trains a day, where speed can be varied so as to improve load factor, are totally different from any condition under which electrification in this country is conceivable.

Experience such as can be gained from the operation of a line like the New York, New Haven, and Hartford, the New York Central, and the Pennsylvania Railway will be of considerable assistance, coupled with that gained on the Continent of Europe, in bringing about the development and the standardisation of the electric locomotive.

ELECTRICITY IN THE PROPULSION OF SHIPS.

By HENRY M. HOBART, B.Sc., M.Inst.C.E., M.I.E.E., M.Am.I.E.E.

In addition to the electric lighting of ships, which was promptly introduced in the early days of the electrical industry, other wide applications of electricity are now being made on board ship. The most interesting is that of using electrical machinery for propulsion. The writer has never made a serious study of the history of the subject. The earliest suggestion of which he has knowledge relating to the use of electrical apparatus for the propulsion of ships is that made by Heilmann in United States Patent No. 602,325 of 1898. The application was filed in 1895, when the Electrical Review was 23 years old. Heilmann proposed the use of a direct-current generator driven by a steam engine and delivering energy to propeller-driving direct-current electric motors. The following paragraph is quoted from the patent: —

"The engines are by this system not compelled to occupy a certain position in the vessel nor to have their crank shafts at a certain height, and they may be chosen of a perfectly balanced type completely exempt from vibrations. The propelling screws may be arranged in any suitable and effective manner."

The earliest electrically-propelled ship of any size of which the writer has any information was a 1,100-ton oil tanker used on the Volga River in 1903. This ship was fitted with Diesel engines, each of 120-h.p. capacity. Each engine was directly connected to a direct-current generator. The three propellers were each fitted with a direct-current motor, and the ship's speed was some seven to eight knots.

In 1908 two electrically-propelled fire-boats were placed in service by the city of Chicago. These fire-boats were propelled by twin screws independently driven by direct-current electric motors which derived energy from 200-kW direct-current generators mounted on the shafts of 1,700-r.p.m. steam turbines. The electrical equipments for these boats were designed by Mr. W. L. R. Emmet.

In September, 1913, the Diesel-electric canal-type tank barge *Tynemount*, of 3,400 tons displacement, made her first trial trip. She was designed and fitted under the supervision of Messrs. John Reid and Henry A. Mavor. The writer had the pleasure of being aboard during her first trial trip, and recalls her excellent performance. However, owing to subsequent disappointments with the Diesel engines, these and the electrical equipment were later replaced by reciprocating steam engines.

Also, in the September, 1913, the United States collier *Jupiter*, of 20,000 tons displacement, was put in commission. Her electrical propelling apparatus was designed by Mr. W. L. R. Emmet, and comprised a 2,000-r.p.m. bipolar 5,500-kVA. three-phase turbo-alternator, and two 36-pole propeller-driving induction motors of the wound rotor type for connection to large water-cooled resisters for starting, reversing, and manœuvring.

Up to the present most of the electrically-propelled ships, both naval and merchant, have been fitted with turbine-driven polyphase generators. The propellers have usually been driven by induction motors. These have in some instances been of the wound rotor type, with external resisters for starting, and in other instances have had special types of squirrel-cage rotors or other special arrangements suitable for providing the characteristics required during starting and reversing.

A more recent development is the employment of synchronous motors having features which provide induction-motor characteristics for starting and manœuvring. This has constituted an important advance. The low speed of efficient propellers (say, from 60 to 150 r.p.m., according to the type and speed of the

ship) has been considered to necessitate motors with many poles. It, for instance, the turbo-generator is bipolar and runs at 3,600 r.p.m., a 90-r.p.m. motor will have 80 poles. An induction motor with this large number of poles will be of large diameter and expensive for its output. Furthermore, its stalling torque and its power factor will both be low as compared with a motor with few poles. If its power factor is 0.75, both motor and generator must be designed for 33 per cent. more amperes (for a given voltage) than would be required with a unity-power-factor motor. The use of a synchronous motor operating at unity power factor decreases the size and cost of both generator and motor, and has been demonstrated in actual service at sea to provide the required operating characteristics. The synchronous motor has, over the induction motor, the further advantage of a much deeper air gap. It is also a more simple machine to repair and to renew parts.

There is a further advantage which the writer believes will be more generally recognised and utilised in due course. It consists in operating the synchronous motor with such high excitation that it will consume a leading current. This will permit of providing part of the generator excitation from its stator windings, and will decrease the burden placed on the rotor of the generator. The rotor is the limiting feature of the design both thermally and mechanically. With a rotor of smaller diameter, the speed in revolutions per minute may be higher, permitting of designing a more economical steam turbine.

It should be pointed out that since a ship is a self-contained unit, it is not necessary to employ a standard periodicity. If 70 cycles or 40 cycles should, for a given ship, be better than 60 or 50 cycles, there are not the objections to a special periodicity which would hold for land installations, where the importance of interconnecting systems is very great.

When Diesel engines are used for prime movers, it will, in the writer's opinion, be desirable to use a very low periodicity. If the Diesel engine's speed is 210 r.p.m., a four-pole generator will have a periodicity of only seven cycles per second. Induction motors for this low periodicity and for customary propeller speeds have very attractive characteristics. If the propeller speed is 70 r.p.m., the motor will have 12 poles. For medium powers (say 500 to 1,000 h.p.) such a motor will have convenient dimensions and be of low cost. Its power factor will be of the order of 0.95 at rated load, and will still be some 0.80 at quarter load. For a 60-cycle, 70-r.p.m. motor the power factor would be only some 0.8 at full load and 0.5 at quarter load. The full-load efficiency of the 7-cycle motor will be one or two per cent. higher than that of a 60-cycle motor for this speed and output, and will be about 5 per cent. higher at quarter to half load. The stalling load of the 7-cycle, 70-r.p.m. motor will be very high indeed, and consequently it can be rated up to its heating limit. With the application of modern insulating materials and processes, and modern knowledge of methods of forced cooling, it is obvious that such a motor will be light and compact, and of low cost. These considerations also apply to low-periodicity synchronous motors.

While this low-periodicity proposition is especially applicable to the Diesel-engine drive, the writer considers that it should also receive careful examination for the case of the steam-turbine drive—at any rate for medium powers. In this case mechanical speed reduction gearing would be interposed between the turbine and the generator. The turbine might, for example, run at 4,000 r.p.m. and drive a bipolar generator at 500 r.p.m. The periodicity would then be 8.3 cycles per second. For a propeller speed of 125 r.p.m., the motor would be built with eight poles, and would have the attractive features already described. This is a very different proposition from that which has already been employed on several electrically-propelled ships of interposing gearing between the propeller and a high-speed motor. In the latter case the low-speed wheel runs at the speed of the propeller (125 r.p.m.), as against 500 r.p.m. in the method which the writer is describing. The cost of a mechanical speed-reducing gearing depends upon the speed of its lowest speed member, and becomes more expensive the lower the speed of this member. Also in the latter case the direction of rotation of the gearing is reversed when reversing the ship, and its speed changes when changing the speed of the ship. In the former case the gearing always runs at constant speed in one direction.



Henry M. Hobart.

If gearing is required, it will be cheaper and will endure better if it is placed between the turbine and the generator instead of between the motor and the propeller. In other words, if part of the speed reduction is mechanical and part electrical, the mechanical reduction should come first, as in the plan described by the writer, and not last, as in the plan which has been employed. Nevertheless, the writer agrees that gearing is to be avoided if an equally economical solution can be found electrically.

Some 15 years ago, when the electric propulsion of ships was first at all widely studied, the geared drive was just being introduced. It has proved to be a formidable competitor, both for naval vessels and for merchant ships. As regards naval vessels, the geared turbine has been successfully applied on a large scale by the British Admiralty. Certainly no less successful has been the application of the electric drive to several classes of ships in the United States Navy. Similarly for merchant ships, although the geared turbine has up to the present been far more widely employed, there are already a good many instances of at least equally successful applications of the electric drive. Indeed, the advantage as regards manœuvring appears to rest with the electric drive. The geared drive is considerably handicapped by the need for providing for reversal of the turbine. That feature prejudicially affects the design and operation, but by no means to such an extent as to obtain for the electric drive any general admission of superiority. In the writer's opinion, the turbo-electric drive will, in the course of time, be conceded to have a distinct advantage as regards lower maintenance costs, and will be very attractive from the standpoint of prompt and effective control.

For merchant ships making very long voyages, the Diesel-engine drive would appear a logical development. Many such ships are in service. The greatly decreased fuel cost will, for such service, more than offset the high

initial cost of the machinery. At present, however, the Diesel engine for direct connection to the propeller has not reached the stage of development where it is considered thoroughly reliable. Consequently the best practice is to employ two engines and two propellers. The low-speed, direct connected engines are very heavy and expensive for their output. By substituting the Diesel-electric drive, a merchant ship need have but one propeller. The electric motor or motors driving this propeller may integrate the power of two or more Diesel engines. Each of these may be of higher speed than for the direct-connected outfit. Diesel engines of small power (even for the same speed) have lower weight and cost per h.p. than large engines, and for 200 r.p.m. or more, the decrease in weight per h.p. is still greater. It is also more practicable when at sea to make repairs on these smaller engines. The withdrawal of one set from service for repair will less seriously affect the progress of the ship the greater the number of sets. Thus, if three sets are provided, the withdrawal of one from service will reduce the available power to two-thirds, but this will only reduce the speed of the ship by some 13 per cent., since the power required is roughly proportional to the cube of the speed.

The late Mr. Henry A. Mavor recognised at an early date the importance of the plan of integrating at a single shaft the power from more than one Diesel-engine-driven polyphase generator, and devised a so-called multiple motor of the squirrel-cage type provided with two or more independent stator windings for different and non-interfering pole numbers. These windings were supplied with electricity of different periodicities from independent generating sets which did not need to be synchronised. This was important, since the operation in synchronism of two generators driven by Diesel engines is not so satisfactory as the corresponding synchronous operation of two turbine-driven generators, the uniformity of angular speed being greater in the latter case.

But with 6-cycle sets of a given speed in revolutions per minute, the departure from uniform speed may be ten times greater for a given limiting electro-magnetic variation, than with a 60-cycle set, and this is a further advantage of the low-periodicity design which has been already described by the writer.

Some engineers have considered the disadvantage from the standpoint of parallel operation to be so great that they have concluded that Diesel-electric propulsion should only be employed with direct-current generators and motors, which was the plan employed in the 1903 Russian oil tanker to which reference has already been made. The writer's opinion, however, is that, according to circumstances, both polyphase current and direct current will be employed in Diesel-electric systems.

The next decade will see an interesting competition between—

(1) Geared turbine drive.
(2) Turbine electric drive.
(3) Direct Diesel drive.
(4) Diesel-electric drive.

The direct turbine drive is not included in the list. It was employed on a good many ships before the advent of the geared turbine drive, but it has been demonstrated to be inferior, especially as regards fuel costs, and is no longer employed in new constructions.

The fact, to which allusion has already been made, that each ship is an independent unit, should lead to fitting otherwise similar ships with different drives and comparing results in a given service. This has frequently been done in marine engineering. It will lead to valuable comparisons being made not only between geared turbine and direct Diesel drives on the one hand, and electric drives on the other, but between various alternative electric drives. Evolution toward better designs ought consequently to be more rapid than, for example, in the case of systems of railway electrification, where agreement on a standard system is very important from the standpoint of interchange of traffic.

Directing attention to the [illegible] systems of propelling ships it would appear [illegible] are not suitable for the Diesel-electric system [illegible] for ocean-going ships on long voyages. [illegible] consumption is the usual period of refuelling at ports [illegible] ocean voyage. A 10,000-9 knot cargo [illegible] Diesel-electric could proceed for 50 days on 2,000 tons of fuel oil. For ships making short voyages there [illegible] reasons in favour of Diesel engines, and the turbo-electric drive would usually be more desirable.

It is customary to assume that for turbo-electric ships the propellers must be driven by polyphase motors. The writer considers that study should be given to the advantages, in certain cases, of fitting the propeller shafts with direct-current motors and interposing mercury-arc rectifiers between the polyphase generators and the motors. As a concrete case, the writer would suggest a ship equipped with three 9,000-kW 3,000-r.p.m. polyphase generators with star-connected stator windings, supplying eight 4,000-h.p. 1,500-V direct-current motors. The efficiency of the rectifiers will be 98 per cent., and they will add but little to the total weight and cost of the installation. The direct-current motors will be installed in pairs to drive the four propeller shafts at 75 r.p.m. For this speed, very sturdy and efficient 4,000-h.p. 1,500-V direct-current motors of convenient dimensions may be designed. The efficiency will be higher than that of induction motors for such a low speed, and the characteristics as regards starting, reversing, and speed control will be much more attractive. The direct-current voltage may be adjusted by control of the excitation of the polyphase generators.

Associated with the electric propulsion of ships is the electrical operation of auxiliary machinery on deck and in the engine-room. While such operation is increasing, it could be wished that the progress might be less slow. The source of excitation for the main drive should also supply the electric auxiliaries. The quickest progress is being made in the electric drive of auxiliaries in the case of Diesel-engine ships. Direct-current motors are almost always employed for driving auxiliary machinery, as their characteristics are very suitable for most cases. As an exception should be mentioned submersible motors, which are at present usually of the squirrel-cage type. Electrical operation of deck machinery should considerably decrease the time occupied in loading and unloading, and thus decrease the port charges which often constitute the largest item in the operating expenses.

Motors for driving auxiliary machinery on ships should be especially robust, and impervious to salt-laden air. The technique of the art of insulating and protecting motors is now so advanced that there ought to be no misapplications in this respect. This would appear to be a very suitable field for pipe-ventilated motors and for double-shelled designs with air circulated between the inner and outer shells by a fan carried by the motor. Such types should be more suitable than plain totally-enclosed motors.

In connection with the use of electricity on ships, both merchant and naval, attention should be called to the two following significant publications:—

"Regulations for the Electrical Equipment of Ships," published in 1919 by the Institution of Electrical Engineers; and

"Recommended Practise for Electrical Installations on Shipboard" (Marine Rules), published in 1920 by the American Institute of Electrical Engineers.

Electric Welding.—Electricity is now being more widely used every year in the construction of ships. Both resistance welding and arc welding are employed for joining steel plates of many parts of ships. On a few small ships, the hull plates have been joined by arc welding instead of being riveted.

A careful study of the possibilities of saving in cost and decreased weight, and consequently increased cargo capacity, has led the writer to believe that a considerable part of the work now being done by riveting will in the near future be done by electric welding.

NOTES FROM "REVIEWS" OF FIFTY YEARS AGO.

Extracts from Our Pages in 1872.

To Our Readers.—We need not dwell upon the importance of the applications of Electricity. It would be better to review the position that the chief branch [illegible] occupies in relation to the trade. The arrangement of the affairs of commerce is [illegible] connected with the progress of Telegraphy, that it is remarkable there exists no Journal [illegible] both the scientific and the commercial aspects of the science. The requirement which *The Telegraphic Journal* is intended to fulfil is manifest. It has been admitted practically, and by Foreign Engineers, that England manufactures telegraphic lines and cables for the world; our cores are unrivalled; our wire is everywhere taken as a standard. Yet [illegible] applied sciences of far less extent have several representatives in periodical literature, the applications of electricity have no special organ. The telegraphist, the electrician, the electrotyper, or the electroplater has had to search for the records of his service through a chaos of irrelevant matter, and perhaps has been referred to articles written in a language with which he is unacquainted. In order in the future to collate the literature of the Science to one common centre, *The Telegraphic Journal* is added to the list of monthly publications.—*November 15th*, 1872.

The "Theory" of Government Ownership.—The purchase of our telegraphic system by the State is in theory a matter of congratulation for the public, and we even look forward to the railways being bought in the same manner. We say in theory, because in England the principle obtains that what belongs to the Government belongs to the people. But, unfortunately, in the case of the telegraph, it is too much in theory and too little in fact that we derive benefit from the change which we expected would prove to be so advantageous.—*November 15th*, 1872.

Formation of the Eastern Telegraph Company.—At extraordinary general meetings of the British Indian Submarine, Falmouth, Gibraltar, and Malta, Anglo-Mediterranean, and Marseilles, Algiers and Malta Telegraph companies held on the 1st inst., resolutions were unanimously passed confirming and completing the amalgamation of the companies, under the title of the Eastern Telegraph Company.—*November 15th*, 1872.

The Leading Article Held Over.—Pressure on our space compels us to postpone our leading article on "International Telegraphy in Time of War." It will appear in our next issue, which will also contain valuable papers on "Telegraphic Batteries," and "Ampère's Theory of Magnetism."—*December 15th*, 1872.

Cable to Australia Opened.—A Banquet takes place to-night (the 15th inst.), at the Cannon Street Hotel, to celebrate the opening of telegraphic communication with Australia, and a wire is to be brought into the room for the purpose of communicating with Australia. A banquet is to be held at Melbourne the same evening. A third will take place at Adelaide, and it is hoped that others will be held at Sydney and Brisbane.—*November 15th*, 1872.

Aspects of International Telegraphy During War-Time.—Though Peace and War are obliged, for the sake of appearances, to sustain a sort of formal opposition to each other, they are, nevertheless, such excellent friends in reality that it is difficult to know how one could ever survive the other. War has afforded practice for doctors, has procured news for editors, has led to discoveries in nosology, has opened vast regions for commerce, and has furnished with facts and statistics airy speculators of all sorts. Peace, on the other hand, is always willing to see her inventions and discoveries adapted for purposes of destruction to human life. Her improved knowledge of shipbuilding, of mechanics generally, of chemistry, of optics, are all at the service of War. But is her old friend as welcome to the last adaptation of one of her most vital discoveries—the electric telegraph? Peace will have to draw the line somewhere, and it looks as if it might be here. For while the construction of systems of telegraphy would be of the greatest use for warlike purposes, their destruction would be equally an object in the same cause; and such a policy as that would be so diametrically opposed to the interests of peace as to make it imperative to consider the aspects of international telegraphy in time of war.—*January 15th*, 1873.

Societies' Meetings for the Month (November, 1872).—Telegraph Engineers.—November 27th, at 7.30 p.m.; Council meeting at 6.30 p.m.

Meteorological Society.—Ordinary meeting, November 20th, at 7 p.m.; Council meeting at 6 p.m.

Early Well-Wishers.—To CORRESPONDENTS: Sir Charles Wheatstone; R. S. Culley; C. W. Siemens; Latimer Clark; R. Sabine; W. H. Preece; S. E. Phillips; C. V. Walker; F. C. Danvers; C. Brooke; J. Faulkner; Dr. Russell Reynolds; W. H. H. Clark (Philadelphia); H. G. Erichsen; E. Rosenbusch (Malta); Indo-European Telegraph Co.; Anglo-American Telegraph Co.; and J. Browning are thanked for their communications.—*November 15th*, 1872.

Seekers After Truth.—Under "Notices of Books" (*January 15th*, 1873) we reviewed a "Reprint of Papers on Electrostatics and Magnetism," by Sir William Thomson, D.C.L., LL.D., F.R.S., F.R.S.E., Fellow of St. Peter's College, Cambridge, and Professor of Natural Philosophy in the University of Glasgow. The review opened in the following terms:—"That men of science should rest upon well-earned laurels would not be a startling fact, even if it were true; and that the fact has no existence in truth is a matter clear to the most ordinary observer. There are few of our scientists that commenced work, say thirty years ago, who are not now in their laboratories, still cross-questioning nature as closely as when their first papers were presented to the world. Thirty years' work has brought fame which could not be extended, yet the old pursuits are followed as assiduously as ever. Evidently our great philosophers work not for fame, but indeed as lovers of truth."

The Edges Cut!—"The edges of the Journal are cut throughout; the Advertisements must, therefore, be seen."—*November 15th*, 1872.

When the "Review" was Forty.—In our 40th Birthday Issue (November 15th, 1912) an article entitled "Many Happy Returns" was contributed by Sir Wm. H. Preece, K.C.B., F.R.S. We make a few extracts:—

"The ELECTRICAL REVIEW made its first public appearance on November 15th, 1872, exactly 40 years ago, as the 'Telegraphic Journal.' In the following January were added to the words 'and ELECTRICAL REVIEW.' I took a keen interest in the paper, and for a short time edited it, but the transference of the telegraphs of the country from private companies to the State threw such a burden of work upon my energies that I had to clear away all other work. . . . The [illegible] the birth also of the Society of Telegraph Engineers, and the first number of the REVIEW reports the seventh ordinary meeting of that Society under the first president, Sir William Siemens, when a paper was read by W. H. Preece, Esq., on 'Lightning and Lightning Conductors.' . . . The ELECTRICAL REVIEW led to the introduction of the *Electrician*, in 1878 the *Electrical Times* (which was first known as *Lightning Conductor*), and many others at home. . . . The life of the Electrical Review is a history of the life of the electrical industry. . . . There is one point connected with the REVIEW that is very marked—its unwavering adherence to the policy with which it set out when inaugurated in 1872, and which it has maintained to the present day. . . . I must congratulate the Editors and Proprietors of the paper upon the position that they have so well maintained, and I trust that I may live long enough to congratulate them at some future day on the [illegible] achievement."

Unfortunately Sir William's hope was not realised, as he passed away less than a year later—on November 6th, 1913.

Braincraft v. Handicraft.—When the ELECTRICAL REVIEW celebrated the completion of its 25th year, the great engineering strike was in progress, and a few weeks later (in our issue of December 31st, 1897), we printed a letter on the dispute from the Duke of Argyll. It was headed by us "Braincraft *v.* Handicraft," and as we then described it as the most sensible letter that we had seen on the disastrous strike, so do we also regard it as a communication of great interest and value to-day:—

"Dear Sir,—I lament with you this disastrous strike of employers. You ask me if I have no suggestion to make as to preventing such suicidal contests. I have only one suggestion—more knowledge of the natural laws which determine 'value' in all things, 'labour' not excepted. As far as I can see, the demand made by the employers as to the exclusive control of the management of their enterprises is an absolutely just demand and necessary; and if the refusal of the employed does really turn on this, they are fighting against nature and against justice. Braincraft is the governing power in all industrial enterprises, and all attempts to make it subject to handicraft, which falsely monopolises the title of labour, must end in discomfiture and in disaster to all concerned. If this law cuts at the root of trades unionism, as the leaders allege, so much the worse for trades unionism, because it is a natural law, which any man can see who exercises his reason dispassionately. But trades unionism can do, and has done, much when properly directed, without entering on the unnatural crusade into which it has been seduced by misleading leaders.—Yours, &c., ARGYLL."

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Liverpool Sub-Centre: Chairman's Address.

At the opening meeting, on November 6th, of the 1922-23 session of the Liverpool Sub-Centre of the North-Western Centre of the Institution, Mr H. Welbourn, chairman, delivered his address, which was illustrated with kinematograph films and lantern slides. Mr. A. S. Barnard, chairman of the North-Western Centre, was present, and addressed the meeting on the value of the Institution to its members.

Mr. Welbourn, who recently paid a second visit to Canada and the U.S.A., and thus had an opportunity to note the progress that has been made there in all things electrical during the past 15 years, said, *inter alia*:—

Telephones.—The first thing that struck me was the extensive use of the telephone, both for short and long-distance work. Of the approximate 14,300,000 telephone stations in the U.S.A., about 850,000 are of the Strowger type, and about 40,000 are of other types. The annual growth of all stations is 6 per cent., but it is significant that the annual growth of automatic stations is approximately 10 per cent. In Los Angeles (700,000 people) there is one telephone to every four people, and telephones are being connected there at the rate of 200 per working day with no sign of saturation ahead. The whole system in Los Angeles is being converted to the Strowger automatic type as quickly as plant can be delivered from Chicago; two exchanges are being equipped in New York with automatic telephones.

Long-distance telephony has made considerable progress; it is possible to telephone by means of main underground paper-insulated lead-sheathed cables, to which Pupin loading coils and thermionic valve repeaters are attached, over 15,000 miles, although the present commercial limit is about 1,000 miles.

Broadcasting.—Owing to early lack of control of broadcasting stations, of which there are about 500, things seem to have got into a terrible muddle in the States, where considerable admiration was expressed for the leisurely, but orderly, way in which the matter is being tackled in this country.

It is estimated that there are about 2,000,000 reception sets in the States, of which one-half has been made by manufacturers and one-half by amateurs. The manufacture appears to have outgrown the demand, and the makers were said to be loaded with unsaleable stock. It is significant that a good deal of second-hand wireless apparatus is being offered for sale.

Electricity Supply.—During the month succeeding my departure from Liverpool I did not see a single gas flare used for illuminating purposes; I only came across it for suburban street lighting about 10 miles from Chicago, but am not conscious of having seen it again through the succeeding 25 days except in the streets of Pittsburgh, Pa., where there is ample natural gas.

In Chicago the Commonwealth Edison Co. has 626,450 kW of plant installed, of which 230,000 kW is in the Fisk Street station. The maximum demand in this city was well over 500,000 kW in December, 1921. With a population of 2,700,000 people, there are 536,982 consumers, of whom 425,200 are residence consumers, and the total kW-hours developed by the company in 1921 was 1,928,271,940, *i.e.*, 714 kW-hours per head of population. The number of new consumers added in 1921 alone was 62,287, and they require a car-load of meters per week to keep pace with the new service work. The total capital investment is $136,310,574.37, say £30,000,000. Comparing these figures with those for Greater London (population of 8¼ millions), for the company and municipal undertakings (thus for the most part excluding all railway load) from the period 1919-20 to 1920-21 the total increase in the number of consumers was in round figures 25,000, bringing the total up to approximately 340,000. During the same period the increase in the plant installed was about 12,000 kW. There was an increase of nearly 40,000,000 in the kW-hours sold, bringing the total up to nearly 700,000,000. The total capital investment now stands at about £38,000,000, exclusive of the amount specially invested in power houses for transportation supplies. To the above figures we can add approximately 560,000,000 kW.-hours for the total energy used for transportation, bringing the approximate total for the last complete year to nearly 1,300,000,000 kWh—that is, about 155 per head of population. Comparing this with Chicago, it will be realised what an immense amount of leeway has to be made up in the capital city of our country alone before the use of electricity reaches the state of development attained by our American cousins.

How is it that this great business is done? One would expect that the cost of electricity to power and domestic users must be considerably lower than it is in this country. With the exception of the Ontario scheme, I do not think that this is the case, but it is difficult to make a direct comparison owing to the different money values obtaining in North America and in this country. The real explanation lies in the fact that electricity is a *habit* with most people in the States and Canada. The States and Canada are largely new countries wherein gas had not become entrenched when electric lighting [illegible] the cities [illegible] In many [illegible] the centre of the [illegible] had the most [illegible] heating, and to [illegible] The advent of electric light into the [illegible] up by very active propaganda by salesmen of electrical accessories, while the companies have extensive [illegible] which prospective consumers can see apparatus in actual use before they commit themselves to a purchase. I would not like to create the impression that the electricity supply authorities in this country are unprogressive, but the above figures show what an immensely greater business awaits them. Apart from railway electrification, which is only developing slowly, much greater attention should be paid to securing the immense domestic load, which may be as great as all the industrial business, and less subject to trade fluctuations. This load is not to be secured by merely cutting the price of electricity; it will require vigorous propaganda and salesmanship in the best sense of the word, the removal of all unnecessary restrictions, and arrangements to enable people to secure the apparatus without which they cannot use electricity. We are apt to forget that it is a feature of electrical appliances that their cost is frequently high compared with the value of the electricity they use in a year. To meet these points we must have: (*a*) a reasonable, but not necessarily a very cut, rate for electricity; (*b*) a system of hire or hire purchase of the more expensive pieces of apparatus; (*c*) in many cases hire-purchase wiring of houses; (*d*) a liberal practice with regard to laying mains, show rooms, demonstration of apparatus, and giving to the public what is generally known as "service."

In America most factories and the street, elevated, tube, and high-speed inter-urban railways are run electrically. Immense loads are provided by the local and express lift systems, which are used in every important office building, and there would seem to be much room for improvement in this direction in our own country. At night large blocks of power are used by the electrical sign advertisements, but despite the big power loads referred to, I was very much impressed everywhere with the steadiness of the pressure supplied for incandescent light. The quality of the street lighting is also for the most part quite good.

In one hydro-electric area the total cost, including all capital charges, depreciation, &c., per kWh. at the power-house busbars is 0.2 cent; 0.35 cent per kWh has to be added to cover all the transmission charges over a 250-mile line to the point of delivery, making a total of 0.55 cent, so that the cost of transmission is much more important than the cost of generation. In this connection the power available from some hydro-electric systems fluctuates more than one had imagined it to do. In the area in question in the last 25 years the rainfall has varied from 10.25 in. to 49.45 in. per annum, and most of it occurs in three months of the year only. It follows that steam stations have to be employed on some parts of the system and, in one case, 30 per cent. of the kWh sold last year were derived from the steam plant. The steam stations in California are usually supplied with oil fuel, which fluctuates considerably in price; were it not for this latter factor and the feared exhaustion of oil supplies, it is not unlikely that more use would be made of steam stations, especially as, at average prices of oil, the total cost of generation on the Pacific Coast is just about the same as the cost of hydro-electric power delivered over such long lines as the one referred to.

A great deal of interconnection of systems and stations has been carried out voluntarily. An outstanding example of the value of liberal linking up was illustrated in the spring of this year, when approximately 160,000 h.p. of generating plant broke down in one week in the various stations at Niagara, and yet the interruption of supply to consumers was negligible. One ounce of practice is worth pounds of theory.

In big cities, which have local steam stations and distribute by means of underground cables, the continuity of supply is excellent. In other cities, which are dependent for their supply on overhead transmission lines and overhead distribution networks, the supply is not by any means so good, particularly in those districts where the overhead lines are much affected by lightning and by snowstorms.

Cables. So far as power cables are concerned, there is a good deal of experience in the States with 24,000 and [illegible] volt 3-core cables, and the records disclose that a [illegible] of it has not been happy. The trouble with under[illegible] cables appears to have been due both to defective [illegible] ture and jointing and to overloadings, partly under [illegible] ditions. A great deal of attention is being [illegible] the development of 3-core high-voltage cables, including those for a working pressure of 33,000 volts. The necessity for this arises out of the big loads to be transmitted and the attitude of the fire insurance companies to overhead wires,

[illegible] residences are built of wood, and [illegible] wires are to the fire brigades [illegible] It would seem that the use of underground cables will rapidly spread in the residential areas.

[illegible] A great deal of the success or [illegible] transmission lines depends on the suspension-type insulators. It is notorious that these were exceedingly unreliable down to five years or so ago, and it is [illegible] that the makers in the States and Canada [illegible] well-known firm in this country, have [illegible] which can be used with every confidence. It is now believed that insulators built to the [illegible] specification No. 137 1922 can be depended on for satisfactory service, but, in my opinion, it is [illegible] high-frequency test added when next the [illegible] revised. In order to get the best practical test, [illegible] best it seems desirable that the wave-form should [illegible] so as to simulate as closely as possible that [illegible] pressure.

D.c. transmission.—The question of a.c. *versus* d.c. railway electrification for main-line working is very controversial, but there is no sign in the States that either system is winning. It is, however, significant that the Chili Government, Paulista Railway of Mrazil, Melbourne suburban railways of Australia, and the South African Government, have commenced their electrification with either 3,000 or 1,500 volts, d.c., and that the French Government has adopted d.c. for main-line electrification. The Illinois Central Railroad has also adopted 1,500 volts, d.c., with catenary construction in and around Chicago. Whenever the question of inductive interference in telephone and telegraph circuits arises, the d.c. advocates are always able to point to the freedom from interference from their conductors. On the Milwaukee system the trolley wires are paralleled most of the way with the 100,000-volt 3-phase line which supplies energy to the motor-generator sub-stations; and, in practice, it has been found that this line causes no trouble to telephone and telegraph circuits, chiefly because it is provided with a continuous earth wire, and because the track overhead equipment is also provided over most of the route with a continuous earth wire.

RADIO DIRECTION-FINDING.

Effect of Local Conditions.

In the course of a paper on the effect of local conditions on radio direction-finding installations, Messrs. R. L. Smith-Rose and R. H. Barfield recently gave members of the Wireless Section of the Institution of Electrical Engineers an account of some of the experiments carried out during the past year by the Sub-Committee of the Radio Research Board on wireless direction finding.

The bulk of the work was done either at the Radio Research Station, Slough, or the National Physical Laboratory, Teddington.

The paper summarises the work of previous investigators on the same lines, and indicates why further research was necessary. It then describes experiments which provide quantitative data and definite figures which show the extent in certain cases of errors produced.

Modern direction-finding installations are well able to detect variations of less than 0.5 deg. in the direction of arrival of the waves under observation. There are, however, many causes which may prevent the readings so obtained from corresponding to the absolute direction of the transmitting station observed to this degree of accuracy.

By far the most important classes of errors experienced in practice are those which have been somewhat vaguely termed "night effect," implying the variation in the apparent direction of arrival at the direction-finding station, a phenomenon which is observed with nearly all transmitting stations between sunset and sunrise. These variations commonly amount to 20 deg. and have been observed by the authors to exceed 40 deg. on certain occasions. Little is known, however, as to the cause producing these effects, though much has been surmised. No practical system has been put forward which avoids these errors, and there is, at present, little more to be said about them save that, by reason of their existence, radio direction-finding is practically restricted to the daytime except over very short distances.

Second in importance is the class of error dealt with in this paper, namely, the errors which are produced by the immediate surroundings of the installation.

Effects of this kind may be caused by neighbouring objects, or by local geographical conditions, and while the errors produced will be constant under ordinary circumstances and thus permit of correction of the bearings, in other cases it may be necessary to avoid all possible errors at the site of the installation. It was known previously that such objects as cliffs, hills and mountains, trees, masses of metal work, and overhead lines would produce very serious errors on a direction finder operated in the vicinity, while the special case of the effect of the metal hull of a ship has seriously engaged the attention of wireless engineers ever since the first ship was fitted with directional apparatus.

Notwithstanding the previous work, however, there is insufficient data on the matter and it is very difficult to obtain for direction finding an absolutely ideal site, which is not prohibitive for other reasons, particularly in the vicinity of towns.

The experiments described in this paper were therefore carried out in order to obtain some quantitative knowledge of the disturbing effects of surrounding objects on a directional receiving set.

The general conclusions thus arrived at are that masses of metal [illegible] connections with the receiving coil do not perceptibly produce any errors in the bearings indicated by the latter except when placed within a very few feet of the coils. As a safe precaution it is as well to keep the space of, say, 10 ft. round the coil fairly clear of even small pieces of metal, as the cumulative effect of several small pieces may become quite appreciable. For this reason it is advisable to ensure that the hut or other structure containing the direction-finding set is as free as possible from metal in the way of joint-plates, door and window fastenings, &c., and that metal oil stoves or lamps are not placed too close to the receiving coils.

When, however, the extent of the metal work in the neighbourhood is moderately great, the resulting errors in observed bearings become very much more serious. As an illustration of the order of the errors which may arise in such cases, the results of an investigation carried out on a large metallic tubular construction are mentioned by the authors. The "tube" or tunnel was of approximately semi-circular cross-section, being formed of a number of curved, corrugated iron sheets bolted together and resting on flat, similar sheets placed on the ground.

The greatly increased effect of metal work when placed in the form of a partly or completely closed loop is well demonstrated by the results, and illustrates the effect which might be expected if, for example, a directional wireless receiver were installed in a corrugated-iron building. The continuity of the metal structure would appear to be very important, and even with such large masses, the nearest portions of these have by far the greatest effects. For example, with the coil receiver placed inside the tube near the centre, the removal of a section of the tube forming the top sides reduced the error in the apparent bearing of Paris from 14 deg. to 1 deg. Similarly, by unbolting two adjacent sections and slightly separating them, a change of 2 deg. or 3 deg. was produced.

With the receiving coil set up along the outsides of the tube, the errors observed were very much less, ranging from 5 deg. to 9 deg. at a distance of 2 ft., to about 2 deg. at 3 ft. from the side of the tube. Also, when the coil was placed on top of the tube the errors varied from 2 deg. to 6 deg.

As a further example of the effect of large masses of metal work, the effect of the metal hull of a ship may be instanced.

When the arriving waves come from either approximately fore and aft or athwartships, the error in the reading is reduced to zero. In intermediate directions the results are in error by amounts varying up to 22 deg. in either direction. There is a tendency for the readings to be concentrated along the fore-and-aft line of the ship. There is no appreciable difference in the error incurred on different wave-lengths (*viz.*, 2.6, 3.2 and 4.5 km.).

When the mass of metal work is very large compared with the receiving coils, as in the case of a ship, the resulting errors in the observed bearings on the direction finder may be very serious; although, when the set is fixed in position on the ship, the necessary correction may be made.

The effect of masses of metal work in producing large errors in the reading of a radio direction finder may in some instances be utilised for the location of such metal work, when the latter is not visible or when its presence is not readily detected by other means. An interesting example of this was recently obtained at the Aberdeen University direction-finding station of the Radio Research Board.

By means of a portable directional receiving set, the authors explored the site and found that the errors were closely associated with a line of manholes indicating the location of a sewer crossing the adjacent fields. It is to be expected that large masses of buried metal work, such as gas and water mains, will have a similar effect in their vicinity.

A possible cause of errors which is frequently encountered in selecting a site for a direction-finding set is the presence of overhead conducting wires. When the wires extend for a

considerable distance, the effects produced in their neighbourhood can be very large indeed.

With the frame coil set up immediately underneath telephone wires along a road, the readings obtained were considerably different from the correct values, and the bearings changed considerably from time to time during the tests. A possible cause of the rapid changes is the alteration of circuit conditions on the telephone wires at the various exchanges to which they are connected.

Errors ranging from 12 deg. to 70 deg. may be produced on a direction-finding coil mounted immediately underneath telephone wires some 20 ft. high. The errors diminish rapidly as the coil is moved away from the wires, but, even at the distance of 120 ft. from the line of wires, the errors may be a few degrees.

The explanation of the above effects must remain very obscure, since it is impossible to realise the conformation of the circuits of the telephone lines at any particular instant. In one sense the overhead wires may be pictured as constituting the top side of a huge vertical frame, of which the earth forms the lower side, and the vertical sides are formed by the connections to earth at the various exchanges. An electro-magnetic wave arriving at an angle to the plane of this large frame would suffer a partial absorption of that component of its magnetic field perpendicular to this plane, and the resultant field would therefore effect a direction-finder coil by giving an apparent direction deflected towards the normal to the plane of the wires.

Paris, on the 2.6 km. wave, showed some freak effects in the experiments and was evidently subject to some other influence, possibly a resonance condition in the overhead line circuits. It would appear that the errors produced are not directly influenced by the actual number of wires near the site, but depend on the conditions of a whole circuit of wires, which may extend over several miles.

The mere existence of neighbouring aerials, proved by their subsequent removal, made no appreciable difference in the observed bearings, and the effect of tuning the aerials was very small. An increased effect may, however, be caused by continuous, as distinct from damped, waves, and the effect also probably depends upon the relative directions of the aerial and the incoming waves.

Further experiments will be carried out on this effect.

The proximity of a closed coil may affect the readings of a direction finder in a manner similar to a tuned aerial system.

There is no apparent error due merely to the presence of a coil, when either on open circuit or short circuit. The bearings on the direction finder might, however, be appreciably affected by the presence of an open coil when working near the natural wave-length of the latter. The results are sufficient to justify the practice in accurate working of keeping all frame coils at least 100 ft. from a directional receiving set, especially if both sets of coils are in operation simultaneously.

The presence of trees has a considerable effect on the propagation of electro-magnetic waves. The presence of trees between a transmitting station and the receiver considerably decreases the signal strength at the latter, and growing trees can be used very effectively as aerials for [illegible] of short wave-length.

A tree may, theoretically, be regarded as being equivalent to a vertical aerial in which oscillatory currents are induced by the arriving electro-magnetic wave, and which [illegible] by means of absorption and re-radiation. Since, however, the tree will possess a fairly [illegible] and it is unlikely to resonate with most wave-lengths, the presence of a single, isolated, tree would not be expected to have very much effect on a direction-finder coil unless placed in very close proximity to the tree. With large masses or clumps of trees, however, a cumulative effect may be produced with regard to the secondary field, which may give rise to serious errors at a directional receiving installation.

The general trend is for the error in the apparent bearing to be progressive as the direction-finder set is taken into the junction of large masses of trees, and has a maximum value at the point farthest from all the trees.

The most noticeable point is the extent to which the bearing may change for a very slight change in the position of the receiving set. These large changes are probably due to the difference in phase effects of the inductive fields from the different trees. The presence of trees within about 300 ft. from a direction-finding installation may produce quite large, measurable errors in the readings of the latter. As it is possible that the error may vary with the changing state of the trees at the different seasons, the error may be a variable one and hence is to be avoided if possible.

Large buildings, hills and mountains act as partial obstacles to the passage of electromagnetic waves, and the tendency is for the latter to be deviated around the obstacle. The effect of working inside a building was well demonstrated, where the errors in the readings obtained ranged up to more than 30 deg., whereas when the set was removed to its final position in an open field [illegible] three miles away, the maximum permanent error experienced was 2.8 deg. At the top of a stone tower about 60 ft. high, from which all the metal work had been previously removed, the maximum deviation error experienced was about 3 deg.

Owing to the great variability in the possible nature and disposition of the surroundings of a direction-finding installation, it is very difficult, if not impossible, to make general rules as to the effect of such surroundings. It is believed, however, that the results of the investigations given above are of value in augmenting the scanty evidence previously existing as to the distortion produced in the propagation of electromagnetic waves by various obstacles on the earth's surface. The experiments [illegible] further lines of advance, and it is proposed to [illegible] as soon as opportunity permits.

SOUTH AFRICAN RAILWAYS.

ELECTRIC LOCOMOTIVES.

The decision of the South African Railways and Harbours Administration to electrify the section of its main-line track between Glencoe and Pietermaritzburg, a distance of about 171 miles, to which reference has already been made in our pages, has resulted in the contract for the supply of the locomotives being placed with the Metropolitan-Vickers Electrical Co., Ltd.

The locomotives, of which 78 have been ordered, have been designed to haul passenger and freight trains over the electrified area, and are to be so arranged that they can be worked alone or with other locomotives in multiple unit controlled by one driver. The conditions which have to be fulfilled are :–

1. Three locomotives coupled together shall be capable of hauling a train weighing 1,800 short tons up a 1 per cent. grade at a speed of from 21 to 22 miles per hour, and of hauling the same train on a level tangent track at 36 miles per hour.
2. The locomotives shall be capable of running at a speed of 45 miles per hour without injury to any part.
3. Three locomotives coupled together shall be capable of starting a train weighing 1,800 short tons on a rising gradient of 1 :100 and attaining a speed of 22 miles per hour in three minutes.
4. Three locomotives coupled together shall be capable of holding a train of 1,640 short tons on a falling gradient of 1 in 50 by regenerative action alone.

The normal duty which the Administration will call upon the locomotive to perform is for three locomotives coupled together to haul a train weighing 1,430 short tons from Ladysmith to Pietermaritzburg, a distance of about 129 miles, in a little more than seven hours, and in the reverse direction a train weighing not less than 625 tons in about 7½ hours. The locomotives are to be capable of performing a round trip from Ladysmith to Pietermaritzburg and back under these conditions once every 24 hours for six days a week. The gradients on the line between these points are mostly in favour of the loaded trains, the ruling gradient against the load being 1 in 65 compensated; the ruling gradient for the trains returning from Pietermaritzburg to Ladysmith will be 1 in 50 compensated. The loaded trains from Ladysmith to Pietermaritzburg will have to travel down this gradient, which for trains in this direction is equivalent to an average gradient of about 1 in 75; there are, however, a number of lengths of tangent track on a gradient of 1 in 50. During one period of the journey from Ladysmith to Pietermaritzburg the loaded train will have to be taken down a gradient about 15 miles long, which includes a number of short lengths of 1 in 50 tangent track.

The maximum gradient on the section to be electrified is as much as 1 in 30 uncompensated, but these gradients occur on an old line which will be used principally as an alternative route in the event of the main line being blocked; under these conditions, the loads will be reduced to the capacity of the locomotives on this steeper gradient.

The accompanying illustration (p. 752) closely resembles what the locomotives will look like when they are built. They are to be of the double-bogie articulated type, and to consist of two four-wheel bogies coupled together at their inner ends by means of a ball-articulating joint, which will allow free movement between the trucks. The draw and buffing gear is to be mounted directly on the bogies, thus ensuring that no undue strains will be thrown on the [illegible].

The four main driving motors are to be [illegible] bogies, supported by suspension bearings on the axles and nose supports on the bogie framing, [illegible]

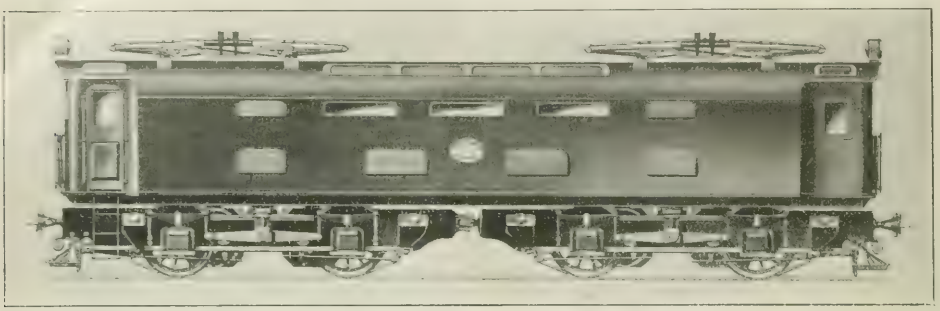
[illegible] to the driving wheels by means of single reduction [illegible]. Each bogie is to be equipped with two motors; [illegible] weight of the locomotive will be available for [illegible]. Each motor will be capable of developing 300 h.p. [illegible] one-hour rating, which will correspond to a tractive effort of 5,800 lb. at 20.75 miles per hour, the tractive effort which the motor will be capable of exerting continuously is [illegible] at a speed of 22.5 miles per hour.

Thus, the locomotive will be capable of exerting 1,200 h.p., which will correspond to a tractive effort of 23,200 lb. at the one-hour rating and 16,400 lb. continuously. The maximum tractive effort which the locomotives will be capable of exerting is about 43,000 lb. as determined by the adhesion between the wheels and the track. The motors themselves will be capable of slipping the wheels of the locomotive under any [illegible] as usual.

The [illegible] of the [illegible] is to be of the box type, will be carried on two cross girders, that will form the bogie pivots, and support the longitudinal girders of the body underframe. Roomy driving cabs are to be situated at either end of the locomotive, and each driving point will be fitted with a controller, driver's valves, and the usual gauges, whistles, and sanding switches, so that the locomotive can be operated equally well in either direction. A gangway will be provided on one side of the locomotive, which will allow of easy access between driving compartments, and arrangements have been made for the simultaneous operation of coupled locomotives by a single crew from the leading driving point.

The control system will be electro-pneumatic: all the control apparatus, together with the auxiliary machines and the main resistances, will be mounted in the central compartment, which will be locked in such a manner that the driver will be unable to enter until all apparatus has been made "dead," thus ensuring that there will be no danger of the driver coming in contact with any high-pressure apparatus which is "alive."

The locomotives have been designed to collect electricity from an overhead trolley line supplying direct current at 3,000 volts by means of two pantograph collectors. A dual system of brakes is provided for, an air-pressure brake for use on the locomotive and a vacuum brake on the train. The locomotives are to be arranged for regenerative control, and the brake system is to be so arranged that, whilst the locomotive is regenerating, the brakes on the train can be applied without applying the locomotive brakes; should, however, the brake application exceed a certain predetermined limit, then the regenerative action will be interrupted and the locomotive brakes automatically applied.



Metropolitan-Vickers Electric Locomotive for South Africa.

Other particulars and the leading dimensions of the locomotives are as follows:—

Weight in working order	about 65 long tons.
Weight of mechanical portion	about 37½ long tons.
Weight of electrical portion...	about 27½ long tons.
Type of locomotive	0—4+4—0.
Gauge	3 ft. 6 in.
Length of body	40 ft. 8 in.
Overall height of locomotive...	13 ft.
Overall width of locomotive ...	9 ft. 0½ in.
Diameter of driving wheel	4 ft.
Wheel base of bogie	9 ft. 3 in.
Weight per driving axle	16¼ tons.
Maximum safe locomotive speed	45 m.p.h.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electrical Oil Igniter.

Some weeks ago reference was made to the electrical installation of the *Volendam*, a large Holland-America liner built at the Govan shipyard, it being mentioned that in the boiler-room electrical oil igniters are used for lighting the furnace burners. By the courtesy of Messrs. Harland & Wolff, Ltd., Belfast, we are now able to reproduce a drawing of one of these igniters. Referring to figs. 1 and 2, the carbons 1 and 2 are mounted coaxially in housings of insulating material separated by spacing strips 5. Carbon 1 is fixed, whilst carbon 2 is connected to a rod of conducting material, which passes through an insulating tube 6 and is provided with a knob or handle, by means of which the carbon 2 may be moved against the action of a spring into contact with carbon 1 to strike the arc. Current is supplied by a flexible twin cable 9 to a connection [illegible] this cable leads to a supply wire 10 connected to carbon 1, whilst the other cable is led to a terminal 11, to which one end of a spring 12 is attached, the other end of the spring 12 being attached to a conducting screw 13, which serves also to secure to the rod 7 an insulating handle 14, by means of which the rod 7 and carbon 2 can be moved against the action of the spring 12, so as to bring carbon 2 into contact with carbon 1 to strike the arc. The tube 6 and the rod 7 are made of such a length as to obviate the danger of the operator being burned when an oil burner is ignited. The method of operation is as follows: The head of the igniter is passed through one of the inspection openings in the boiler front and the opening where the carbons appear is put just in front of the oil burner. After the oil has been turned on, the arc is struck by the operator pushing the carbons together by the pressure of his thumb on knob 14 to bring the carbons into contact. Then the pressure of the thumb is slightly released, so as to form the arc, and as soon as the oil is lit the pressure is released altogether, after which the igniter can be withdrawn. In this way all risk of fire and naked lights is obviated.

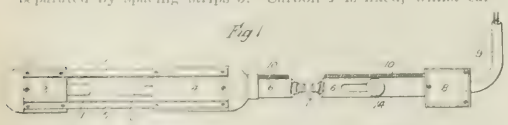


Fig 1

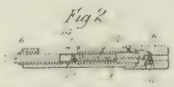


Fig 2

Figs. 1 [illegible] Electrical Oil Igniter.

Electrodes for Welding Non-Ferrous Metals.

To its series of 17 types of electrode for the welding of ferrous metals, Alloy Welding Processes, Ltd., 14/16, Cockspur Street, London, S.W.1, has added three new forms for use with copper, brass, and bronze. These are made on similar lines to the ferrous electrodes, but have a core of pure copper. The copper core is covered with a flux which adheres firmly to it and does not break away when subjected to [illegible] heat. The flux is of a special nature to suit the copper alloy to be welded, and produces a powerful

reducing atmosphere around the work to ensure good metal being deposited in the weld. As the temperature range between the welding and fusion points of copper and its alloys is very short, experience is necessary to prevent the metal becoming fluid or remaining in a sluggish condition. The firm recommends the pre-heating of the work and the use of a refractory material as support.

This development should prove of great value to users of non-ferrous metals in many industries.

The "Unit" Time Switch.

In the note on this device in our issue of October 20th we stated that "this, we believe, is new in that it constists of an adaptation of an ordinary alarm clock." In making this statement, we regret that we overlooked the prior claim of Messrs. Venner Time Switches, Ltd., who have had a similar invention on the market for a considerable time.

The "Excelsior" Electric Toaster.

The *Electrical News* recently published a description of the "Excelsior" electric toaster made by an American firm—The Perfection Electric Products Corporation, New Washington, Ohio. This device, as will be seen from the illustration (fig. 3), is equipped with two racks which can be reversed by the movement of a handle mounted at the top.

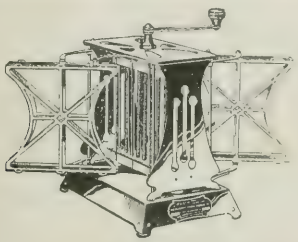


Fig. 3. The "Excelsior" Electric Toaster.

The Geipel Float-type Steam Trap.

This trap has been designed not to compete with the Geipel expansion type, which has its own special function, but to meet requirements where float traps are more suitable or are preferred by users. It has been designed with a view to obviating the loss of steam which is occasioned by the usual

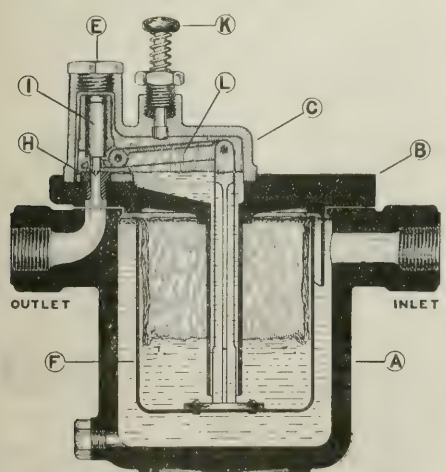


Fig. 4.—The Geipel Float-type Steam Trap.

construction. This loss is chiefly due to two causes, leakage at the valve and excessive radiating surface. A further object has been to overcome the difficulty caused by levers and pivots, through their being used to act in two directions; in the Geipel trap, they act in one direction only, so that wear and tear can be easily rectified.

The valve arrangement is such that the wear and tear is reduced to a minimum, whilst the material of which it is constructed, nickel, gives the maximum durability. Special facility has been provided for access to the valve, so that it may be periodically inspected and kept in good condition with ease. The valve (I) is situated above the cover (B) of the float chamber, so that it can be got at by simply unscrewing the valve head (E) without interfering with the steam connection and cover. The working parts are [illegible] by simply removing the cover [illegible]. With a view to minimising the loss by radiation, the body is [illegible] cylindrical and its extent; the bore length of the [illegible] so that maximum [illegible] is obtained for a given size of chamber. Further, this power is increased by the lever attachment that it requires rather [illegible] than three ounces pound as float type traps. For a given discharge capacity this the size of the body is reduced to the lowest limits, thus reducing the radiating surface.

The operation of the trap is as follows. When steam is turned on, the float (J) is at its lowest position and the valve (I) is open and remains so until the condensation is discharged, whereupon the float rises and the valve is closed by gravity and held tight by steam pressure. When water accumulates, the float again sinks and re-opens the valve (I). To examine the valve it is only necessary to unscrew the valve head (E). The valve (I) and the valve seat (H) are made of nickel and are easily renewable. An air valve is arranged in the body to ensure that there is no air lock in the trap when first starting up. To blow through the trap, the knob (K) is depressed either by foot or by hand. These traps will raise water two feet for every pound pressure. They are made by Messrs. Wm. Geipel & Co., St Thomas Street, London, S.E.1.

The Webster Magnet Light.

Dark nights are coming and every motorist knows the annoyance of repairs or tire-changing on the road after dark; and even in his garage the difficulty of lighting some awkward part of his car when making adjustments. The many engineers who have wanted at times a handy, safe light for use in out-of-the-way corners, will be interested to know that such a lamp is procurable from the Webster Electric Co., 118, Victoria Street, London, S.W.1. The Webster magnet lamp requires no hook and yet directs the light "right there"; it is a new inspection lamp having an electro-magnetic base that will cling to any iron or steel part of a car or machine (painted or plain), whilst the lamp is alight. A flexible cord enables it to be placed just where required, and a nickel-plated reflector directs the rays on the object under examination, whilst it shades the eyes and protects the bulb against breakage.

The "Maco" Adjustable Template Corrector.

In our note on this device, in our issue of September 1st (p. 301) we gave the credit of the invention to Mr. E. James Brown, who is selling it. Mr. Brown disclaims the credit, stating that the template was devised by Mr. Albert Maden, of Newchurch-in-Rossendale.

REVIEWS.

Automotive Repair—Instruction Manual of Repair Jobs—Vol. II, for electrical service men. By J. C. Wright. Pp. xii+417; figs. 164. London: Chapman & Hall, Ltd. Price 15s. net.

"Typically American" is the comment which naturally occurs to the mind after reading "Automotive Repair: Vol. II, Electrical Service Work." Books of this kind appear to be popular on the other side judging by the number that have been produced in recent years; most of these volumes seem to be written by professors or, as in this case, by a "Director Federal Board of Vocational Education." These professors, it seems, go round to "service stations," where they analyse the repair jobs which have been done in a certain time, subsequently numbering, docketing, and tabulating them in true American fashion, for the typical American loves statistics before everything.

The present volume is a good example of its class. It is divided into two watertight compartments, the first of which deals with practical instruction on electrical repairs, fifty-six "jobs" having been chosen as those most often required by the electrical service man. Selecting a few of these jobs at random we have subjects such as: Cleaning spark plugs; installing a spot light; insulating starting cable; removing end-play in armature shaft; adjusting generator charge; undercutting mica; re-wiring lighting system; overhauling a magneto, &c. Each job is treated under three headings:—

(1) Operations necessary to perform the job. (2) Names of parts to be reviewed before performing the job. (3) Descriptions of operations.

Sometimes these instructions seem rather superfluous, for instance, Job No. 8, installing new light bulbs:—

(1) Remove lamp cover.
(2) Remove bulb.
(3) Inspect bulb.
(4) Replace with new bulb if necessary.
(5) Test lamp for operation.
(6) Replace lamp cover.

Repairing by numbers this might be called; one can almost hear the sergeant-instructor wheeling the electrical service man up into line, forming him into fours and performing

[illegible] What happens if the job [illegible] is not [illegible]

[illegible] is covered again in the [illegible] American custom.

[illegible] practical experience can be gained from [illegible] is a matter of opinion. [illegible] books and lectures [illegible] workshop.

The second part of the book deals with the theory of the [illegible] the eight chapters are as follows:

[illegible] Electrical Units of Measurement; Electrical Measurements; Batteries; Generators; Starting Motors; Ignition.

This part of the book is quite good, the information being clearly set out and sufficient for all the needs of the electrical repair man in general. The theory in the first chapters is given in the conventional manner starting with magnetic lines of force and following the well-worn track through the hydraulic analogy. The chapter on "Generators" is especially good; a full description of the third-brush system of output control (for which the North-East Electric Co. appears to be responsible) is a useful feature.

The chapter on "Ignition" deals chiefly with battery-coil systems as would be expected, the magneto being treated in a rather summary manner. Nothing is said about British magnetos, but descriptions of the few American machines are included. The book is well printed and is fully illustrated throughout, many of the figures, however, being from catalogue blocks. A large proportion of the wiring diagrams are provided by the Delco and Remy Companies and these, as always, are models of what such diagrams should be. They have an excellent plan of showing two diagrams of each system, one entirely pictorial and the other entirely technical, the first appeals to the ordinary user and the second is welcomed by the electrician. Both diagrams are first rate in their way and other manufacturing companies would do well to follow this example. F. H. H.

Electrical Circuits and Connections. By W. R. Bowker. Pp. xii+211; figs. 165. London: Crosby Lockwood and Son. Price 15s. net.

The scope of this work is indicated by the sub-title which states that it is a technical, practical and operative treatise on direct, alternating, polyphase, and hydro-electrical engineering circuits.

In his preface, the author states that his book is practical rather than theoretical and mathematical. There is no doubt but that theory and mathematics are absent.

The work comprises the following sections:—

Introductory Notes and Explanations.
Continuous Current Dynamos.
Direct Current Motors.
Two- and Four-pole Shunt Motor and Auto-Starter.
Electric Traction.
Combined Lighting and Power Schemes.
Alternating and Polyphase Currents.
Fault Test Panel.
Rotary Converters, Hydro-Electric Layout, and Automatic Control and Operation.

These headings give some idea of the order—or rather lack of it—in the book, and a detailed examination does not make matters much clearer.

A great mass of elementary practical information is given without any basic principles which would enable a reader to grasp the true significance of this information. The book is very similar in many respects to the old-fashioned army drill books, but is far behind even them in accuracy and definiteness. Most of the information is common-place working instructions for operating electrical machines of different kinds, and it is to be hoped that no one will have an opportunity of trying to operate machinery solely on the ground of instruction received from this book. This is especially the case in connection with the starting of rotary converters and paralleling of alternators.

The one original point dealt with comes under the title of "Corona Solution." The author's explanation of corona is worth quoting in full.

[illegible] tion of cumulative physical effects of electrical energy applied [illegible] break down the insulating properties of the air dielectric."

This will doubtless be extremely illuminating to the artisan readers for whom the book was specially planned. Mr. Bowker, however, has evidently no dubiety in his own mind about "Corona," and states that with an arrangement pro[illegible] that 3-phase transmission at 3,000,000 volts will soon be a [illegible]

[illegible] for C² on page 5.

The fact that the book has gone through three editions proves that numerous readers have been found for it. These are deserving of the deepest sympathy.

Technical Electricity. By H. T. Davidge and R. W. Hutchinson. Fourth edition. Pp. 514; figs. 403. London, 1922: University Tutorial Press. Price 10s. 6d.

The first edition of this book was published in 1906, and it has now an assured place among the text books that one can recommend with confidence to the average engineering student. The larger page, improved diagrams and the general expansion of the text in this new edition should add to its popularity in spite of the fact that these improvements have necessitated the raising of the price to half a guinea.

In its earlier form as one of the "Organised Science Series" of text books the authors appeared to be hampered in their good intentions by the size of the page; many of the illustrations seemed to lack elbow-room and the descent into a peculiarly uninspiring small type in the case of some of the less important paragraphs was a weariness to the flesh. The present format is much more worthy of the book and consequently the use of the volume either for study or reference is more pleasant and satisfying.

The book is intended for first and second year students in electrical engineering at the technical schools and colleges and at the universities; for candidates for the various professional examinations for students of physics; and for shift engineers and test-room staffs. Messrs. Davidge and Hutchinson have maintained the original purpose of their work, namely, the bridging of the gulf between "Magnetism and Electricity," and "Electrical Engineering"; they have brought their book well up-to-date by suitable modifications and additions, and have entirely rewritten many of the sections in order to bring them into conformity with modern electrical engineering practice. Much entirely new matter has been incorporated, especially in those branches of the subject such as electric lighting, central station equipment, telegraphy and telephony, wireless, X-rays, &c., in which great progress has been made in recent years.

Particularly notable are the improvements in the sections on alternating currents, magnetic measurements, and motors and motor generators. One or two idiosyncrasies have come over from the earlier editions, including the working out of cross-sections of indoor wiring to six places of decimals of a square inch (page 452); also the sentence in which the Coolidge X-ray tube is described on page 477 is inaccurate—the incandescent cathode *provides* the stream of electrons, it does not increase the supply of them. But altogether the book is a good one, and the authors are to be congratulated on the renewed vigour and improved looks of their sixteen-year-old offspring.

LEGAL.

Soc. Anon. Internationale De Telegraphie Sans Fil, v. Ambatralos.

Mr. Justice Roche, in the King's Bench Division, on November 8th, heard a claim by the plaintiff company for £871 11s. 4d., in respect of wireless apparatus supplied to a Greek ship, alleged to belong to the defendant. The defendant, however, while admitting the contract, said that it was signed by him as agent for his brother, who owned the steamer, and that he was not, therefore, liable.

Mr. Samuels, appearing for plaintiffs, said that the defendant had acted as agent for his brother for some years and had offices in London, and the brother was the owner of two steamers which had been fitted with wireless by the plaintiffs. The contract having been admitted the issue of agreement was raised and that depended upon the construction of the contract. A contract signed by a person in his own name, without qualification, was, *primâ facie*, evidence that he was the contracting party, although in the body of the contract he might say that he was acting as agent for another person.

It having been decided that the contract having been admitted the onus of proof was on the defence.

The defendant was called, and in the course of his examination by Mr. Valletta, his counsel, said that he had never had any interest in the vessel in question. He had received accounts from the plaintiff company although it had obtained judgment against his brother in respect of the same steamer. Witness added that he had always informed plaintiffs that he was only an agent.

His Lordship said that in the contract it did not appear that defendant was the owner of either of the two vessels in question. The law was that if a man signed as an agent, and there was nothing in the contract to show that he was an agent, then he would be liable as a principal or a contracting party.

In cross-examination, the witness said that he informed the plaintiffs before signing the contract that he would have to communicate with the owners.

His Lordship said that the contract being with the owners of the ship the action should have been against the owner.

Mr. Samuels said that the defendant having signed the contract in his own name the plaintiffs were entitled to regard him as the shipowner, even though he might have inserted in the contract the words "acting for the ship owners."

His Lordship, in giving judgment, said that the question was whether the defendant was liable although he was only an agent and not the owner of the ship, and the plaintiffs contended that he was liable because he had signed the contract. The first issue was whether the defendant was the owner or part-owner because, if he were, it would be open to the plaintiffs to recover from him as principal. Having heard the defendant's evidence, he found that defendant had no material interest in the ship and that he was merely acting as London agent for the owner. He had signed the contract without qualification, but in the document he had described himself as "acting for the shipowners," and the clause upon which the plaintiffs relied provided that the shipowner should pay so much as an annual rent. He considered that the defendant was not liable; there would therefore be judgment for the defendant, with costs.

Southern Brazil Electric Co., Ltd.

In the Chancery Division, on November 7th, Mr. Justice P. O. Lawrence heard a petition by the Southern Brazil Electric Co. for the sanction of the Court to a proposed reduction of capital.

Mr. Clauson, K.C., said that the company held shares in a large number of electrical companies in Brazil. It had a capital of £750,000, and it was proposed to reduce this to £425,000 by writing 10 per cent. off each of the 650,000 issued shares of £1 each.

His Lordship said the petition did not state whether this was capital lost or was represented by available assets.

Mr. Clauson replied that the whole trouble arose over the fall in the rate of exchange, and nobody could tell when it might improve.

His Lordship sanctioned the proposed reduction.

Halls *v.* Pert.

At the Shoreditch County Court on November 7th, Mr. Arthur Halls, of 21, Elsenham Road, Manor Park, an engineer, claimed "not more than £500" from Mr. Charles Pert, of 73, Bulwer Road, Leytonstone, an electrical engineer. He asked for a declaration that he and the defendant were partners in the business of engineers at 19, Mansfield Street, Kingsland Road. He further asked (1) for accounts and inquiries; (2) payment of what was due to him; and (3) such further or other relief as might seem just to the Court. Mr. Dickens, appeared as counsel for the plaintiff, and Mr. Pert in person. The plaintiff said that on May 8th he and defendant had a discussion as to a partnership, and after a time it was decided that it should date back from May 1st, although nothing was actually signed to that effect; agreements were being drawn up however. Finally, it fell through because the plaintiff would not agree to the book debts of £240 being included in the assets, as the defendant was only to pay £174 for a half share of the goodwill of the business, and the profits. All the defendant had paid was £20 on account. Plaintiff said cards were printed, defendant was introduced as a partner to customers, whilst a joint account was opened at the bank, upon which defendant signed several cheques. Defendant drew £20 while he was with the firm, saw customers, and gave orders to the staff. The partnership lasted from May 1st to July 3rd, during which time there was a loss, owing to various actions of the defendant.

In his defence, Mr. Pert said he had never been a partner, but was only on the premises to see if it was a business he could enter. He denied being introduced as a partner. He was of opinion that the book debts were not of the value given, so he decided to have nothing further to do with it. It was true he signed cheques, and the joint account at the bank, but he denied drawing anything out of the business. Mr. Dickens submitted that it was not necessary to have the papers signed to make him a partner; if he acted as one it was sufficient.

Judge Cluer said he must find that the defendant did not act as a partner, but he had gone in to see if he would become one. He had signed the joint account at the bank, and that certainly did render him liable for any overdraft until he revoked it.

Mr. Dickens asked for leave to appeal, which was granted.

Payment for Electric Irons.

In the Shoreditch County Court on November 2nd, before Judge Cluer, Adolph Frigmuhlum, an electrical dealer, sued D. Rose & Co., of Whitechapel, hardware dealers, to recover a balance of £2 8s. for electric irons supplied. In the defendant's absence and after a postponement, the amount was allowed by the judge. Defendant arrived 31 minutes after the decision and asked for a new trial, but as he was unable to pay at once the costs of the first trial the judge said that the decision must stand.

CORRESPONDENCE.

Letters received after 5 p.m. on Tuesday must be deferred until the following week. Correspondents are requested to write on one side of the paper only, and to give their full name and address in our possession.

Catalogues Wanted at Bermuda.

There is a demand at this dockyard, and I should be glad if [illegible] Correspondence Course [illegible] Catalogues of all types of [illegible] manufactured by British firms will be gratefully received.

T. C. Hunt,

H.M. Dockyard, Bermuda.
October 24th, 1922.

Prospects in South Africa, British South West Africa, or British East Africa.

Could any reader [illegible] the States named above, supply me [illegible] this Journal, with information as to the prospects [illegible] electrical employment in those States?

Assoc.Amer.I.E.E.

November 10th, 1922.

Fixing the Price Per Point.

The problem set by Mr. J. Lander in your issue of November 3rd is one which cannot [illegible] in this command, where there is a very large number of huts and cottages supplied with electric power from War Department power stations, and no meters are installed.

The present system of charging is to divide the year into a summer period and a winter period and to [illegible] number of "lighting hours" up to 11 p.m. in each period. Half the number of lamps installed are assumed to be "on" during the whole of the lighting hours, and the B.O.T. units estimated to be consumed per month are charged for at the same rate as metered supplies. Whether this is fair to consumer and supply company is open to argument. I am afraid it does not satisfy the consumer. He compares his charges with his "metered" neighbour's and finds them considerably higher, but the supply company has to remember that it is only human nature that the man who pays by meter will be very much more [illegible] the man who knows that his bill will be the same whether he switches off or not. Electric light in unmetered houses must, in my opinion, be much more expensive and, therefore, less popular than where supplies are metered, and I should say the system is almost impracticable in civil life. I shall be glad to see the letters of others who have tried it.

O. H. Campbell, Lt. Col

Southern Command,
Headquarters, Salisbury,
November 8th, 1922.

Electrical Trading Relations.

At the first E.D.A. Conference, and after asking the chairman's permission, I made bold to suggest that [illegible] relations, trade discounts, &c., were matters having a vital bearing on the selling of electrical products. At subsequent conferences these subjects have been ruled out, and rightly so, in view of the confusion which their discussion may occasion. None the less, the opinion has since been expressed to me that such matters must be regularised if the electrical business is to have any settled future. At present selling in the electrical trade is little better than a wild scramble between manufacturer, superfactor, wholesaler and retailer, to get at the buyer. The prospect of a steady growth of trade—a growth which will bring to each party its proper share of the business—should make us [illegible] our present sales methods. They display complete ignorance of that simple plan that the way from the manufacturer to the buyer is through the wholesaler and the retailer, and that way alone.

A means must be found to operate the electrical trade according to this plan, otherwise the E.D.A. Salesmanship Conferences will fail or fall far short of their object, namely, to improve the efficiency of selling. These conferences can be a great co-ordinating force. They are already bringing together men whose sole work is selling electrical products, and I hope it will be possible to include in this year's programme an extra evening when subjects now obviously taboo can be discussed. Such a meeting would, I am confident, be well attended and would have the effect of clearing much lumbered ground.

In the face of a great electrical trade revival [illegible] ling between manufacturer, central station engineer, wholesaler and retailer, must cease. It has served the [illegible] a bad past, but has no place in any [illegible] future. I would appeal to every trading section to rid the electrical industry of an incubus which it has borne too long.

W. E. Warrilow.

London, *November 10th*, 1922.

BUSINESS NOTES.

Private Arrangements.—Fuller's United Electric Works, Ltd., [illegible] Health, London, E.—In [illegible] a meeting of the trade [illegible] was held on November 9th at Winchester House, Old Broad Street, E.C., Mr. Chair was occupied by Mr. W. Humphries, one of the principal creditors. The meeting was called for the purpose of considering a scheme for the liquidation of the company's liabilities. Under the scheme the unsecured creditors for amounts of £10 and upwards were offered income debenture stock carrying interest at the rate of 7 per cent., the stock to mature in 1932.

Sir Arthur Whinney said that from the proxies received the creditors were overwhelmingly in favour of the scheme. He thought he could say that 99 per cent. of the creditors were in favour of the scheme. It had to be remembered that the company was not in a position to pay cash for the goods it had received, and it was offering the creditors security for their claims. The amount due to the creditors was about £60,000, and there were note holders whose claims aggregated £250,000. He was afraid that if the creditors were to press for their right to receive cash the chance of their obtaining anything would be extremely small. The assets were not of a kind that would realise well under the hammer. As a going concern the thing was quite good. Break it up and the thing was quite bad. The company was asking the creditors to be patient and they would all be paid in full. The company required a moratorium. The income debenture stock offered to the creditors would be protected by a trust deed and a trustee. That was the most the company could do. It was necessary to put the company into a proper position of stability. In the past it had not been successful, and it was now proposed to cure some of the defects. It was recognised that the ills of the company could not be cured by the ordinary methods available to an accountant. They were ills which ought to be dealt with by a technical engineer. Mr. C. H. Wade had been consulted. He was the most eminent man the company could find, and on the whole he had reported satisfactorily on the business. Mr. Wade, however, called attention to certain defects which he considered ought to be remedied before the company could be placed in a sound position. In short, he said there was a necessity for re-arrangement in the lay-out of the factory. With a bad lay-out the various operations were wasteful, there was a restriction in output, and the quality of the goods was not uniform. Mr. Wade also pointed out that there must be an improvement in the manufacturing side of the business, and small additions to the plant, which would then be capable of producing three times as much as the present output. With a turnover of £450,000, which he said it was not impossible to secure, there should be a very substantial profit. Mr. Wade suggested that it was by no means impossible for the company to earn a profit of £100,000 a year. The commercial side of the business was very considerable, and it was capable of large developments. He concluded his report by saying that the board of the company ought to be remodelled. The Messrs. Fullers, whose interests were bound up with the company, had agreed that their own personal positions should not stand in the way of anything that was likely to arise for the benefit of the business. After mature consideration a board of directors had been proposed which he (Sir Arthur Whinney) considered was ideal. A works director was required, and a very influential and important person had been secured. That was Mr. W. L. Topple, who was for many years with Messrs. Vickers, and came to Fullers with the highest possible credentials from Sir Trevor Dawson. It was proposed that Mr. Palmer should become the managing director, while Mr. Leonard Fuller, who was occupied very [illegible] would be asked to take a seat on the board. Mr. F. J. Gordon, who had hitherto dealt with the [illegible] of the company, would also be a director, while Mr. C. H. Whaite would be the financial director. Finally, as chairman of the company, they would have Mr. F. R. Wade. Mr. Fuller, Senior, was standing aside. They did [illegible] altogether, and he was the gentleman [illegible] the building up of the business. His name was a household word in the trade, and it was proposed that he should remain with the company in a consultative [illegible] his services could be made use of. In conclusion Sir Arthur Whinney said there was a prospect of future prosperity in sight.

[illegible] James Ferguson & Sons, Ltd., inquired whether the income debenture stock to be issued to the creditors would be a marketable security.

[illegible]

The creditors [illegible] whether a Stock Exchange quotation could be obtained, and whether any modification could be made in the scheme. Would the stock, he asked, be of any value?

The Chairman replied that they only hope the stock would be of value, and the question of the scheme could be considered. In view of the circumstances the scheme was a good one. From his knowledge of the trade he had no hesitation in saying that they had practically no alternative but to accept the scheme as the only possible means of getting something out of nothing. He proposed a resolution expressing approval of the scheme.

The representative of Messrs. J. Glickstein & Co. seconded the motion, which was carried by a large majority, there being only one creditor voting against the motion. It was announced that the short-term note holders had previously approved of the scheme, the voting in its favour being £75,525, while only note-holders for £8,950 voted against it.

Williams & Laming, electric fittings factors, Great Portland Street, London, W.—A meeting of the creditors of the above was held recently at the offices of Messrs. C. Travis and Co., C.A., Moorgate Station Chambers, E.C. In the circular calling the meeting it was stated that, acting upon the advice of the principal creditors, the debtors had decided to cease trading, and had jointly entered into a deed of assignment, the trustee being Mr. Dutchman. The latter reported that the liabilities amounted to £956, of which £242 was for cash advanced. The assets totalled £372, or a deficiency of £593. The assets consisted of furniture, fixtures and fittings, £37; stock, £124; and book debts, £210. The business had been carried on by the debtors for about ten months, and during that time the turnover had been rather more than £1,500. The purchases had been a little short of that figure, and it appeared that the business had been carried on at a loss. The debtors had each drawn about £4 a week.

A resolution was passed in favour of the meeting being adjourned, and the opinion was expressed that the debtors should make an effort to bring forward a proposal for the payment of a composition of not less than 10s. in the £.

Bankruptcy Proceedings.—*Re* E. W. Morgan, company director and electrical engineer, Eccles Mill, Monton Lane, Eccles.—With reference to the notice appearing in the Electrical Review, November 3rd, p. 625, regarding this matter, the Ironclad Switchgear Co., Ltd., of the same address, write stating that this bankruptcy has no connection with that company.

J. R. Gough, electrician, 79, Prospect Road, Scarborough.—Receiving order made November 6th on debtor's own petition.

Company Liquidations.—Modern Electrical Supply Co., Ltd.—Winding up voluntarily. Liquidator: Mr. R. Stephens, 51, Lombard Street, E.C.

The "Watt" Electrical Co., Ltd.—Voluntary liquidation. Mr. H. Gardiner, Palmerston House, London, E.C.2, liquidator. Creditors to send particulars of debts, &c., by December 6th. Meeting of creditors, November 23rd, at Institute of Chartered Accountants, Moorgate Street, London, E.C.2.

Weldrics, Ltd.—Meeting of creditors, November 22nd, at 34, Nicholas Lane, E.C.4. Liquidator: Mr. R. R. Cullingham.

Dissolutions of Partnership.—R. W. E. Braham & Co., manufacturers of electrical and gas fittings and general spinners, 21, Bowling Green Lane, Clerkenwell, E.C.—Messrs. R. W. E. Braham and A. E. Hodgson have dissolved partnership. Debts will be attended to by Mr. Hodgson, who will continue the business under the same style.

Ash & Fraser, sanitary and electrical engineers, Belmont Street, Monton, 51, Barrfield Road, Pendleton, and 21, Anson Street, Monton, Lancs.—Messrs. J. H. Fraser and J. W. Ash have dissolved partnership. Mr. Ash will attend to debts at Belmont Street, Monton.

Clampett & Jones, electrical engineers, 13a, Paton Street, Manchester.—Mr. R. H. Clampett and Mr. E. M. Jones have dissolved partnership. Debts will be attended to by Mr. E. Williams, 12, Cleveley's Avenue, Chorlton-cum-Hardy, Manchester.

Caerphilly & District Engineering Co.—Electrical and sanitary engineers, 71, Cardiff Road, Caerphilly, The Square, Senghenydd, and Pandy Road, Bedwas.—Mr. J. H. Miles and Mr. F. D. Zussen have dissolved partnership. Mr. J. H. Miles will attend to the debts of the electrical branch and carry on that side of the business at The Square, Senghenydd. The debts due to and owing by the sanitary and plumbing department will be attended to by Mr. F. D. Zussen, who will continue the sanitary and plumbing department at 71, Cardiff Road, Caerphilly.

Trade Announcements.—The London office of Messrs. G. D. Peters & Co., Ltd., has been transferred to Caxton House, Tothill Street, Westminster, S.W.1. The Consolidated Brake and Engineering Co., Ltd., of 15, Dean's Yard, Westminster, and the British Air Brake Co., Ltd., of 64, Victoria Street, Westminster—companies of which Messrs. Peters are the sole proprietors—are also transferring their offices to the same address. Telephone: Victoria 2900/1; telegrams: "Peters, Vic., London"; cables: "Peters, London."

Messrs. J. & A. Anderson, 231, St. Vincent Street, Glasgow, have been appointed distributing agents for Scotland by the Holland Insulated Wire and Cable Works, of Amsterdam. Messrs. John McCurdy & Co., 7, Waring Street, Belfast, will represent the company in the North-Eastern counties of Ireland. Both firms will hold stocks.

Messrs. [illegible] have appointed Mr. David Rowland to be Works Manager. Mr. Rowland [illegible] agent in Scotland for [illegible] and [illegible] has had a considerable [illegible] that district.

The North Electric Manufacturing Co. of England, is removing its [illegible] to Newgate [illegible] Street.

Mr. E. Lafont, [illegible] Company, has [illegible] at Angoulême, Charente, and [illegible].

Mr. Hugh Smith, electrical engineer and lighting specialist, has opened premises at 2, Lord Street, Birmingham.

The [illegible] Electric Co. [illegible] Ltd., [illegible] Lane, Leeds, have been appointed [illegible] Electric Welding Co., Ltd., Sheffield, to the joint agency [illegible] Albion Street, New Oxford Street, W.C.1, to [illegible] and [illegible] accessories should be forwarded.

Catalogues and Lists.—Messrs. Siemens [illegible] 116 New Oxford Street, W.C.1.—An [illegible] dealing [illegible] designs, describing [illegible] starters, [illegible] and their standards, &c.

Messrs. JOHN Muir & Son, Leith, Scotland.—A series of pamphlets describing a specially developed [illegible] for loading by road-waggon and [illegible] by [illegible].

The Ediswan Electric Co., Ltd., 123 and 5 Queen Victoria Street, Manchester.—Publication No. 974, containing a good selection of views of power-house and substation switchgear of many types.

Messrs. A. & A. Electrical Co., Ltd., 15, Farringdon Road, E.C.1.—Lists A.1/22, giving illustrations and particulars of three and three-pound [illegible] and [illegible].

Mr. E. J. Cooke, Trinity Electric Works, Tettenhall, Manchester.—A price list of his [illegible] switches, instruments, test [illegible] and [illegible].

The Metropolitan Electric Manufacturing Co., Ltd., Hertford Street, Birmingham.—An illustrated and priced leaflet, giving a full description of the [illegible] switch.

The Reliance Machine Co., Ltd., Dudley Street, Manchester.—An illustrated booklet describing the Reliance [illegible] motor.

The Wolsey Co-operative, Ltd., Ellaline Road, Old Trafford, Manchester.—An illustrated and priced [illegible] of [illegible] and radiators for [illegible] and [illegible] lighting.

Metallic Filaments, Ltd., 3, Central Buildings, Westminster, S.W.1.—A detailed description of the Method Electrolyte for testing [illegible] and [illegible].

Messrs. E. H. Bentley & Son, Ltd., 29 and 30, Margaret Street, W.1.—A comprehensive catalogue of [illegible] instruments, including [illegible] switches, instruments, [illegible], [illegible] &c. Priced.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Catalogue, Section [illegible], dealing with electric [illegible] sets for farms and country houses. Prices, [illegible] and particulars of accessories are included. Priced.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—A priced [illegible] of [illegible] lamps in various [illegible]—also [illegible] &c.—for [illegible] purposes.

Messrs. Siemens & Co., Ltd., 39, Upper Mall, Strand, W.C.1.—A well-illustrated and priced catalogue of lighting fittings of all types, including [illegible], [illegible], [illegible], [illegible] trolleys, &c.

Newcastle Electrical Contractors.—The President of the Electrical Contractors Association, Mr. H. Morton, M.I.E.E., visited the Newcastle branch of the Association on Thursday last. In an address to the members on the position of the Association, he said [illegible] Association [illegible] and [illegible] of Electrical trading and of the various [illegible] Council. Other matters that required [illegible] and [illegible] new organisations which [illegible]. These would be discussed at the [illegible] meeting, held at the [illegible] Mr. Morton [illegible] and [illegible] and [illegible] support and [illegible] by [illegible].

After the meeting, Mr. Morton and Mr. W. H. F. Tolmie, A.M.I.E.E., were entertained to lunch at the Turk's Head, by members of the Branch, and a number of [illegible] were presented to the [illegible] secretary by the chairman.

After lunch, Mr. Morton was taken to the Electricity [illegible] some of the members joined the [illegible] examination in the Close, and he expressed his surprise and appreciation of the efforts that were being made in this district to [illegible] before the public the uses to electricity. Later in the day Mr. Morton took the chair at a meeting in the Chamberlain Hall, when Mr. Angus Watson, B.E., gave a paper on "Sales-manship."

Electrolytic Copper in Spain.—It is announced that the Sociedad Española de Electrolisis, Puente-Mercantes, which was formed some time ago for the production of [illegible] copper by the electrolytic process, [illegible] and [illegible] Rio Tinto, Spain, has [illegible] in the early part of next year.

Queensland Electrical Employers.—The Electrical Employers' Association of Queensland has come to the support of the [illegible] by [illegible]. The scheme [illegible] membership [illegible] and [illegible] of [illegible]. The Association is very active in [illegible] and the examination of employés as to their fitness for the industry.

Our Foreign Trade.—[illegible]. The following [illegible] of [illegible] and [illegible] of electrical [illegible] for [illegible]:—

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	£	£	£
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Electrical	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]

Book Notices.—"Science Abstracts, A & B." Vol. XXV. No. 297. Part 9. September 30th, 1922. Price 2s. 6d. net each.

The Journal of the South African Institution of Engineers. Vol. XXI. No. [illegible], 1922. Johannesburg: The Institution. Price 2s. This issue contains papers on "Waste Heat as a Fuel [illegible] A. A. Quance, and "The Vaal River Scheme, with special reference to the Barrage," by W. Ingham, M.Inst.C.E. A list of recent South African patents is also published.

The Bulletin of the Hydro-Electric Power Commission of Ontario. September, 1922. Articles upon the Galt municipal transformer station, "Locating a Fault in an Underground Cable," "The Coulomb Voltmeter," and many news items are included in this issue.

The following publications have been received from the Bureau of Standards, U.S. Department of Commerce. They are obtainable from the Government Printing Office, Washington, at the prices given in parentheses:—Scientific Papers, No. 445. "A Piezo-Electric Method for the Instantaneous Measurement of High Pressures" (5 cents); No. 446, "Spectrophotoelectrical Sensitivity of Argentite" (5 cents); and No. 449, "Radio-Frequency Amplifiers" (5 cents). Circulars No. 24, "Publications of the Bureau of Standards"; [illegible] No. 104, "U.S. Government Specification for Fire-Extinguishing Liquid (Carbon Tetrachloride Base)." Technologic Paper No. 216, "Properties of Electrical Insulating Materials of the Laminated Phenol-Methylene Type" (30 cents).

"The A.C.E.C. *Revue*," October-December, 1922. London: Ateliers de Constructions Electriques de Charleroi. This issue, which is in French, is devoted to articles on high-pressure cables, the application of electricity to rolling mills, centrifugal pumps, and a set of conditions drawn up by the Belgian Electrotechnical Committee to which insulated wires and cables must conform.

New Spanish Companies.—With the designation of Saltos del Rio Ondarro, and a capital of 1,450,000 pesetas, a company has been established at Jemein (Vizcaya) for the production of light and power.

There has been embodied at Barcelona, La Energia Industrial, for electro-mechanical manufacture, installation, and representation. Capital, 500,000 pesetas.

Local Exhibitions.—The recent exhibition was a great step forward in the history of Douglas. It is 26 years since a deputation from the Corporation visited the Continent to inspect electrical systems, but, for financial reasons, the Council was not able to go forward. Matters are now well in hand, however, and it will be possible to provide current by next July. Many well-known firms took advantage of the opportunity by exhibiting splendid selections of their wares. On the stand of the Douglas Corporation were shown various types of lamps. The Carron Company gave daily demonstrations of electric cooking. One of the brightest stands was that of the General Electric Co. Here were heating appliances and electric motors, together with Witton-Kramer electrical tools and country-house lighting sets. Messrs. Seddon & Co., of Manchester, had a display of lighting apparatus, and at Mr. J. H. Blackburn's (Bolton) stand demonstrations in ironing and cooking were given. No less enterprising were the local firms, including Lawton & Co., T. W. Broadbent, A. V. Bellamy & Co., Christian & Shaw, and J. C. Fargher & Co. All these firms have already equipped private establishments with lighting plants, &c. The price of electricity has been fixed definitely at 10d. per unit from sunset to midnight and 2½d. per unit from midnight to sunset the following day. It is estimated that the cost of installations in ordinary premises will not exceed 37s. 6d. per point, including plain fittings. Mr. Bertram Kelly, A.M.I.E.E., of Douglas, has been appointed borough electrical engineer, and Messrs. Creer Bros., of Douglas, have secured the contract for the building of the new electricity works.

A successful electrical exhibition was held from November 2nd to 11th, at Warrington. The organisers were the Electricity and Tramways Committee and local members of the Electrical Contractors' Association. The show was opened by Sir Peter Rylands, who said that electricity was gradually superseding other forms of power, and an exhibition of this nature would show the public what could be done by its aid.

A number of the leading electrical firms participated in the exhibition, one of the most prominent being the St. Helens Cable & Rubber Co., Ltd. Mr. J. H. C. Brooking, of this firm, was the hon. secretary to the organising committee. The [illegible] cables of all sizes and samples of insulating materials. The Economic Electric Co. displayed wireless apparatus, lighting plants, and domestic appliances. Messrs. Etchells, Congdon, & Muir, Ltd., showed a model [illegible] Messrs. Wright Motors, Ltd., exhibited [illegible] tures. Carron Company and the Falkirk Iron Co., Ltd., represented electrical cooking with appliances of many types and sizes. Messrs Evershed & Vignoles, Ltd., showed, through their Northern agents, Messrs. Jessop & Boydell, Ltd., a range of their instruments including the "Meg" insulation tester, voltmeter and ammeters. Mr. George Ellison had examples of industrial switchgear on view. Messrs. Harry Bibby & Co., local electrical contractors, occupied a large space and showed representative appliances made by many [illegible] local firms which took part were the Warrington Electrical Co., Ltd., Messrs. C. H. & J. Dawson, Ltd., and Messrs. Hanson & Edwards, Ltd. (welding plant). Messrs. Veritys, Ltd., the British Electric Transformer Co., Ltd., Hotpoint Electric Appliances, Ltd., and Messrs. Parmiter, Hope, & Sugden, Ltd., also had stands. A Scots Guards' orchestra provided music during the exhibition.

The members of the management committee were Messrs. C. J. D. Barlow, A.M.I.E.E., F. V. L. Mathias, M.I.E.E. (borough electrical engineer), H. Horrocks, A. L. Madden, B. Nadin, G. A. Platt, H. Evans, and Ewart Watson.

Openings in Northern Ontario.—H.M. Trade Commissioner at Toronto (Mr. F. W. Field) has furnished to the Department of Overseas Trade a report in which he states that there is a good demand in Northern Ontario for mining machinery and supplies (estimated at a value of $20,000,000/$30,000,000) including the following: electrical material and equipment; air compressors; rock drills; pumps, hoists, skips, cages, &c.; boilers, steam plant, steam engines, &c.; labour-saving machinery for lifting and dumping; and storage battery locomotives for underground work. It is believed that British firms may, with advantage, review their agency arrangements with a view to obtaining a greater volume of business in the northern section of this area. Several United States firms pay small retaining fees to local representatives in Northern Ontario whether or not any great volume of business is being obtained at the time. United Kingdom manufacturers should warehouse a fairly substantial supply at Montreal or Toronto for the Northern Ontario market, and it is recommended that British firms' catalogues and other trade literature containing details should be circulated in this area. Buyers insist on having descriptive catalogues containing particulars as to dimensions, and, as one buyer stated, "Telling the whole story." A list of some of the principal purchasing agents in Northern Ontario to whom the Trade Commissioner recommends that catalogues, &c., should be sent can be obtained by interested United Kingdom firms on application to the Department of Overseas Trade.

Belgian Offer to Budapest.—It is reported from Budapest that M. Bettern, president of the Belgian Electricity Trust, has made a proposal to the municipal council of that city, offering to take over the municipal supply works and the tramways. The Belgian financial group offers as payment for the transfer the sum of 25,000,000 Belgian francs, corresponding to 4½ milliards of Hungarian crowns.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below.

Calite. No. 426,997. Class 5.—Unwrought and partly-wrought metals used in manufacture. British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C. November 8th, 1922.

Electromophon (lettering and design). No. 426,571. Class 8.—Electric gramophones. Purcar, Ltd., 18, Prudential Buildings, Portsmouth. November 8th, 1922.

Fellocryst. No. 428,765. Class 8.—Wireless communication apparatus. Fellows Magneto Co., Ltd., Cumberland Avenue, Park Royal, London, N.W. November 8th, 1922.

Reako, London (lettering and design). No. 425,162. Class 13.—Metal goods. Russell Electrical Appliances Co., 60, Queen Victoria Street, London, E.C. November 8th, 1922.

Price Reductions.—The Jackson Electric Stove Co., Ltd., announces that the prices of certain of its cookers have been reduced, and, in addition, a number of improvements have been effected enhancing the appearance of the appliances.

Messrs. Bastian & Allen announce a reduction in prices of Bastian Quartzalite heating elements. A new catalogue is in preparation.

An Engineers' Guild.—The November *Journal* of the Amalgamated Engineering Union contains an account of the formation of The Guild of Engineers (London), Ltd. This is a co-operative undertaking organised by the London branches of the Union, with the participation of any other trade union or group of engineering workers, to carry out public contracts. It is stated that the Guild has already received an order to carry out a boiler installation for the Camberwell Borough Council's public baths. The Guild has been successful in securing the support of several members of the Institutions of Civil, Mechanical, and Electrical Engineers, and the name of Mr. C. Ashmore Baker, A.M.I.E.E., is mentioned in this connection.

Proposed International Exhibition at Sofia.—On the occasion of the fiftieth anniversary of the independence of Bulgaria, the Government proposes to submit a bill to the Sobranjé for the organisation of an international exhibition at Sofia, in 1928. A commission of technical experts will shortly be appointed to elaborate with the assistance of the Ministries of Public Instruction and Commerce and Industry the details of the scheme. The State, the Chambers of Commerce, and the provincial and municipal councils will introduce credits in their budgets each year up to 1928, in order to help to cover the cost of the organisation of the exhibition.—*Reuter's Trade Service* (Sofia).

Defections from Trade Unions.—The quarterly report of the General Federation of Trade Unions states that the Unions are still losing members, although it is considered that the loss is not so bad as would appear from the figures. The report points to the fact that countries whose currency is comparatively stable have more unemployed than those whose currency has collapsed. This is attributed to the fact that the latter become "sellers" instead of "buyers," with resultant injury to the financially stable countries. The financial position of the Federation is declared to be sound, a reserve of £65,339 being disclosed after meeting all claims.

The British Empire Exhibition. We learn that the B.E.A.M.A. has made considerable progress with the organisation of the Electrical and Allied Engineering Section of the British Empire Exhibition. There is about 120,000 sq. ft. of space to be let, and something like half the space has already been booked. We wish to draw the attention of all makers of electrical machinery and appliances of whatever kind, including manufacturers of wireless appliances, to the exhibition. An invitation is extended to all to exhibit in the section and thus ensure that the electrical industry will be adequately represented at this great exhibition. Applications for space should be made to the British Electrical & Allied Manufacturers' Association, 36 and 38, Kingsway, W.C.2, and it is specially desired that application should be made without delay, as it is hoped to have the bookings fairly complete by the end of the year in order that the final plans for the buildings for this section can be passed. The members of the B.E.A.M.A. have already done a great deal towards making this section of the exhibition a success, for, in addition to taking the bulk of the exhibition space already booked, they have arranged to loan to the exhibition at a purely nominal rental the whole plant and accessories, having a capital value of approximately £130,000, for the temporary power station which will be installed in the exhibition building itself and form an attractive feature of the section. As already stated, the Association is also organising a world power conference, which is to be held during the exhibition in the lecture halls which are being provided. This conference has already received the support of Government departments and representatives of overseas Governments in this country, and of many distinguished representatives of science and industry throughout the world. In the United States, for example, it is receiving the consideration of the Federal Power Commission, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the Electrical Manufacturers' Council, the National Electric Light Association, and the Power Club. In Norway it is being supported by the Norwegian Water-power and Electricity Board, and the chief director of the Board is giving the matter his personal attention. In Sweden the question is being taken up by the Swedish Technological Association, the Royal Swedish Academy of Engineering Science, the Federation of Swedish Industries, the Swedish Water-Power Association, and the Royal Swedish Water Board. On such lines as these the interests of the conference are being advanced in France, Italy, Denmark, Holland, and other countries, and national committees are in process of formation, which will consider how much of a wide and comprehensive programme can effectively be undertaken at Wembley in 1924.

Mr. John Campbell, late of the United Provinces Civil Service, has been appointed secretary to the Indian and Burma Advisory Committees for the Exhibition by the Government of India.

British Industry and the Canadian Market.—The Federation of British Industries has decided to inaugurate a British Section at the next Canadian National Exhibition, to be held at Toronto next year. The question of trade with Canada is of the utmost importance at the present time, for more than one reason. As a result, considerable interest is being manifested in the Canadian National Exhibition, one of the most important trade gatherings of its kind held in the world. It is hoped that next year there will be a million and a half visitors. The exhibition is held for a fortnight at the latter end of August. Although a few British manufacturers have for many years been in the habit of exhibiting at the exhibition with marked success, the bulk of the manufactured goods exhibited have been either of Canadian or American origin, and it is felt that the participation of United Kingdom firms should be very much greater in view of the opportunities for British business in Canada which exist at the present time. It is with this aim in view that the F.B.I. has decided to start a British Section. Realising, moreover, that one of the obstacles confronting British firms is the distance from England to Canada, and the expense and trouble necessitated in arranging an individual exhibit, a scheme has been prepared in which the Federation will undertake all the preliminary work and trouble of arranging exhibits.

An adequate block of space in one of the principal buildings is being held at the Federation's option by the exhibition authorities, and on this block it is proposed to erect a group of stalls to be placed at the disposal of British firms at advantageous terms. An expert staff from the Federation's Head Office will go to Canada some time before the commencement of the fair to undertake this work, and will erect the stalls, receive, unpack and arrange exhibitors' samples and attend also, where desired, for expert representation of any kind during the run of the exhibition. For this a fixed inclusive rate will be charged, and firms will be relieved of the considerable trouble and heavy expense of sending a representative of their own to arrange the exhibit. A further advantage will be the offer of small and inexpensive spaces to firms unwilling to incur the expense of a complete stall. The grouping together of British exhibits will give importance and weight to even a small exhibit which it would not possess if merely placed haphazard along with other and larger displays. In the centre of the section will be placed a Federation stall which will act as a general headquarters and information bureau for visitors interested in British products. It is necessary, of course, if the "collective" exhibit is arranged that it should be well supported. A section that is too small to have an impressive effect will hardly be worth undertaking, but trade conditions generally, and the prospects of business with Canada, are such that it is hoped a great number of firms will avail themselves of this opportunity of attacking the market.

Wages of Fitters.—At a meeting of the No. 2 District Council for the Electricity Supply Industry, on November 8th, a letter was read from the manager of the Sheffield Corporation Electric Supply Department stating that he had received a complaint that the wages of skilled men in the engineering trades were less than those paid to semi-skilled and unskilled workers in the electricity supply industry. He asked that the anomaly might be removed. After consideration, the Employers' side agreed to consider amending the rate if the Trade Union side was willing to consider, as anomalies, the rates being paid to electrical fitters, electricians or electrical wiremen, and telephone electricians or linesmen (which are at present governed by the National Contracting Council). The Trade Union agreed to this course and the matter was put down for consideration at the next meeting of the District Council.

German Trade with South Africa.—The resumption of activity by the German Consuls in South Africa has been followed by the forwarding to Berlin by the Consulate at Pretoria of a report dealing with the question of direct or indirect trading with that part of the British Empire, as seen from the German point of view.

The report states that if direct sales are attempted it is necessary for the German exporters to keep in mind the fact that English goods, tastes and styles still predominate in South Africa, and it is, therefore, desirable for English market conditions to be studied first before thinking of undertaking direct business with the Dominion. Firms who usually avail themselves of the services of export houses for transmarine business are also recommended to follow the English and American example and make direct and regular offers in the South African market, as this often leads to transactions being entered into. Offers are to be accompanied, the report states, by the notice: "Orders solicited through European Export Houses," and by patterns and samples, where possible. The catalogues and prices f.o.b. port of shipment, are to be in English, and English weights and measures are to be used, but the Consulate will not undertake the distribution or forwarding of printed matter.

Coming to discuss the question of payment the report states that South African firms as a rule pay through their European buying houses or agents on presentation of the shipping documents. On the other hand, firms who are not in connection with European buying houses usually pay by means of bills which, in the case of well-established houses, are mostly discounted by the South African banks in Europe without being first sent for acceptance; and in these cases the bills are drawn at from 60 to 90 days' sight. It is added that although import firms two or three years ago were willing to pay an instalment on account of orders already placed, it is improbable that such a condition would now be agreed to, except perhaps in the case of machinery.

In conclusion, the report refers to Government orders and states that if non-British firms have representatives in South Africa, in principle they are not debarred from competing for contracts thrown open by the Government.

Commercial Arbitration.—It would be of interest to learn the precise situation of the scheme for a Court of Arbitration in connection with the International Chamber of Commerce in Paris, for the adjustment and settlement of international commercial disputes. According to the sources from which we recently quoted on the question the Court has been formed, but this appears to be somewhat premature despite the fact that the members of the Norwegian National Committee in the matter have been appointed. This assumption is based upon a statement made by Mr. A. C. Bedford, chairman of the American Section of the International Chamber of Commerce, who is reported from New York last week to have announced that "plans have been perfected for the establishment of a Court of Arbitration," with headquarters in Paris, and independently of all Government agencies. Apparently the promoters are either unwilling to await the effects of the low-speed machinery of the League of Nations or they believe that there is more prospect of success in the case of a private scheme.

The G.E.C. Delivery Service.—The General Electric Co., Ltd., now possesses a fleet of 18 motor and 4 horse-drawn vehicles for delivering goods in the London postal area as well as in certain districts beyond this area. There are two deliveries a day in the West End and City, one a day to most of the other places, with the exception of one or two outlying districts which are visited twice a week.

Chinese Notes.—The Ministry of Communications has recently drawn up a set of regulations laying restraints on the registration of electric light companies. One article of the regulations provides that the registration of electric light companies will be subject to cancellation if actual erection of the plant is not commenced within a period of three months dating from the grant of registration.

Mr. Chow Kai Tsing and others plan to organise the Ta-Ming Electric Co. in Nantungchow, with a capital of $400,000.

The Yeh Chung Machine Co. has been organised by C. C. Nieh and other prominent merchants of Shanghai. Its main business is to manufacture electrical materials and machines. Its factory site is at Yang Ching Chiang Pootung.

LIGHTING AND POWER NOTES.

Abertillery.—Electricity in Bulk.—Arrangements have been made to obtain electricity in bulk from the Ebbw Vale Co., and it is anticipated that the centre of the town will be lit by electricity by Christmas.

Australia.—Western Australia.—The earnings of the Government electricity supply undertaking for the year ended June 30th last amounted to £118,775, as compared with £92,312 in the preceding year. Working expenses rose from £74,978 to £87,582, leaving a gross surplus of £31,193, as against £17,334. Interest and depreciation charges absorbed £31,759 (£26,894), resulting in a net deficit of £566, as compared with £9,560. The amount of energy sold increased from 22,596,330 to 27,105,309 kWh. The average price obtained rose from 0.973d. to 1.05d. The plant capacity remained at 12,000 kW.

New South Wales.—The Blue Mountains Shire Council proposes to raise a loan with a view to extending the electric lighting system from Woodford, so as to include Faulconbridge, Springwood, and Valley Heights.

Rockhampton (Queensland).—The City Council proposes to borrow £100,000 for various purposes, including an electricity supply scheme.

Maryborough (Victoria).—The Town Council is floating a loan of £15,000 with a view to providing electricity for lighting and power purposes in the town.

Cardiff (N.S.W.).—Steps are being taken to obtain a supply of electricity for the town, and the Newcastle Council has been asked to extend its system to serve the district.

Billericay.—Electricity Supply.—The Rural Council has consented to applications for Orders to supply electricity in the district by the Brentwood District Electric Co., Ltd., and the Wickford & District Electricity Supply Co.

Bootle.—Charges of Canal Company.—The Ministry of Transport, on October 31st, instituted an inquiry into a complaint by the Bootle Corporation that the Leeds & Liverpool Canal Co. charged excessively for the water taken from the canal by the Corporation for condensing and feed purposes. A charge of .01d. per kWh generated was fixed in 1901, and, in spite of plant improvements, the company declined to reduce it. In 1920 the Corporation received a letter intimating that an increase to .015d. per kWh was to be made as from January 1st, 1921, and under the threat of having supplies cut off the Corporation decided to apply for an Order under Section 15 of the Electricity Supply Act (1920). The company refused to accept arbitration in the matter. The Corporation contended that the company was not put to any expense through the use of the water, nor was any service required by the company in connection with it. The borough electrical engineer (Mr. T. D. Clothier) and the chairman of the Electricity Committee (Councillor James Scott) gave evidence. The company maintained that the charges were necessary and not excessive, and pointed out that the question would soon cease to trouble the Bootle Corporation. This was not a proper case for the establishment of a precedent. The Corporation admitted that it was charging more than double the pre-war price for electricity, although the charge for water had only been increased by 50 per cent.

It was intimated by Mr. Kessane, who conducted the inquiry, that an early decision would be given.

Brazil.—Hydro-Electric Scheme.—Official consent has been given to the plans submitted for the utilisation of the falls of Mambucaba, situated on the frontier-line between the States of Rio de Janeiro and Sao Paulo. It is proposed to form an influential syndicate for the purpose of installing the necessary plant and machinery to supply hydro-electric energy for a number of public services. The approval of the plan by the Government has entailed the reservation of an area of 12,300 hectares of land which can be devoted to any useful industrial purpose.—*Reuter's Trade Service.*

Cheadle and Gatley.—Loan Sanctioned.—The Urban Council has received sanction from the Electricity Commissioners to a loan of £10,000 for electricity purposes.

Chile.—Progress of Santiago Station.—So satisfactory has been the progress in the erection of the Santiago power station that completion is expected before the end of December. The work which has been carried out will enable the station to receive the 110,000-V current from the great dam and station located at Maitenes, where it will be transformed to 550 V and distributed for the lighting and street-railway services of the Chilean capital, as well as for the service of the electrified railway now being constructed between Santiago and Valparaiso.—*Reuter's Trade Service.*

Continental.—France.—The Commercial Counsellor at Paris (Mr. J. R. Cahill) reports that the French Cabinet adopted, on October 31st, a Bill for promoting by State advances, the development of electrical distribution in country districts. Under this Bill loans for periods up to thirty years are grantable by the State to communes, to unions of communes, and to authorised agricultural associations, at the rate of interest of 4 per cent., and these loans will be guaranteed by the departments in which these organisations are domiciled. The necessary funds for making advances will be obtainable from the Caisse des Depôt et Consignations, but in no year may the total lent under the scheme exceed 600 millions. It is a stipulation that the advances of the State to any recognised organisations are not to exceed the amounts raised by such organisations for the same purpose. It is, therefore, seen that the programme of electrical distribution in country districts, if advantage is taken of the State loans, will be capable of realising work representing in value a total of 1 milliard 200 millions of francs.

La Société Havraise d'Energie Electrique is erecting a 30,000-V transmission line between the generating station at Gainville and the town of Bolbec.

Rumania.—Steps are being taken to utilise the waterfalls in the Transylvania mountains for generating electricity. With this object in view a company, styled the Karpathenwerke, has been formed in Hermannstad to utilise some 125,000 h.p. of the waterfalls in the Carpathians.

Germany.—A German electricity supply company, the Kraftwerk Sachsen-Thüringen A.G., in announcing recently the raising of the price of electricity for lighting to 45 marks, and for power to 36 marks per kWh, makes known its willingness to receive payment in goods, instead of in coin or paper namely—for each kWh of lighting energy, 10 eggs or 3 lb. of wheaten flour, or a ¼ cwt. of potatoes.—*Elektrotechnischer Anzeiger.*

Czecho-Slovakia.—Steps are being taken to erect large hydro-electric power stations at Seestadtl and Kaaden. The linking up of the power stations in north-eastern Bohemia and the extension of the network of the North Bohemian Electricity Works are also in hand.

Costa Rica.—San Jose.—The municipality of San José has decided to install a new electric power plant sufficient to light the whole of the city and to supply power for several industrial establishments already erected there, and for others which are contemplated.—*Reuter's Trade Service.*

Guildford.—Extension of Supply.—Onslow Village, Ltd., has asked the Town Council for terms for extending the electricity supply to include the village. The Council has replied that it will be necessary for Onslow Village, Ltd., to guarantee £450 per annum and to bear its own service charges for laying mains.

India.—Hydro-Electric Scheme.—The hydro-electric works which was recently completed in Naini Tal was started in 1920. To-day, 17 miles of roads and streets are being electrically lighted. Most of the hotels and houses have also been connected with the distribution system. The electric power is also going to be used for driving the waterworks pumping plant. Water is taken from the lake at Naini Tal, while the main power station is situated 1,500 ft. below at Durgapore. The water is conveyed by two steel mains 2,300 yards long. The main power station is connected with three sub-stations by a transmission line, the transmission pressure being 3,300 V. The sub-stations are equipped with Westinghouse oil-cooled transformers, the necessary switchboard, &c.—*Indian Textile Journal.*

Llandrindod Wells.—Purchase of Undertaking.—A ratepayers' meeting has decided to support the Council's proposal to purchase the electric light undertaking for £22,500.

New Zealand.—Ashburton.—A poll of the ratepayers has approved of the borrowing of £296,500 for the purchase of the plant and transmission lines of the Ashburton Electric Supply Co., Ltd.

Norden.—Electricity Scheme.—The Urban District Council is suggesting to the Rochdale Corporation: (1) That the Corporation supply electricity to Norden in the same manner as it now supplies gas to agreed points on Edenfield Road and Bagslate Moor Road; (2) that the Corporation should take over the Bury Road district's electric lighting; (3) that the Corporation should supply electricity in bulk to Norden, the District Council to erect a transforming station. Negotiations

are now proceeding and a report on the estimated cost of the scheme is to be prepared by the Council's electrical engineer when the Rochdale reply is received.

Pembroke (Co. Dublin).—Price Reduction.—The District Council proposes to reduce the price of electricity in its area from 10d. to 8d. per unit for lighting.

Peterborough.—Year's Working.—The accounts of the Corporation Electricity Department (engineer: Mr. H. A. Nevill) for the year ended March 31st last record a total revenue of £34,561, as compared with £25,152 in the preceding year. The working expenses absorbed £29,344, as against £22,862, leaving a gross surplus of £5,217 (£2,590). After the payment of capital charges the result was a net deficit of £6,870, which was the largest deficit yet incurred, the figure being £3,580 in 1920-21. The adverse result is attributed principally to the coal miners' strike last year. The energy sold showed a large increase, *viz.*, from 1,280,653 to 1,973,936 kWh. This increase was entirely due to bulk supply contracts; without these there would have been a decrease.

Rawdon.—Electricity Supply.—The Electrical Distribution of Yorkshire, Ltd., has agreed to supply electricity to the district, and a sub-station is to be erected at "Mawcroft."

Torrington.—Electricity Supply.—An agreement has been signed between the Corporation and Mr. S. I. Knill, of Hele Manor Park, Barnstaple, by which the latter will provide, within 18 months, a supply of electricity to the town, either as a separate undertaking or as an extension of the Bideford and District Electric Supply Co., Ltd.

Venezuela.—Hydro-Electric Resources.—It is stated that attention is to be given to the exploitation of hydro-electric resources, only the fringe of which has hitherto been touched. Abundant opportunities are believed to exist. The soil of Venezuela is watered by no fewer than 1,059 rivers and streams; a considerable number of the affluents to such rivers as the Orinoco, Apure, Leta, Caura, Negro Guarico, in addition to several waterfalls, could be successfully adapted to the supply of power. Considerable development is possible at Naiguata, 20 km. (12.43 miles) from Carácas; these falls have a drop of 1,026 metres (3,364 ft.), with a volume of 515 litres (18.18 cu. ft.) per second, and a rated effective horse-power of 4,300. It is claimed that this source of power, with slight additional cost, might be made to deliver 6,000 h.p. It is also proposed to use the waterfall of the Manzanares River to work the railway from Cumana to Cumanacoa. This line is of 1.07-m. gauge (3.51 ft.) and 60 km. (37.28 miles) in length. Foreign capitalists exploiting this enterprise and similar undertakings would probably enjoy exemption from local, State, and Government taxes.—*Reuter's Trade Service* (Caracas).

Wantage.—Electricity Supply.—The Urban Council has decided to give support to an application by Sir Charles Bright & Partners, Ltd., for an order to supply electricity to the town.

TRAMWAY AND RAILWAY NOTES.

Australia.—New South Wales.—The *Industrial Australian and Mining Standard* states that the State Railway Department is anxious to proceed with the electrification of the Sydney suburban lines, but the question of finance is causing some difficulty. The first stage is the electrification of the Illawarra line to Hurstville and the Bankstown line. The total cost of this, including locomotives, is estimated at £500,000. Power is already available, but the conversion would take about two years. Over £250,000 has already been spent in anticipation of electrification, including tunnel widening, new rolling stock, &c. It is stated that conversion would double the present traffic capacity. The Cabinet may defer the work until next year, but the view of the Railway Department is that permission to go ahead should be given immediately. If suburban railway electrification is carried out, it will probably delay the conversion of the Newcastle steam tramway system, for which £1,000,000 is required.

Melbourne.—The electric tramways operated by the Melbourne Tramways Board earned a total revenue of £600,698 last year—an increase of over £126,000. The working expenses amounted to £436,518, leaving a gross surplus of £164,180, out of which £70,285 was paid in interest on stocks and debentures. The number of passengers carried was 63,546,435, and the car-mileage increased by 740,166 to 6,178,990.

Western Australia.—The annual report upon the working of the Government tramways (year ended June 30th, 1922) shows an increase of revenue from £221,892 to £248,463. Working expenses also increased—from £204,459 to £209,104. The gross surplus was thus £39,359, as compared with £20,433. Interest charges absorbed £35,524, leaving a net profit of £3,835. In the preceding year the final result was a deficit of £9,384. The car-mileage increased from 2,552,550 to 2,644,725, and the number of passengers carried decreased from 25,753,113 to 25,042,689.

Birmingham.—Railless Cars.—The Old Square is being prepared as the starting point for the railless cars, which will run on the Nechells route. A number of these vehicles have been delivered. The date of the opening of the new service is not yet decided.

Continental.—France.—With the equipment of its lines for electrical working, the Midi Co. is proceeding with the erection of additional stations to provide the necessary power. At present its power station [illegible] 50,000 h.p., but the harnessing of a further 300,000 h.p. of water-power is planned [illegible] Artouste and Lanouse.

Italy.—A Bill has been introduced in Parliament to empower the Government to sanction the construction of the electric railway, Trieste-Cividale-Passodel Predel, which will link Trieste to Central Europe, by private enterprise. The estimated cost of carrying out the work is 500,000,000 lire.

A company has been formed at Pavia by representatives of the communes interested and of the provincial authorities of Milan, Pavia and Piacenza, for the construction and working of an electric tramway to run from Milan to Valtidone. The Milanese engineer, Croci Alfredo, is now engaged on preparing the plans.

The building of an electric railway between Gozzano and Alzo, province of Novara, to assist the granite industry of the Cave of Alzo and the district of Cusiana, is under consideration by the local authorities.

A committee has been nominated for the construction of an electric railway linking Ancona, Osimo, and Castelfidardo, and eventually Loreto, Porto Recanati, Falconara, Camerano, and Montesicuro. Application for official sanction is to be made.

Spain.—Bilbao tramwaymen have not resumed work with the other men who went on strike as a protest against the trial of four workmen accused of having murdered an employer. The whole tramway staff has been dismissed, and another general strike is threatened.—*Reuter.*

Bulgaria.—A commission of experts is now engaged in studying the question of the electrification of the Pernik-Sofia line in order to increase the output of the coal mines, and so help to meet the railways' requirements for coal. The construction of an electrical power station at Pernik is planned, which will supply electrical energy, not only to the Sofia-Pernik line, but also for lighting purposes in Sofia. The commission will shortly present its report to the Government, which will take the necessary steps for the realisation of the project.—*Reuter's Trade Service* (Sofia).

Darlington.—Light Railway.—The Town Council has agreed to the recommendation of the Electricity and Light Railways Committee that the manager shall prepare an estimate of the cost of completing Railway No. 3 to Haughton-le-Skerne, and also of extending the lines along Brinkburn Road, Feethams, and Victoria Roads.

Manchester.—New Route.—With a view to finding work for the unemployed, the Tramways Committee states that it is prepared to proceed with the construction of a tramway track along Anson Road, through Victoria Park, and along Birchfields Road.

Rochdale.—New Route.—The Town Council is recommended to sanction an application for powers to construct the new station tramway route *via* Richard Street and Maclure Road in place of the present route by the High Level Road.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—Wireless Chain.—It is stated that the Dominion Government of Canada proposes to provide a chain of six radio stations extending into the Arctic circle. Five of the stations will be constructed at Forts Smith, Resolution, Simpson, Norman, and Macpherson, on the Mackenzie River and the sixth at Dawson City. The primary object of the chain is to keep Federal officials in touch with one another.—*The Times.*

Chile.—Earthquake Damage.—Severe earthquake shocks during the night of November 11-12th did much damage. The sea floor appears to have been raised considerably, and at Coquimbo the post office and radio station were destroyed. All the submarine cables along the coast were damaged, and direct communication between South and North America were completely interrupted. The cables of the All-American Cables Inc., Ltd., were interrupted below Iquique; there was much loss of life.

Germany.—Radio Telegraphy.—Since 1919, according to the *Telegraph und Fernsprech Technik*, Germany has been establishing a great radio organisation. It consists at present of a central post at Berlin; 17 provincial stations, the principal having multiple transmitters and the secondary simple transmitters; 75 receiving stations; seven meteorologic receiving stations, and two coast stations—at Norddeich and Swinemünde. The central post at Berlin comprises a transmission installation at Königswusterhausen, and a receiving installation at Zehlendorf, both controlled from the Berlin central telegraph office. The equipment at Königswusterhausen consists of one 32-kW Poulsen; one of 5/10 kW [illegible] transmitters of 5/10 kW; five tube transmitters of 2 × 500 W and five transmitters of 500 W. All these transmitters are furnished with separate antennæ, and can work simultaneously with distinct wave-lengths. The big tube transmitters consist mainly of 10 tubes of 1.5 kW each. For the

chief provincial posts, the transmission apparatus is separated from that of reception by from 1 to 2 kW), and is worked on the duplex system (simultaneous transmission and reception).

Submarine Cables.—The Germans have laid since the war two submarine cables (one of three and the other of nine circuits) between that country and Sweden—from Stralsund to Malmö. But the weakness of the currents secured on these circuits was such that the exchange of correspondence was found to be impossible by the ordinary means. Improvement has, however, been achieved by the use with the receivers, both at Stralsund and Malmo, of vacuum amplifiers. At Berlin a similar extemporisation has allowed of satisfactory communication with Stockholm on one hand, and, on the other, with the most distant German cities, such as Munich, Frankfort, &c. A bridge, similar to that of Wheatstone, allows the transmission to be effected in the two directions as if on a single line. *L'Electricité pour Tous.*

Radio Telephony.—International Conference.—The International Conference on Regulations for Radio Telephony and Telegraphy will be held in Paris, France, in January, 1923, says the *T. & T. Age.*

Broadcasting Commences.—Pending the formation of the British Broadcasting Co., which will be completed in a few days, the Broadcasting Committee has decided to commence a limited nightly programme from the London station. This will consist of two copyright news bulletins and official weather reports broadcast at 6 p.m. and 9 p.m., on a wavelength of 360 metres. The first two bulletins were to be broadcast on Tuesday evening, November 14th. Special messages indicating the progress of the General Election were to be broadcast, as received, on Wednesday and Thursday evening.

South Africa.—New Radio Station. In a paper that was read on behalf of Col. Childs and Mr. H. E. Penrose before the South African Institute of Electrical Engineers, it was mentioned that in the case of the long-range station that is to be built in the Union, 170,000 metre-amperes (the product of the mean height of the aerial and the aerial current) was the figure decided upon as being necessary to give good commercial signals in the United Kingdom—about twice the metre-amps. of the St. Assise station. The height of the masts was to be 840 ft., and the aerial was to be suspended from 800 ft.; thus the mean height would be 0.7 of this value, *i.e.*, 170 metres, and the necessary aerial current would therefore be 1,000 amps. The provision of 24 masts would be necessary. Since the direct current flowing through an arc was 1.4 times the r.m.s. value of the aerial current, it followed that an arc would have to be built to absorb 1,440 amperes, whilst the voltage required would certainly not be less than 1,000. The input of the arc, regardless of auxiliary apparatus, would, under these circumstances, be of the order of at least 1,440 kW, whereas the input to the proposed valve transmitter would not exceed 400 kW. It was proposed to apply 360 kW to the aerial, which would develop 1,000 amps. The total aerial resistance could not, therefore, be greater than .360 ohm. Without an earth screen, the aerial current would probably be of the order of 300 amps. Valves of the order of 3¾ kW had an average life of about 5,000 hours per valve, hence the maintenance cost of a whole battery of 100 valves of the Marconi glass type was of the order of 9s. per hour. In view of the high efficiency of the valve transmitter, and the further important fact that it was entirely unnecessary to install it in duplicate, the saving brought about by using this type of transmitter was apparent.

Sweden.—New Radio Station.—The Telegraph Board has decided that the new radio station for the purpose of communicating with America shall be built at Grimeton, near Varberg, as was expected. The station will be named Varbergs Radiostationer, and will be ready for service before the end of 1923.—*Reuter's Trade Service* (Stockholm).

Turkey.—Cable Reported Cut.—The daily Press announced on November 9th that the Eastern Telegraph Co.'s Constantinople cable had been cut by Kemalists at Erenkeui, on the Turkish side of the Chanak zone of the Dardanelles. An attempt to repair it was frustrated by the Nationalists. The British Government is said to be in communication with Constantinople by means of radio telegraphy. Smyrna has been cut off from direct telegraphic communication with Europe since last month.

On the 10th inst. the Constantinople cable was reported to have been restored and to be working smoothly.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne ... May 15th. Electricity Commissioners. Switchgear [illegible] for the Morwell power scheme. (November 3rd.)

January 26th. H.p. steam, drain and feed piping, valves, traps, &c. (November 3rd.)

January 23rd. Melbourne Harbour Trust Board. One 500-kW rotary converter and a 550-kVA transformer.

December 20th. Victorian Railways. One 2-ton electric hoist.*

Barnes. — November 27th. Electricity Department. Turbo-alternator, with surface condenser and auxiliaries, rotary converter and transformer, h. and l.p. switchgear and connections. (November 10th.)

Burton-on-Trent.—November 20th. Board of Guardians. Electric light installation, Imbecile Block. Mr. H. S. Askew, clerk.

Dundee.—November 24th. Electricity Department. Two-core and three-core l.p. paper-insulated, lead-covered, and steel-tape-armoured cable. (November 10th.)

One 15-ton hand-operated overhead travelling crane at Craigie sub-station, Dundee. Mr. D. H. Bishop, general manager and engineer.

Edinburgh.—December 4th. Electricity Supply Department. One 500-kW converting set. (See this issue.)

India.—November 9th. Great Indian and Peninsular Railway Co. Electrification of Bombay suburban lines: Electrical equipment of coaches, overhead equipment of permanent way, and overhead distribution lines. (See this issue.)

London.—St. Marylebone.—November 29th. Electricity Department. Turbo-alternator and condensing plant, water-tube boilers, fan-draught water-cooling tower, and rotary converter plant. (November 3rd.)

Paddington.—November 20th. G.W. Railway Co. Stores for six months, including telegraph instruments, electrical apparatus, electric wires and cables, electric lamps, &c. (November 10th.)

St. George's-in-the-East, E.1.—November 23rd. Board of Guardians. Installation of electric lighting at the Green Street (Upton Park) Schools. (November 10th.)

Manchester.—December 4th. Electricity Committee. Two 2,500-kW, one 1,500-kW, and one 1,000-kW rotary converters, with static transformers; or, alternatively, motor converters, with switchgear, l.p. transformer, &c. Four 500-kW automatically-controlled rotary converters and static transformers; or, alternatively, motor converters, complete with the necessary switchgear and full automatic equipment. (See this issue.)

New Zealand.—Wellington.—January 9th, 1923. Five sets of 11,000-V sub-station switchgear, for the Mangahao power scheme. Two sets 11,000-V sub-station switchgear, for the Lake Coleridge power scheme.*

Carterton.—November 20th. Wairarapa Electricity Power Board. Switchgear, lightning arresters, &c.*

South Africa.—Johannesburg.—December 4th. South African Railways and Harbours Tender Board. Twelve months' supply of electric incandescent lamps.*

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Sydney City Council Electricity Committee has recommended the acceptance of the tender of Messrs. Noyes Brothers for the supply of 25,000 electricity meters of English manufacture at a cost of £42,936.—*Reuter's Trade Service* (Sydney).

FORTHCOMING EVENTS.

Institution of Electrical Engineers.—Informal meeting. Monday, November 20th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Electric Light Wiring," to be opened by Mr. F. J. Pearce.

(East-Midland Sub-Centre).—Tuesday, November 21st. At the Loughborough College. At 6.45 p.m. Paper on "Some Recent Research in Electrical Engineering," by Prof. W. Cramp.

(Scottish Centre).—Saturday, November 25th. At the Grosvenor Restaurant, Glasgow. At 7 p.m. Smoking concert.

Institution of Mechanical Engineers, Graduates' Section.—Monday, November 20th. At the Institution, Storey's Gate, S.W. At 7 p.m. Paper on "Works Management," by Mr. H. R. Hockley.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, November 21st. At the Rankine Hall, Glasgow. At 7.30 p.m. Ordinary general meeting.

Royal Society of Arts.—Wednesday, November 22nd. At John Street, Adelphi, W.C.2. At 8 p.m. Paper on "The Economy of Smoke Abatement," by Basil W. Smith.

Nottingham Society of Engineers.—Wednesday, November 22nd. At the Welbeck Hotel. At 7.30 p.m. Paper on "Mechanical Draught for Boiler Installations," by Major S. Utting.

Chelmsford Engineering Society.—Thursday, November 23rd. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Industrial Refrigeration and Ice-Making," by Mr. W. B. Statham.

Edinburgh Electrical Society.—Friday, November 24th. At the Philosophical Institute. At 8 p.m. Paper on "Overhead Transmission," by Mr. J. Walker.

Institution of Mechanical Engineers.—Friday, November 24th. At the Institution, Storey's Gate, S.W. At 6 p.m. Adjourned discussion on Mr. Kenyon's paper on "Air Compressors."

(Graduates' Section).—Monday, November 20th. At the Institution, Storey's Gate, S.W. At 7 p.m. Paper on "Works Management," by Mr. H. R. Hockley.

Junior Institution of Engineers.—Friday, November 24th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Notes on Waterworks Plant in Italy," by Mr. F. J. Murrell.

Physical Society of London.—Friday, November 24th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of :—

Ferrault resistance-heating elements.
Endura insulating varnish.
Coley generating sets.
Also any available information as to the Faborizing process for protecting metals.

NOTES.

The Great Silence and a General Election.—We are not unmindful of the fact that this issue of the Electrical Review was being prepared while other things were happening which were of momentous importance outside our own little world. While our work was in progress on Saturday morning the Bell of St. Paul's Cathedral (beneath the shadow of which, by the way, the Electrical Review has been edited during practically the entire course of its existence) began to strike the hour of eleven. Not many seconds later the sound of maroons heralded the impressive and eloquent "Silence" in memory of that vast Host of Men, blood of our blood and bone of our bone, who laid down their lives for England and for us between August, 1914, and November, 1918. The Great Metropolis of the British Empire became for two minutes silent as a city of the dead, and as we rose to stand in reverent memory, we could not resist the inrushing flood of thoughts of men in the electrical profession who to-day are missing in bodily presence, but whose sacrifice stands out as the greatest event of the entire past Fifty Years. To-day they are not forgotten. They form a victorious company in the Spiritual Realm, leaving behind to us all a duty and a responsibility which God forbid that we should leave unfulfilled or unshouldered because four years have passed. No! they are not forgotten, nor should be those they left. How can they rightly be remembered save by winning England back again to her former moral greatness and industrial prosperity, bringing food and work and peace and contentment to all? The "Silence" ended, the City went on its way softened in heart by the memory of love and sacrifice, but soon we found ourselves confronted with the actualities of life in the shape of "General Election" bills and the call to "Vote." It is not ours to exercise influence in this matter—but is there no connection between the thoughts of Armistice and supreme sacrifice for England and the re-establishment of Government on a basis which shall bring peace and prosperity to England? The result of the Election will be known as these lines come before the reader, but whatever the result, there will remain for all of us, whatever our status in life may be, the imperative call to perform faithfully our part in industry, in profession, and in all our manifold ways, helping to rebuild the broken places and to promote a spirit of unity in the nation.

"Electrical Review" Contributors.—We regret that notwithstanding the large size of this number of the Review, we have not space to spare to do full honour to the army of writers who have collaborated with us in our editorial functions. Of our late "Chief" T. E. Gatehouse, Technical Editor for so many years, what *can* we say? Everything must be summed up in the grateful recognition that his influence—making so cheerful an atmosphere in the editorial rooms—lingers with us still, and we hope that it will long do so. Then of the innumerable writers who have come to us, some quite unknown, others comparatively so, and who have lent us their assistance as they have simultaneously climbed upward in their own career until they became so engrossed with other duties that the "writing-for-the-Press" days had to end—what shall we say of these? Some of them have died in harness; some others are filling places of responsibility and influence to-day partly due, as they have not failed to recognise, to the Review having given shape, form and publicity to their ideas when they needed assistance; others in different parts of the world will remember the promises that have accompanied their handshakes on leaving these rooms to seek greater prosperity abroad, and they will as they read recall those good intentions and will, maybe, utter a sigh at the weakness of the flesh which overcomes so many when they leave the bustle of London and "settle" amid new surroundings in other climes. We desire to-day to greet all these and other contributors, correspondents and readers throughout the world who have formed a more or less personal attachment with us.

Those who have tried us know that it has always been our policy to welcome any man—young or old—known or unknown—professional or artisan—who had something to say worth saying. Nor have we tried to evade criticism from the general reader; on the contrary, we have welcomed suggestions—even gone out in search of them in our desire to provide a journal which should meet all needs as far as lay within our power. It is so to-day, as much as it ever was. Many of our readers know that the Electrical Review is a help in a hundred ways of which the man in the street would never dream.

Accident. Charles Halifax, an Accrington [illegible] fitter, was burnt on the face and hands on [illegible] an outburst of flame [illegible] on an underground cable in Plantation Street.

Dazzling Headlight Danger. One man was killed and two others injured owing to their motor-car running into a telegraph pole, near Derby, on November 8th. The driver was confused by the dazzling headlights of another car.—*The Times.*

British Engineering Standards Association.—The Association has issued a tentative British Standard Specification for dimensions and test values of [illegible] electrical instruments and apparatus (No. 156—1922; 1s. net). In the introduction it is stated that it is recognised that the manufacture of this class of material is not sufficiently advanced to enable a complete specification to be prepared, but the Association is satisfied that this tentative specification will be of considerable benefit to both purchasers and manufacturers. The publication contains details of mechanical, chemical, thermal, and electrical tests, notes on joints and resistance, &c.

Engineering Joint Council.—The Committee that has been considering the formation of the above-named Council, to which reference has already been made in our pages, has recommended the following constitution, which has been approved by the four Institutions concerned: The Joint Council shall consist of two members of each of the Councils of the Institutions of Civil, Mechanical, and Electrical Engineers, and of Naval Architects, in the first instance; they shall be appointed annually and shall be eligible to serve for not more than four years consecutively. One of the first two appointed by each Institution shall serve for not more than two years, but shall be eligible for re-appointment for a further period of not more than four years consecutively. The chairman shall be elected annually by the Joint Council, and the secretary of the Institution represented by the chairman for the year shall act as secretary of the Joint Council; the chairman shall be chosen from the several Institutions in rotation. The Joint Council shall consider matters referred to it by the Council of any one of the constituent Institutions; it shall not initiate proposals affecting the Institutions. The first Joint Council will be constituted as follows:—

Inst.C.E.: Sir M. Fitzmaurice and Mr. W. B. Worthington.
I.Mech.E.: Capt. H. R. Sankey and Mr. W. H. Patchell.
I.E.E.: Messrs. J. S. Highfield and R. T. Smith.
I.N.A.: Two representatives to be nominated.

The "Juice."—"Hackney Guardians have asked the Electricity Department to supply electricity for an experimental period of one year at a minimum charge of 10s. per quart."—*Daily Paper.*

"Here's to the good old electricity.
Drink it down, drink it down."—*Punch.*

Electricity in Textile Mills.—In a recent lecture upon the above subject to the Blackburn Textile Society, Mr. P. P. Wheelwright, the Blackburn electrical engineer, said that the supply of power was now a specialised industry, and it was far better for manufacturers to take their electricity from a public source, rather than generate it themselves. In working out power costs manufacturers often lost sight of many items of expense. The electrification of mills could be accompanied with a minimum interruption of plant and work. Electrification not only benefitted employers and employed, but also the district and the nation at large; the last by the conservation of coal. A considerable waste of power in mechanical transmission was avoided by the use of electricity. Moreover, as the load decreased so the amount of energy taken decreased, which was not the case with mechanical drive. Then the uniformity and steadiness of the electrical method was a great advantage which had a good effect upon the quality of the product. Mr. Wheelwright emphasised the fact that the purchase of electricity from a central authority relieved the management of a mill from the worries of a thousand and one details, apart from the economies effected by the ability to measure power exactly. In addition to electrical driving the speaker drew attention to the possibilities of electrical heating. He urged greater consideration for electrical methods, pointing out that in India and other competing countries electrification was the rule rather than the exception.

The Orientation of Molecules in a Magnetic Field.—In a letter to *Nature*, Mr. Marshall Holmes, of the Sir Donald Currie Laboratories, Queen's University, Belfast, states that he has obtained experimental results indicating that the molecules of a substance undergo an orientation when placed in a magnetic field. A pencil of X-rays directed through a solution of barium iodide produces on a photographic plate an image which is more than 10 per cent. [illegible] when exposed to the influence of a [illegible] than the image obtained without the field. The result has been corroborated by methods entirely independent of the properties of X-rays, and the matter will be further investigated.

Report on the Training of Electrical Power Engineers.—One of the principal objects of the Electrical Power Engineers Association is to improve the training and raise the [illegible] engaged in the generation and distribution of electrical energy. The Association has published a report on this subject, dealing with the advantages of training to the various parties concerned, the objects and methods of training, proficiency tests, &c. The report, which is admirably drawn up, calls for careful consideration, and will be reviewed in an early issue.

Electric Heating in Canada.—At the moment of going to Press there reaches us from our Canadian correspondent the following information:—"A somewhat extraordinary situation has arisen in Canada, more particularly in Ontario and Quebec, owing to the serious fuel shortage created by the prolonged strike of the coal miners in the United States, which ended only a few weeks ago. It is authoritatively stated that there is no possibility of more than 60 per cent. of the normal supply of anthracite reaching Canada this winter; at the time when the strikers went back to work, Toronto, which uses about 900,000 tons of anthracite per annum, had only received about 10 per cent. of this quantity, whereas usually the proportion is very much larger by the time autumn has arrived. The situation referred to above is that, owing to electricity being comparatively cheap, the use of electric heaters, with a view to saving coal and other fuels, all of which are both scarce and dear, is growing by leaps and bounds, and it is more than probable that voltage regulation in many municipalities will be particularly bad this winter. Unfortunately, Canadian winters, except on the other side of the Rockies, are so cold that, abundant as are the water powers of the country, there is no possibility that electricity can be used on any generous scale for the heating of buildings. The following facts show this clearly:—Actual tests indicate that an average house of six or eight rooms requires not less than from 15 to 20 h.p. to heat it on very cold winter days; in Toronto there are nearly 100,000 houses, and if all these were heated electrically it is evident that from 1,500,000 to 2,000,000 h.p. would be required for heating houses alone—and this only refers to one city. Moreover, this would be purely a winter load, and the full amount would only be needed on the very cold days; on milder days much less would be required, hence the annual load factor would be low, and the problem would be to find sufficient extra power in the winter to supply other needs, even if enough could be furnished to meet the heating requirements.

"Many people here, ignorant of such facts as those cited, look joyfully forward to the time when Niagara and other of Canada's great water powers shall make this country altogether independent of the United States with regard to fuel supplies, and when (to use a phrase of which the daily papers are fond) 'the turning of a switch' will bring heat in abundance for the whole country. Notwithstanding the above, electricity during the present chilly autumn days is proving a godsend to many a home which at the present time is almost without fuel."

Fuel in Czecho-Slovakia.—By a Government ordinance, an "Institute for the Economic Use of Fuel" has been called into being, with its seat at Prague. Its operations will embrace the whole of the republic, and are defined as the systematic investigation of fuel and its places of deposit, with their development. The Institute is under the control of the Minister of Public Works, who nominates its members for three years from the localities where the Institute is operating, such members being representatives of public schools, gas works, electricity works, and sundry others.

Control of Gaseous Conduction.—In electric circuits of all sorts, power is transmitted principally by metallic conductors. In order to control the flow of power, or to convert it from one form to another, the constants of the circuits are varied. The connections of the metallic conductors may be altered for this purpose; but at high potentials this operation is attended with difficulty. The rapidity and ease of control are also limited. For this reason there has been a tendency, in recent years, toward the increased use of control devices employing non-metallic conduction, and these are now being rapidly brought to the fore. As examples we have the very versatile thermionic tube and the mercury arc rectifier. Devices employing conduction by gaseous ions have been handicapped in this general evolution by three main disabilities: the first being the difficulty of placing the discharge where wanted; the second, the tendency of the working gas to disappear; and the third, decidedly erratic action. These disabilities have recently been to a large extent removed by the advent of a principle called the "short path principle," by which discharge can be prevented except where wanted. This has also led to long life, for by placing the discharge in proximity only to certain porous materials, gaseous clean-up and disintegration are both prevented. With this change, uniformity of action also appears. By utilising this principle, gaseous conduction devices may be designed, for example, as rectifiers. Two examples are described in the A.I.E.E. *Journal* for September, 1922, the first obtaining unilateral characteristics by the use of a magnetic field, and the second [illegible] space charge. The present models, as described, are capable of handling only small amounts of power; but there is no inherent limitation in this direction. The usual conditions of cost, reliability, life, and so on, will determine development for higher powers. It is impossible to predict at present the particular portions of the electrical field in which this device in its various forms will find a use. The authors believe, however, in the possibility of constructing gaseous conduction devices which can be depended upon and which will last indefinitely. The control is so complete that a ratio of currents in two directions of several thousands to one can readily be obtained. These rectifiers will readily stand a back pressure of several thousand volts, and the current which they can pass is limited only by the possibility of getting rid of the heat evolved. The internal drop is around 200 volts with the usual arrangements of the device; heavy currents can be passed for short intervals.

One commercial model of this form of S-tube is rated at 50 milliamperes continuously, and 1,500 volts back pressure. It has a substantial continuous overload capacity. It is designed primarily for charging fire alarm batteries and for the use of radio amateurs. For convenience, it is built to be screwed into the ordinary standard lamp socket. No other appurtenances or auxiliaries are necessary, and its life is very long. The efficiency depends upon the circuit, and is high when high voltages are rectified. Such tubes may be used in series or parallel to any desired extent in order to obtain a desired voltage, current, or output.

Mont Blanc Electric Cars.—An electric cable car service from Les Bossoms, in the Chamonix Valley, to the summit of Mont Blanc, is expected to be running next year. The line will be 12,500 ft. high, and the journey will occupy about 90 minutes.—*Daily Mail.*

The Chemical Industry.—The Association of British Chemical Manufacturers has published, under the title "Shall the State throw away the Keys?" an exposition of what fine chemicals mean to the nation. In a foreword, Sir William J. Pope, F.R.S., Professor of Chemistry in the University of Cambridge, summarises the case for the protection of the country's chemical industry by means of tariffs. He shows the importance of the industry to the nation, both in peace and war. The booklet itself expands upon this theme, giving in detail the many directions in which the chemical industry is indispensable. It is of some satisfaction to note that peace applications occupy most of the exposition.

Service Note.—Recruiting is now open for the first Territorial Battalion of Royal Engineers, to be formed under the War Office scheme for defending London against aerial attack. The new unit is designated the 10th (London) Anti-Aircraft Battalion, Royal Engineers, and the training of the battalion, which is of a scientific nature, will consist of operating searchlight projectors, engines, and sound locators. Men of a high standard are being selected, and engineering students and men with technical knowledge in electrical or mechanical engineering are particularly asked to join. Those desirous of joining should apply at the Headquarters, 10th (London) A.A. Battalion, R.E., Duke of York's School, Chelsea, S.W.—*The Times.*

New X-ray Diffraction Apparatus.—Many materials may be readily identified and their crystal structure determined with a high degree of accuracy by X-ray analysis. The apparatus described in the September, 1922, issue of the *General Electric Review* has been developed to provide a convenient means for applying this laboratory method of analysis to general crystal research and factory-control work. In the latter field, particularly, it should prove to be of great value. The article describes apparatus by which the characteristic X-ray diffraction patterns of fifteen powdered crystals may be taken at once. Each pattern is recorded on a strip of photographic film placed in a cassette which automatically holds the film on the arc of a circle of 8 in. radius, having at its centre the specimen of powdered crystal. The whole apparatus, exclusive of the switchboard, occupies a space 3 ft. in diameter and about 4½ ft. high.

The time required to obtain a satisfactory record of the diffraction pattern varies from 5 to 12 hours for substances like NaCl to 70 hours for substances like CuCl and CsI. The diffraction pattern may be interpreted directly in terms of the interplanar distances in the crystal by means of a metal scale which is calibrated in Angstrom units. If the crystal happens to belong to the cubic, tetragonal, or hexagonal systems, its structure may be interpreted directly from these interplanar distances by means of charts.

Good and Bad Works Managers.—Even in Soviet Russia, where all the industrial establishments and other works are vested in the State and conducted by so-called trusts and syndicates, it is recognised that there must be officials as well as workmen. But what can be thought of the communist mentality of the Moscow *Pravda* (Truth) in opening a prize competition to settle who are and who are not good works managers? The newspaper has invited the workmen to send full details to it concerning good and bad managers, and the information will be published. It will then be left to the participating workmen, apparently by voting, to decide who is the best and who is the worst works manager. Prizes are offered—overcoats, boots, watches, &c., and the newspaper expects that the competition will have a "special educational effect on the managers of works."

Company Liquidation.—Globe Supplies (Electrical), Ltd., 159, Pentonville Road, London, N. The creditors interested herein were called together on November 13th, at the Manchester Hotel, Aldersgate Street, E.C. The liquidator appointed in the voluntary liquidation of the company submitted a statement of affairs which showed ranking liabilities of £5o2, while the assets were estimated to realise £143, or a deficiency of £119. The assets comprised book debts £63, expected to produce £43, and stock at cost £300, valued at £100. Mr. E. Russell, the liquidator of the company, said that the business was established by Messrs. Bruce & Whitehouse, the object being the purchasing of cheap German electrical goods. They carried on the business for about six months, and the company was formed in March, 1921, with a nominal capital of £300. All the shares were issued to the vendors in payment for the assets they transferred. The company had experienced considerable difficulties in getting supplies from Germany, while a sufficient turnover could not be made. Finally creditors began to press and voluntary liquidation was then decided upon. The principal asset was the stock, but it included a quantity of foreign wireless goods.

A creditor pointed out that such goods were of no use in this country as they would not meet the requirements of the broadcasting regulations.

The liquidator suggested that the creditors should appoint an informal committee of inspection to assist him in the liquidation of the company, but no resolution was passed.

The following are creditors :—

	£		£
Malleable Fittings, Ltd. ...	20	A. & A. Electrical Co. ...	11
Radiant Electrical Co.	10	General Cable Co.	12
Telephone Manufacturing Co. ...	40	Hogan & Wardlop ...	14
Williams, Thomas	13	Exide Battery Co.	12
Clough & Co.	35	Smith, H. W., & Co., Ltd.	23

Appointments Vacant.—Senior lecturer in electrical engineering (£850-£1,000), for the Royal Naval Engineering College, Keyham, Plymouth; telegraph foreman (£440), for the Government of Nigeria.

Electricity in Poplar.—On November 13th an extension of the Glaucus Street electricity works of the Poplar Borough Council was inaugurated by the Mayor (Ald. Scurr). A large party attended the ceremony, and afterwards visited an electrical exhibition, also opened by the Mayor. The new plant consists of two 3,000-kW turbo-generators, one a Fraser and Chalmers-G.E.C. set and the other a Brush-Ljungström set. Both sets operate at 130 lb. pressure, 28½ in. vacuum, and 3,000 r.p.m. They deliver 3-phase, 50-cycle current at 6,000 V. Both are standard machines. Another new feature of the station is a six-panel charging board for electric vehicles, supplied by the General Electric Co., Ltd., and erected by the Council's staff.

The former chairman of the Electricity Committee (Councillor Edgar Lansbury) presided at the ceremony, and gave particulars of the expansion of the undertaking in the past three years. He said that the number of consumers had increased from 1,863 to 2,774, the length of h.p. mains had increased by 10 miles (40 per cent.), and the l.p. distributors now had a length of 60 miles as against 48 miles. He paid a tribute to Mr. Bowden, the electrical engineer, and his staff, and asserted that although gas charges were still from 140 to 160 per cent. above the pre-war level, the price of electricity in Poplar was only advanced 50 per cent. The Mayor, in declaring the extension and exhibition open, urged his audience to take electricity in their homes and factories; once they did this they would never wish to revert to the older methods. Votes of thanks were passed to the Mayor (proposed by Ald. Hopwood, chairman of the Electricity Committee, and seconded by Mr. E. Wilson, of the G.E.C.), and to the Chairman (proposed by Mr. Bowden and seconded by Mr. Deverill, Brush Electric Engineering Co.).

The exhibition, which remains open until the 18th inst., is very representative, and the following firms are included in the list of exhibitors :—The General Electric Co., Ltd.; the British Electric Transformer Co., Ltd.; the Sloan Electrical Co., Ltd.; the Standard Electric Sign Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; the Western Electric Co., Ltd.; the Cable Accessories Co., Ltd.; Plant & Supplies, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; J. H. Tucker & Co., Ltd.; the B.T.H. Co., Ltd.; and Siemens Bros. & Co., Ltd.

Mr. Carrington, a local baker, has undertaken to bake bread electrically from flour supplied *gratis*, and to sell it in aid of the Poplar Hospital.

An employés' canteen, capable of cooking (electrically) daily meals for 30 persons, was also inaugurated. The cookers are of the "Tricity" type.

Ministry of Transport Rules and Orders.—The Minister of Transport has issued Statutory Rules (1922, No. 1165), dated October 11th, 1922, relating to the costs and expenses incurred in connection with inquiries or inspections made on his behalf, and superseding the Provisional Rules dated May 19th, 1922.

The Minister has also issued Statutory Rules (1922, No. 1166), dated October 14th, 1922, with respect to the confirmation of Orders under Section 7 of the Electricity (Supply) Act, 1919, reciting the procedure to be followed by persons objecting to the confirmation of an Order, and superseding the Provisional Rules dated May 31st, 1922.

Broadcasting Music.—During recent weeks interesting experiments have been conducted by the new radio apparatus which has been erected at Trafford Park [illegible] Metropolitan Vickers Electrical Co. The station [illegible] (2 Z Y) and it is to become the broadcasting centre for the area.

Some of the experiments were carried out with a view to ascertaining precisely how the transmission of music by various types of instrument was affected in transmission by wireless. The assistance of amateurs who heard the transmissions was sought, and their information on technical points has been valuable in the determination of phenomena associated with different kinds of music. The services of a full orchestra were engaged by 2 Z Y and transmissions of the separate instruments were made. These included the piano, violin, 'cello, harp, clarionet, bassoon, euphonium, and French horn.

On the writer's installation—a circuit employing reaction with five valves—the transmissions were heard clearly, the distance from 2 Z Y being over seventy miles. With the exception of the French horn, there was no pronounced distortion which could be attributed to the actual process of transmission. The distinctive musical qualities and characteristics of each instrument were accurately reproduced, sometimes with astonishing clarity and volume.

The transmission of music by wireless is, however, a long way yet from perfection and there is a field of research which must be more definitely explored before perfection is attained. The phenomena presented in the transmission of selections by the complete orchestra, or indeed by any concerted rendering, vocal or instrumental, need careful investigation. It is well known to anyone who has frequently listened to wireless music that certain notes do not lend themselves easily to faithful reproduction, and often create unpleasant vibrations and a curious dragging or re-echoing effect. Chiefly these are strident notes, and the clashing of cymbals is particularly liable to create discord in the receiving set. On the other hand, sonorous music, such as that of the cornet and the mellifluous qualities of the harp, are rarely blemished by actual transmission.

The problem of rendering all types of music more accurately receivable in wireless is one for the radio engineer, and for the skilled musician also. The latter can do much by studying the effects mentioned, and probably, by a suitable balancing of the component parts of an orchestra during a rendering, can make reception as a whole more gratifying. It is a subject to which he might well devote time and attention, for broadcasting, necessitating, as it will, lengthy programmes of music every night, is going to create a new sphere for the services of the musical profession.

For the electrician, the chief problem at present undoubtedly is the microphone, by means of which music and speech are superimposed upon the carrier-wave generated by wireless plant. It is the only means known at present, and it has many imperfections. To begin with, it works upon a principle which, electrically, is essentially unsound, a loose contact. The carbon granules which are placed behind the diaphragm vibrate in sympathy with the modulations of sound impressed upon it, and thus incorporate speech or music with the oscillations producing radiation from the aerial. Not infrequently the granules "pack" under the influence of an excess of electrical energy, and the immediate effect is, of course, distortion in the transmission. Since the granules respond to the smallest modulation, it would seem that the notes of some instruments which are strident invariably cause packing, which lasts long enough to destroy the true quality of the note. Cannot a better means of conveying speech and music into the radio circuit be devised? In any circuit a loose contact is bad: in wireless the defects of the microphone are considerably magnified.

It is interesting, by the way, to note that experiments have been carried out with several microphones in use. This has led to decided improvement, especially in the rendering of music by more than one instrument. In a violin selection, with piano accompaniment, the piano could be heard loudly and the violin hardly at all when only one microphone was used. But when two were employed, one before each instrument, the result was a remarkable meety of balance.—L. B. Powell.

German Electric Cable Works Destroyed.—The Gartenfeld electric cable works in Berlin, belonging to the Siemens-Schuckert Co., have been partially destroyed by fire. Several firemen were almost asphyxiated, and one has died.—*Reuter* (Berlin).

Legal.—Walsall Hardware Manufacturing Co. *v.* The Electric Components.—With reference to this case reported in our "Legal Columns" (p. 683) last week, Messrs. Electrical Components, Ltd., of Great Charles Street, Birmingham, desire it to be understood that there is not, and never has been, any connection between the company concerned and themselves.

Effect of Broadcasting on the Gramophone Industry.—At the general meeting of the Gramophone Co., Ltd., on November 8th, Mr. E. T. Ll. Williams, who presided, explained that radio telephony and broadcasting in the present state of the art was in no way likely to adversely affect the company's business. Development would be watched with interest, and the future might show influence upon the gramophone industry far other than prejudicial.—*Financial Times.*

INSTITUTION NOTES.

Finsbury Technical College Old Students' Association.—This Association held its eleventh annual dinner on November 4th at the Engineers' Club, and 73 members and their guests participated. The toast of "The College" was proposed by Mr. A. Chaston Chapman, F.I.C., F.R.S., and Dr. W. H. Eccles, F.R.S., in reply, referred to the loss the College had sustained by the appointment of Dr. M. O. Forster, F.R.S., a past student of the College, to the Directorship of the Institute of Science at Bangalore, and also by the selection of Mr. Catterson-Smith to fill the chair of Electrical Engineering at the same institute. Mr. F. Gill, O.B.E., President I.E.E., proposed the toast of "The Association," and Mr. W. G. Head, M.I.Mech.E. (the President of the O.S.A.), replied, and announced that Sir Oliver Lodge, F.R.S., had consented to give the first Silvanus P. Thompson Memorial Lecture. Mr. W. M. Mordey, M.Inst.C.E. (president-elect of the O.S.A.), proposed the toast of "The Guests," remarking that they numbered among their guests the Presidents of the Chemical, Electrical, and Mechanical Institutions. Dr. Hele-Shaw, LL.D., F.R.S., briefly responded. Between the toasts a number of excellent musical items were given under the direction of Mr. L. M. Clark, A.I.C., F.C.S.

Edinburgh Telegraph and Telephone Society.—On November 7th Col. C. G. Chetwode Crawley, R.M.A., Deputy Inspector of Wireless Telegraphy to the G.P.O., lectured to the Telegraph and Telephone Society and the Edinburgh Radio Society on "Wireless Communication." He instanced the difficulties that had prevented the Imperial Wireless Chain from being accomplished, but stated that negotiations were in progress, and that shortly a definite scheme embracing the whole Empire would be in operation. The status of the radio amateur and the "broadcaster" were also discussed.—*Scotsman.*

S.A. Institute of Electrical Engineers.—According to the *Transactions* of the Institute, a sub-committee of the Council is endeavouring to collect contributions to the proposed "History of Electrical Engineering in South Africa" from electrical engineers in all parts of the country. A sub-committee of the Council has very carefully considered the "model conditions" prepared by the Institution of Electrical Engineers, London, and strongly recommends the Council to urge consulting engineers to adopt these conditions as a basic standard, and further to make use of the British Engineering Standards in their specifications. The Development of Resources Committee has been formed to assist in furthering the development of the resources of the country. There are many projects that might be brought forward in the initial stages, which, with the help of the Committee, might be brought to the point where consulting engineers are employed. It is not intended to specify the plan necessary for carrying out projects or to act as consulting engineer, but its advice may be of assistance in bringing to maturity some developments in connection with the resources of the country.

Institution of Electrical Engineers.—The Informal Meetings of the Institution commenced for the new session on November 6th with a discourse by the president, Mr. F. Gill, on the "Importance of Commercial Knowledge to the Engineer." Mr. W. E. Warrilow was in the chair, and a large gathering was treated to a stimulating address which provoked an interesting discussion. Mr. Gill said the fundamental and true function of the engineer was to apply physical laws with the least expenditure of capital and properly equip himself for the larger interpretation of the engineer's functions; it was becoming more and more important for the engineer to study the phraseology and methods of business. The engineer to-day should know the elements of accountancy, the rudiments of a balance-sheet, &c., and Mr. Gill went on to enumerate some of the commercial issues that vitally concerned the engineer. The London supply authorities were supposed to be unable to extend their business because of the imminent termination of their licences. That termination was about nine years hence, and if that period was considered too great a hindrance it was very evident how badly needed was the study of economy by engineers. Mr. Pooley opened the discussion, in which 14 members took part.

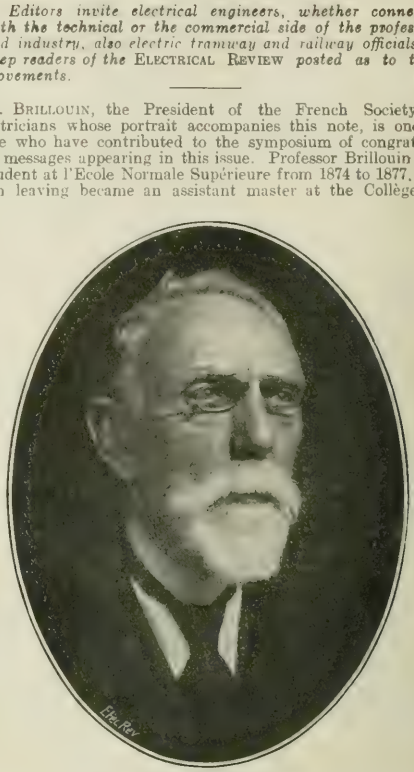
Edinburgh Electrical Society.—At the meeting held on November 27th, Mr. F. J. Taylor read a paper on "Scientific Illumination." The paper dealt with the flux distribution and efficiencies of a variety of electric light sources in common use. The author exhibited numerous diagrams and ingenious models illustrating flux in terms of water capacity, and the paper was illustrated with lantern slides giving examples of good and bad illumination of interiors.

Association of Consulting Engineers.—The annual dinner of the Association of Consulting Engineers is to be held on Wednesday evening, December 6th, at the St. Stephen's Club, Victoria Embankment, Westminster, S.W.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

M. Brillouin, the President of the French Society of Electricians whose portrait accompanies this note, is one of those who have contributed to the symposium of congratulatory messages appearing in this issue. Professor Brillouin was a student at l'Ecole Normale Supérieure from 1874 to 1877, and upon leaving became an assistant master at the Collège de



Prof. Brillouin.
President, Société Française des Electriciens.

France, where he remained until 1880. He subsequently occupied positions in the Universities of Nancy, Dijon, and Toulouse. In 1887 he returned to l'Ecole Normale Supérieure as Professor of Physics, remaining there until 1900, when he was appointed Professor of Physics and Mathematics at the Collège de France, a post which he still occupies. Prof. Brillouin was elected a member of the Academy of Sciences last year.

Mr. E. M. Dence, L.C.C., who has been elected Mayor of Greenwich, is a director of Johnson & Phillips, Ltd., of Old Charlton.

Mr R. W. Dalton, who for the past six years has been H.M. Trade Commissioner in New Zealand, is in attendance at the Department of Overseas Trade for a brief period, and will be pleased to interview manufacturers and merchants interested in trade with New Zealand. Appointments with Mr. Dalton can be made by application to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. The reference T.G. 3,962 should be quoted in all cases.

M. Philippe Bede, who has sent one of the messages of congratulation which appear elsewhere in this issue, graduated from the Institut Montefiore de Liége in 1890, and after spending some time in Germany, joined the direction of a Belgian company whose business was the carrying out of electric lighting and power installations. Then, for ten years, he was in business on his own account as a manufacturer of glassware for lighting, with an electrical installation department. He now represents a number of French and Belgian electrical firms, and is the present president of the Société Belge des Electriciens. This institution was formed in 1883, and has now 500 members in three classes:—Educationalists and Government officials; officers of provincial and municipal administrations; and industrialists. The president is chosen from each of these three classes in rotation. The two gentlemen immediately preceding M. Bede as president were M. Emile Pierard, Director of the Telegraph Administration, and a professor at the University of Brussels, and M. Edmond Lacomble, chief of the Brussels electricity supply system.

Mr. Grosse, electricity manager under the Portrush (Co. Antrim) District Council, has tendered his resignation.

Alderman Max Muspratt, of The Grange, Fulwood Park, Liverpool, upon whom a baronetage is conferred in the List of Dissolution Honours, is chairman of the United Alkali Co., Ltd., founded by his father, and a director of the Automatic Telephone Manufacturing Co., Ltd. He was Lord Mayor of Liverpool in 1916-17.

Tunbridge Wells Town Council has increased the salary of the chief assistant electrical engineer (Mr. J. E. Townall) from £496 per annum to £534.

Mr. W. Powell, for 15 years meter superintendent at the Hereford Corporation Electricity Works, has been presented, on his resignation, with two divan easy chairs.

Mr. Milton, borough electrical engineer of Maidenhead, has asked the Town Council, in view of the increasing gross profits, that 1 per cent., instead of 2 per cent., of the gross profit should be added to his salary as from April 1st, 1923. This was the amount he originally suggested, and the Electric Lighting Committee, in accepting the proposal, expressed their appreciation of the spirit shown by Mr. Milton in making the suggestion.

Mr. Joseph Toole, the Labour candidate for the Everton division of Liverpool, was, ten years ago, an employé of the British Insulated & Helsby Cables, Ltd., of which his political opponent, Sir Harmood Banner, is chairman.

Mr. S. L. Pearce, city electrical engineer of Manchester, has been elected a member of the Alpine Club. Mr. Pearce has spent many holidays climbing in the Alps, both in summer and winter, and has derived much benefit therefrom. He is also a member of the Alpine Ski Club and the Swiss Alpine Club.

Mr. Councillor Beale being unable, owing to his business engagements, to accept re-election as chairman of the Birmingham Electric Supply Committee, Mr. Alderman J. B. Burman, J.P., a former chairman, has been appointed. Alderman Burman is a member of the National and District Industrial Councils for the Industry.

Captain Arthur Angers, A.M.I.E.E., principal of the firm of Messrs. A. Angers & Co., electrical and mechanical engineers, Liverpool, was again returned as a member of the Liverpool City Council on November 1st by a large majority.

Obituary.—Mr. W. H. Smith.—We regret to record that the death took place on Sunday last of Mr. W. H. Smith, late manager of the Liverpool and Ireland branch of Simplex Conduits, Ltd. His services in the Simplex interest extended over a period of 18 years. The depot at 96, Whitechapel is now under the control of Mr. B. L. Myer, A.M.I.E.E., who, in the capacity of acting manager, relieved Mr. Smith of his duties during his recent ill-health.

Mr. J. McDougall.—The passing of a very old servant of the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., took place in the death of Mr. J. McDougall at his home at Forest Gate, London, E., on the 8th inst. Mr. McDougall, who was within a few days of attaining 66 years of age, entered the company's service as long ago as 1870, and was for many years in charge of the waterproofing department at Silvertown, from which position he was transferred to the company's London branch in Cannon Street in 1907.

Mr. F. W. Fox.—The death has taken place at Folkestone of Mr. Frederic William Fox, electrician, who for many years carried on business in Bank Street, Ashford, Kent. He was 68 years of age.

NEW COMPANIES REGISTERED.

Charmlyn Electrical Co., Ltd. (185,471).—Private company. Registered November 3rd. Capital, £500 in £1 shares. To carry on the business of electrical engineers, manufacturers and sellers of electrical apparatus, implements and machinery, &c. The provisional directors are: Miss E. M. I. Rollason, 20, Forthbridge Road, Clapham Common, S.W.11, secretary; A. J. Lloyd, Glastonia, Ashingdon, Essex, clerk. Secretary: Evelyn M. I. Rollason. Registered office: 16, Gray's Inn Road, W.C.

Crystophone Manufacturing Co., Ltd. (185,443).—Private company. Registered November 2nd. Capital, £1,000 in £1 shares. To carry on the business of wireless, telephone, telegraph and electric light, heat and power supply company, &c. The first directors are: N. E. Dobbin, 3, Granville Place, South Kensington, S.W.10; S. L. Forbes, 52, Fitzgeorge Mansions, West Kensington, S.W.14; J. L. Greener, 85, St. Mary's Mansions, Paddington, W.2; J. W. Fothergill, 12, Lansdown Place, Blackheath, S.E.10. Qualification: £1. Registered office: 16, Wells Street, W.1.

Broadfield Radio Co., Ltd. (185,523).—Private company. Registered November 6th. Capital, £100 in £1 shares. To acquire the business of radio apparatus manufacturers and designers carried on by R. J. Sawbridge and R. K. Coupland at Caldy Island, Pembrokeshire, as "Sawbridge and Coupland." The permanent directors are: R. J. Sawbridge, Caldy Island, Tenby, South Wales, radio engineer; R. K. Coupland, 1, The Glen, Saundersfoot, Pembrokeshire, radio engineer. Qualification: £5. Remuneration: £100 per annum, divided between them. Registered office: New Hedges, Tenby, Pembrokeshire.

Wireless Service, Ltd. (185,604).—Private company. Registered November 8th. Capital, £2,000 in 1,000 pref. shares of £1 each and 20,000 ordinary shares of 1s. To carry on the business of manufacturers of, and dealers in wireless, telegraphic, and telephonic apparatus, instruments, equipment, and accessories, &c. The first directors are:—L. M. Robinson, "Thomazines," Reydon (chairman); H. A. Reeves, 55, Talgarth Mansions, Barons Court, W.4 (manager). Qualification: 50 pref. shares. Registered office: 2, Lower John Street, Piccadilly Circus, W.1.

Waterloo Wireless Co., Ltd. (185,600).—Private company. Registered November 8th. Capital, £1,000 in £1 shares. To carry on the business of electricians, electrical engineers, dealers in wireless, telegraphic, and telephonic apparatus of all kinds, &c. The first directors are:—R. J. Kelsall, 36, Great George's Road, Waterloo, Lancs.; T. W. Craig, 3, Church Road, Waterloo, Lancs. Qualification: 100 shares. Registered office: 3, Church Road, Waterloo, Lancs.

Leo Sunderland & Co., Ltd. (185,448).—Private company. Registered November 2nd. Capital, £10,000 in 9,000 10 per cent. cumulative preference shares of £1 each and 10,000 deferred shares of 2s. each. To take over the business of electrical and general engineers carried on as "Leo Sunderland & Co." The subscribers (each with one share) are:—G. C. Pillinger, "Avening," Holland Avenue, Sutton, Surrey, electrical engineer; L. Sunderland, 1, Sheen Park, Richmond, electrical engineer. L. Sunderland is permanent managing director. Registered office: 40, Albemarle Street, W.

Milford Haven Electric Welding Co., Ltd. (185,518).—Private company. Registered November 9th. Capital, £2,000 in £1 shares. To carry on the business of electric and oxy-acetylene welders, boilermakers and repairers, engineers, founders, smiths, machinists, &c. The first directors are:—D. W. Thomas, 17, Harrismith Road, Cardiff; [illegible] Thomas, 17, Harrismith Road, Cardiff; [illegible] Thomas, 17, Harrismith Road, Cardiff; D. W. Hopkins, [illegible] director, subject to holding 100 shares, with remuneration of £300 per annum and 5 per cent. of the profits [illegible] after 20 per cent. [illegible] has been paid. Remuneration [illegible] £2 per annum. Registered office: 129, Bute Street, Cardiff.

Crystor Cowl Insulators, Ltd. (185,444). Private company. Registered November 2nd. Capital, £1,000 in £1 shares. To carry on the business of [illegible] and power supply company, &c. The first directors are:—S. D. Fitzgeorge Mansions, West Kensington, S.W.14; S. L. Forbes, 52, Fitzgeorge Mansions, West Kensington, S.W.14; S. L. Forbes, 52, Place, South Kensington, S.W.10; [illegible] £1 Registered office: 16, Mortimer Street, W.1.

Cardiff Electric and Wireless Supply Co., Ltd. (185,579).—Private company. Registered November 8th. Capital, £2,000 in £1 shares. To carry on the business of electricians, [illegible], manufacturers, and sellers of, and dealers in electricity, wireless engineers, &c. The first directors are:—S. D. Taylor, 12, Cwrtyvil Road, Penarth, Glam., electrical engineer; L. E. R. Dean, 54, Pill Street, [illegible] Glam., [illegible] J. W. Dean, 54, Pill Street, [illegible] Qualification: [illegible] Registered office: 49, Bute Street, Cardiff.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Torquay Tramways Co., Ltd.—Satisfaction to the extent of £1,300 on September 30th, 1922, of charge dated March 8th, 1911, securing £100,000.

Lyto, Ltd.—Particulars filed of £1,500 debentures authorised October 19th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount at the present being £1,300.

British Wireless Supply Co., Ltd.—Particulars filed of £800 debentures authorised by resolutions on October 19th and 20th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Walsall Electrical Co., Ltd.—Satisfaction in full on October 11th, 1922, of mortgage dated March 7th, 1913, securing all moneys due or to become due from the company to [illegible] and Midland Bank.

North Somerset Electric Supply Co., Ltd.—First mortgage debenture dated October 30th, 1922, to secure £20,000, charged on various properties in Portishead, Long Ashton, near Bristol, Easton in Gordano, Somerset, and the company's undertaking and other assets, including uncalled capital. Holders: Solicitor to H.M. Treasury.

British Glass Wool Co., Ltd.—Debenture dated October 25th, 1922, to secure £600, charged on Britannia Works, Lowman Road, Holloway, N., and the company's undertaking and property, present and future, including uncalled capital. Holders: Barclay's Bank.

Kartret Engineering Co., Ltd.—G. B. Manley, of 80a, Coleman Street, E.C., was appointed receiver and manager by order of court dated October 23rd, 1922.

Rawlings Bros., Ltd. (67,908).—Return dated September 22nd, 1922. Capital, £100,000 in 70,000 ordinary and 30,000 preference shares of £1 each. 50,744 ordinary and 20,685 preference shares taken up. £71,429 paid. Mortgages and charges, nil.

Royce, Ltd. (63,871).—Return dated August 1st, 1922. Capital, £170,000 in 70,000 preference and 100,000 ordinary shares of £1 each. 34,955 preference and 72,487 ordinary shares taken up. £1 per share called up on 4,955 preference and 6 ordinary and 15s. per share on 30,000 preference. £27,461 paid. £79,981 considered as paid, being £1 per share on 72,481 ordinary and 5s. per share on 30,000 preference shares. Mortgages and charges, nil.

Electric Supply Corporation, Ltd. (52,036).—Return dated July 18th, 1922. Capital, £250,000 in £5 shares. All shares taken up. £215,000 paid. £35,000 considered as paid. Mortgages and charges, £154,914.

St. Helens Cable & Rubber Co., Ltd. (87,774).—Return dated May 29th, 1922. Capital, £100,000 in £1 shares. 84,000 shares taken up. £84,000 paid. Mortgages and charges, nil.

George Moritz, Ltd. (38,158).—Return dated February 26th (filed May 5th), 1922. Capital, £10,000 in £1 shares. 9,081 shares taken up. £8,081 paid. £1,000 considered as paid. Mortgages and charges, £1,000.

CITY NOTES.

Telephone Manufacturing Co., Ltd.

In presenting the report and accounts at the annual meeting on November 7th, Viscount Chetwynd, referred to the death of Sir John Rees, in June last. Turning to the balance sheet, he pointed out that investments in installation companies had increased from £203,378 to £271,875 due to increased holdings. The principal "sundry debtors" item was £208,208, representing installation companies' current accounts. As the business of these companies was done principally on a rental basis there must continually be investment of capital; investment in a very lucrative business, but still investment rather than turning the money over and recovering it with a small profit in any immediate sense. This process must of necessity continue for a space of years, until such time as the number of installations completely written off represented a fairly large proportion of the whole. Until that time arrived the company would continually require fresh capital, and to attract the necessary capital it was essential that a really conservative policy be pursued. For this reason the directors proposed to write off certain items on the assets side to the amount of £20,158, or more than double the amount paid in dividends. With regard to the general prospects, the chairman said that until taxation was lightened industry would not recover. There was a satisfactory reduction in maintenance costs. There had been a steady increase in the business done by

their installation companies abroad, especially in Brussels. The Paris company's results were not so satisfactory, owing to the competition of cheap French instruments. The Melbourne company continued to progress, and in January last a branch was opened in Sydney, and this had already secured satisfactory orders. A new company had been formed in Madrid, and agencies had been arranged in South Africa, China, and India.

As regarded new developments, the directors had undertaken the sale of electrical fittings all over the country. The company hoped to benefit considerably by the sale of wireless telephony receiving sets. The company was a member of the Broadcasting Company, and much time had been devoted to the design of apparatus, which was now ready for the market. Any concern engaged in electrical work must of necessity have a future before it in a country so behind in electrical matters as this country.

Mr. Frederick T. Jackson, the managing director, outlined the year's progress. Two new developments were a cheap and efficient loud-speaking telephone for offices and factories, and a new automatic telephone. The "Laryngophone" had been adapted for use on ships. To meet the anticipated broadcasting "boom" the laboratory, experimental department, and drawing office, had been considerably extended, and they considered that their receiving set was equal to any competing set on offer.

Callender's Share and Investment Trust.

The revenue for the year ended August 31st last was £16,006. Working expenses amounted to £1,139, and contribution to redemption fund to £1,800. £740 was written off the outstanding balance of preliminary expenses and cost of debenture stock issue, leaving £12,325. Debenture stock interest absorbs £4,141, £500 is transferred to reserve, and £1,000 allocated to corporation tax, leaving £6,684, to which is added £6,619 brought forward, giving an available total of £13,303. The directors recommended a dividend of 6 per cent. less tax, carrying forward a balance of £6,221. The debenture redemption fund stands at £21,568; investments have increased from £156,043 to £286,275. The meeting was held yesterday.

Auckland Electric Tramways Co., Ltd.

Mr. C. G. Tegetmeier, presiding at the annual meeting on November 9th, said that the time was ripe for winding up the company, in view of the improved marketable value of the company's assets and its reduced liabilities. The directors, therefore, proposed to take a favourable opportunity of realising the assets and distributing the proceeds. In the winding-up the preference shareholders would receive the par value of their holdin; while the ordinary shareholders could look forward to not less than the par value of their shares. They had not decided upon any definite procedure with regard to the sale of the corporation debentures.

Marconi Wireless Telegraph Co. of Canada, Ltd.—Several changes were made at the annual meeting held recently in Montreal. Mr. G. C. Greenshields, K.C., of Montreal, assumed the presidency in the place of Mr. A. E. Dyment, who remains as vice-president. Mr. Henry W. Allen was appointed to the Board to represent British interests. A revision of the contract with the Dominion Government has been secured, making it more favourable to the company, and a licence has been obtained to operate a station with a 1,500-mile range at Louisburg, Nova Scotia; this will add considerably to the company's business. The Marconi Co. has secured valuable patent rights in connection with commercial radio telegraphy and telephony, and the co-operation of the Canadian General Electric Co. has been obtained in the manufacturing side of the company's business.

The Zurich Electrical Bank.—At the recent general meeting of the Zurich Bank for Electrical Undertakings, the question was raised as to whether a further reorganisation of the bank was to be expected. In reply, the chairman is reported to have stated that two points of view had been taken up in the matter. One group of priority shareholders desired to receive interest as soon as possible, while the other wished for a readjustment of the capital. The bank was no longer so much dependent upon the German mark; the engagements in marks, which still amounted to 2,200,000 fr. on June 30th, 1922, had been reduced to 450,000 fr. by the end of October. In conclusion, the chairman remarked that there could be no idea of a fresh reorganisation at the present time, as conditions had been insufficiently cleared up.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

[illegible] 6,825 ordinary shares of £1 each.
[illegible] 5,345 7 per cent. cumulative preference [illegible] 102,974 to 108,318

Application has been made to admit the following to be officially quoted:—

[illegible] Tramways Light and [illegible] 7 per cent. preference stock.

Electric Construction Co., Ltd.—Interim dividend in respect of the year ending May 5th, 1923, at the rate of 6 per cent. per annum on the ordinary shares, less tax.

Indian Electric Supply and Traction Co., Ltd.—Interim dividend of 3 per cent. on the ordinary shares.

North Melbourne Electric Tramways and Lighting Co., Ltd.—In their report for the year ended September 30th, 1921, the directors state that the company's undertakings have been sold to the State Electricity Commission of Victoria as from August 1st, 1922. When the audited accounts arrive from Australia a final balance-sheet will be prepared and submitted.—*Financial Times.*

Associated Fire Alarms, Ltd.—Profit for year ended June, 1922, £7,612, plus £6,968 brought forward. To reserve, £10,000, carrying forward £4,579. Part of the capital which is no longer represented by available assets is to be cancelled.

STOCKS AND SHARES.

Monday Evening.

Fifty years ago electricity supply shares had not come into the Stock Exchange lists. There were a good many gas issues quoted, but electricity supply was barely in its infancy, and the companies formed to deal with the new industry did not make their appearance for another fifteen to twenty years. However, the prices of some of the securities connected with the electrical railway and cable work are interesting enough, although, so far as the former are concerned, it is scarcely necessary to add that the lines were not then electrified. Consols half-a-century ago to-day, stood at 92¼, being then 3 per cents. The present quotation is 57 for the 2½ per cents. Metropolitan Consolidated at 70¾ was 15 points higher than the current quotation, but Districts were only 27½ as against the existing price of 41½.

The Brompton, Metropolitan, St. James' and Westminster Companies were registered in 1888, the Chelsea Company four years earlier. The Charing Cross came into being in 1889. The City of London and County of London started in 1891.

In the group of cable stocks, these are some of the principal prices given in the Stock Exchange Official List of November 16th, 1872:—

Company.	Price.	Company.	Price.
Anglo-American ...	130	Indo-European	15
British Australian ...	9¾	Mediterranean Extension ...	6¾
British India Extended	14½	Mediterranean Extension 8 per cent. pref.	11½
China Submarine ...	10½	Reuters	10
Cuba, Ltd.	9	Submarine	22
Eastern	10½		
West India & Panama ...	6¼		
Great Northern ...	11		

Eastern ordinary in those days were shares, and the then price of 10½ was equivalent to 105 for stock, so that to-day's level shows a gain of about 85 points, without taking into account the new issues which have been made from time to time. The Stock Exchange market of those days was a small affair as compared with that of to-day, and business was limited to a handful of stocks and shares as compared with the thousands now available for the attention of investor, speculator, and—gambler.

The political events of the past week, both at home and abroad, have caused a general diminution of business in most markets, though quotations are well maintained, on the anticipation that, whichever party comes into power, it will certainly not be that of Labour. So much has been made of the Capital Levy as a menace to security of every description that it is taken for granted the country will not stand the tampering with safety which a capital levy is taken to mean. Therefore, the gilt-edged market is strong, and the Government-guaranteed stocks of the three tube railways have improved to ¼ discount, the fully-paid to 93¾. A curious question has arisen with regard to Stock Exchange commission in connection with these issues. On Government stocks, the brokerage is sensibly less than that chargeable on those of railways, and buyers of the former have been urging that these new Tube debentures are really Government stocks, liable to the lower rate of commission as laid down by the Stock Exchange Committee as a minimum. The point is a nice one, worthy of argument in club smoking-rooms when Election topics become exhausted.

The Eastern group of cable stocks is dull, owing to a little selling which came about by reason of the Turks having cut one of the cables in the vicinity of Chanak. The Stock Exchange market is rather inclined to regard this with polite amusement, and, so far as can be learned, the damage is not likely to be of any great moment to the companies concerned. However, Eastern ordinary has gone back 3½ points, Western Telegraphs 10s. and Eastern Extensions ¼. Cuba Submarines fell 7s. 6d. to 7¼. Anglo-American deferred is easier at 23½. Allotments of the Marconi 6½ per cent. debentures, which were expected to be out on Monday, failed to put in an appearance. They are likely to be dealt in on the Wednesday in this week, and the price will probably start in the neighbourhood of 2 premium. It was said in advance that plenty of buying orders were in the market for execution as soon as dealings began. Brokers know, however, that the debentures were heavily stagged and, if this leads to selling at the outset, the premium will, of course, be reduced. At anything like 1 premium, the stock will be worth taking up by the investor.

Amongst electricity supply shares, Brompton, Charing Cross ordinary and South Londons all show advances, which movement is in itself a convincing illustration of the manner in which the General Election is expected to run. Amongst manufacturing shares, changes in prices are inconsiderable. Callenders eased off to 2 3/16. General Electrics drooped to 17s. 6d., and the rest of the group maintains its previous levels. Whitehall Electric preference are quoted at 17s. 9d.; the debentures are 87.

Home Railway stocks show no movements as compared with the prices of last Tuesday. British Columbia Electrics have further advanced, the deferred at 77½ being 3 higher, making a gain of 6 points in as many days. Mexico Tramway Fives are 3½ better at 74½, and the Sixes at 46½ show a gain of four points, the bonds coming into considerable demand from Brussels and some of the foreign exchanges. Anglo-Argentine seconds weakened to 3⅜, on a little selling from Ireland on behalf of people who were taking profits on shares bought considerably lower down. The company's 5 per cent. debenture at 84 is 1½ to the good. Brazilian Tractions lost a point at 46.

The rubber market is quiet again, and, although the price of the produce strengthened to about 1s. 0¼d. per lb., this failed to re-galvanise the activity which was a feature of the Stock Exchange three weeks ago. The iron and steel group is also lacking in interest, the reason for public abstention being attributed to the slight doubt felt as to what is likely to be the result of the election contests in the North of England and in Wales. The Stock Exchange will be thankful when the contest is over, but a still greater measure of relief would be experienced by a settlement of the matters now in dispute between the Allied powers and Turkey.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Nov. 13. 1922.	Rise or fall).	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	9¼	+ ½	£6 9 9
Charing Cross Ordinary	8	9	7⅞	+ ½	5 16 2
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6⅜	—	4 12 4
City of London	14	14	2⅛	—	6 15 7
do. do. 6 per cent. Pref.	6	6	28/-	—	5 4 4
County of London	8	8	1⅞	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7½	—	6 13 4
London Electric	2½	4	3⅛	—	3 17 6
do. do. 6 per cent. Pref.	6	6	5	—	5 17 1
Metropolitan	7	7	6⅜	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9⅜	—	6 11 6
South London	7	7	4¼	+ ¼	6 11 9
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102	—	5 17 6
do. Def.	1½	84/6	28½	— ½	6 9 6
Chile Telephone	6	6	6½	—	4 16 0
Cuba Sub. Ord.	7	7	7½	— ⅝	9 0 8
Eastern Extension	10	10	19¼	— ¼	5 4 0
Eastern Tel. Ord.	10	10	190	—3½	5 5 3
Globe Tel. and T. Ord.	10	10	10½	— ¼	5 4 0
do. do. Pref.	6	6	11⅝	—	5 5 0
Great Northern Tel.	24	22	28	—	7 17 2
Indo-European	10	10	35⅛	—	7 1 0
Marconi	25	15	2⅞	—	6 9 6
Oriental Telephone Ord.	12	12	2⅛	+ 1/16	*5 4 0
United R. Plate Tel.	8	8	7⅞	—	*5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	— ½	*5 5 3
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	65½	—	4 1 1
do District	Nil	1	41½		2 8 2
Underground Electric Ordinary	Nil	Nil	3	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	3	4	86½	—	*4 12 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	6½	12½	88	—	7 11 9
do. do. 2nd Pref.	Nil	5½	38	+ ⅛	7 2 0
do. do. 5 per cent. Deb.	5	5	84	+1½	5 19 1
Brazil Tractions	Nil	Nil	46	1	8 14 0
British Columbia Elec. Ry. Pcs.	5	5	77½	+1	6 9 0
do. do. Preferred	5	98/-	68	+2	*6 18 0
do. do. Deferred	8	124/-	77½	+3	*8 1 9
do. do. Deb.	4½	4½	76	+3	5 11 10
Mexico Trams. 5 per cent. Bonds	Nil	Nil	76	+3½	6 11 7
do. do. 6 per cent. Bonds	Nil	Nil	42½	—	Nil
Mexican Light Common	Nil	Nil	20½	—	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds	Nil	5	65½	—	7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	16	81	—	4 18 6
British Aluminium Ord.	10	5	16/9	—	5 19 5
British Insulated Ord.	17	15	44/6	—	6 14 10
Callenders	15	16	2⅛	—⅛	6 17 0
6½ Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	8/-	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	14⅜	—	7 17 0
English Electric	8	5	15/0	—	6 7 0
do. do. Pref.	7	7	18/3	—	6 8 0
Gen. Elec. Pref.	6½	6½	21/9	—	5 19 6
do. Ord.	10	5	15/6	—6d.	6 14 3
Henley	10	10	9½	—	6 9 10
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	14/6	—	—
Met.-Vickers Pref.	8	8	3⅝	—	6 11 6
Siemens Ord.	10	10	25/9	—	*7 15 4
Telegraph Con.	90	90	262	—	*4 18 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Tuesday, November 14th.

CHEMICALS, &c.		Latest Price.	Fluctuations since last Tues.
a Acid, Oxalic	per lb.	7½d.	½d. inc.
a Ammoniac, Sal	per ton	£42	£1 dec.
a Ammonia, Muriate (large crystal)	..	£48	..
a Bi-sulphide of Carbon	..	..	..
a Borax	..	£40	..
a Copper Sulphate	..	£29 15s.	5s. dec.
a Potash, Chlorate	per lb.	5d. to 5½d.	..
a ,, Perchlorate	..	7½d.	..
a Shellac	per cwt.	£17 10s.	25s. inc.
a Sulphur, Sublimed Flowers	..	£9	..
a ,, Lump	..	£7 15s.	15s. dec.
a Soda, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£6	..
a Sodium Bichromate, casks	per lb.	5d.	..
METALS, &c.			
b Aluminium, Ingots	per ton	£100	..
b ,, Wire	per lb.	1/9 to 2/6	..
b ,, Sheet	..	1/6 to 2/-	..
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£17	£2 inc.
Grade II	.. ..	£12	..
Grade III	..	£7	£1 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	..
c ,, Tubes (solid drawn)	..	11¼d. to 1/-	..
c ,, Wire, basis	..	9½d.	..
c Copper Tubes (solid drawn)	..	1/1½	..
c ,, Bars (best selected)	per ton	£95	..
c ,, Sheet	..	£96	..
c ,, Rod	..	£96	..
d ,, (Electrolytic) Bars	..	£71 5s.	10s. dec.
d ,, ,, Sheets	..	£145 10s.	..
d ,, ,, Wire Rods	..	£81 5s.	10s. inc.
d ,, ,, H.C. Wire	per lb.	10½d.	½d. inc.
f Ebonite Rod	..	3/6	..
f ,, Sheet	..	9/-	..
g German Silver Wire	..	2/6	..
b Gutta-percha, fine	..	12/6	..
b India-rubber, Para fine	..	1/1½	..
i Iron Pig (Cleveland Warrants)	per ton	95s. 6d.	..
l ,, Wire, galv. No. 8, P.O. qual.	..	£24	..
g Lead, English Pig	..	£27 10s.	..
k Mercury	per bot.	£12 to £12 5s.	..
e Mica (in original cases) small	per lb.	3d. to 5d.	..
e ,, ,, medium	..	4/- to 8/-	..
e ,, ,, large	..	10/- to 20/- & up.	..
p Phosphor Bronze, plain castings	..	1/1	..
p ,, drawn bars and rods	..	1/8	..
p ,, rolled strip & sheet	..	1/2½	..
p ,, wire	..	1/3½	..
o Platinum	per oz.	£231	..
d Silicium Bronze Wire	per lb.	1/6	..
r Steel, Magnet, in bars	..	10d.	..
n Tin, Block (English)	per ton	£179 10s. to £180	£9 to £9 10s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	3/2	..

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Dance.—The annual staff dance of the Newcastle-upon-Tyne Electric Supply, Ltd., was held at the Assembly Hall, Heaton Road, Newcastle-upon-Tyne, on Friday, November 10th. The guests were received by Mr. R. P. Sloan, C.B.E., and Miss Sloan at 7.30 p.m. Amongst the guests and members of the company's staff present were:—Mr. and Mrs. C. H. Merz, Colonel W. McLellan, Mr. A. Bonnin (director), Mr. and Mrs. Norbert Merz, Mr. J. P. Gregory (B.T.H. Co., Rugby), Mr. and Mrs. H. W. Clothier (A. Reyrolle & Co.); also Mr. and Mrs. J. S. Watson, Mr. J. Cusworth, Mr. G. W. Briggs, Mr. and Mrs. H. L. Riseley, and Major and Mrs. N. H. Firmin. The Dance Committee comprised the following:—Mr. A. A. Hughes (chairman), Mr. E. Fenwick, Mr. P. V. Horler, Mr. C. S. Jowsey, Mr. W. F. T. Pinkney, Mr. M. F. Sheedy, and Mr. Cresswell (hon. secretary).

The Nobel Prizes.—The Noble Prize for Physics (1921) has been awarded to Prof. Albert Einstein, of Berlin, in recognition of his work in theoretical physics.

The 1922 prize for physics has been awarded to Prof. Niels Bohr, of Copenhagen, in recognition of his research work into the structure of atoms.

The 1921 prize for chemistry has been awarded to Prof. Frederick Soddy, Professor of Inorganic and Physical Chemistry at the University of Oxford, for his contributions to the knowledge of chemistry of active elements and his researches into isotopes.

The 1922 prize for chemistry has been awarded to Dr. Francis William Aston, Research Fellow of Trinity College, Cambridge, in recognition, among other things, of his chemical research work.—*Evening News.*

THE H.T.A. COIN COLLECTOR AND IMPULSE DIAL.

A New Telephone Call Box.

Hitherto the extension of the public telephone call cabin system to automatic exchanges has been hindered by the absence of a suitable coin-collector box and impulse dial. The result has been that where automatic exchanges cover an area in which public call cabins are needed, the authorities have been forced to install an expensive manual section to deal with this traffic.

In general coin-collector boxes in automatic areas are of the prepayment type, and it is the general practice to insert

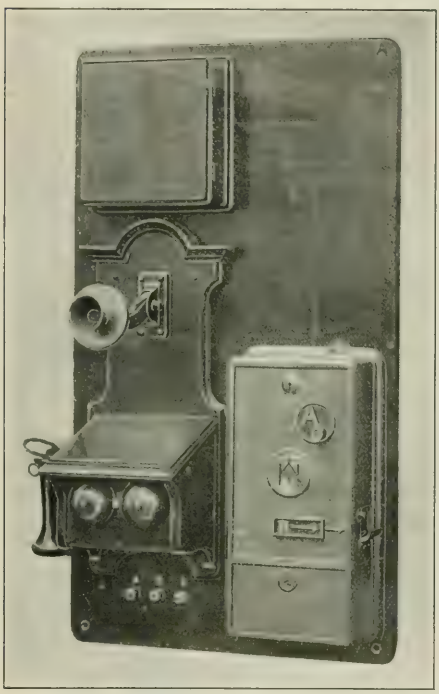


Fig. 1.—H.T.A. Coin-Collector Box.

payment in order to remove the short-circuit from the dial and enable the caller to proceed with his call. The caller has been limited hitherto by this condition, and cannot obtain the manual operator without previously inserting his fee in order to pass particulars of trunk calls, inquiries, &c., or to send telegrams.

In order to overcome this undesirable and costly limitation, a suitable coin-collector box was devised by Hall Telephone Accessories, Ltd. Next, in order to remedy the remaining defects, a simple adaptation of the standard impulse dial has been patented for use with the coin box, so that the dialling of 0 by the caller, without making payment, automatically breaks the dial short-circuit and calls the manual operator concerned with trunk, &c., calls.

The return of the dial to its normal position restores its short-circuit and allows the caller to proceed. The arrangement, of course, does not affect the normal functions of the dial and coin box, and does not allow the caller to dial for local traffic without the usual pre-payment. Its great merit is that it increases the utility of public call cabins in an automatic exchange area, without necessitating the provision of a manual section, to equal the efficiency of private lines.

This new dial is being installed by the G.P.O. in England in connection with the newest automatic exchange (which we recently had the pleasure of visiting at Fleetwood) in combination with the new coin-collector box, which is suitable for use on all systems and for any telephone apparatus where it is desired to collect payment for each call made. It is a pre-payment type of collector, and it has been installed by the British G.P.O., the French, and Swiss Post Office authorities for public service, and the Telephone Administrations of the Argentine and Belgium are introducing their first machines for trial purposes.

The collector is of very simple construction and is purely mechanical in action; it operates with any denomination of coins through the medium of either one or more slots, and it accepts any desired number of coins of each denomination. It is, therefore, suitable for use in any country. In the case of the British machines, it is made to operate with any value of coins from 3d. to 12d. for local or toll calls, and for larger sums in the case of boxes designed to deal with distant traffic.

The accompanying illustration, fig. 1, shows the coin box, while the diagrams indicate the circuits as used by the G.P.O. in England. Fig. 2 shows the working parts and connections of the coin collector arranged for manual or automatic exchanges. Fig. 3 shows the circuit wiring used in an automatic exchange (normal position for incoming calls). For local outgoing calls, when two pennies are placed in the box, contacts 1, 2 open and remove the dial short-circuit; 3, 4 close and short-circuit the callers' transmitter. When the distant subscriber answers, the caller presses button A, and contacts 1, 2 close, while 3, 4 open. If the call is effective, the caller presses button B; contacts 1, 2 close, while 3, 4 open and 5, 6 open for an interval long enough to clear the exchange, and then close.

For trunk and junction calls the caller dials 0 *without* depositing his fee. Contacts 11, 12 open and remove the dial short-circuit; the manual telephonist answers and takes particulars of the call. When the call matures the telephonist requests the caller to place his fee in the box, and each penny deposited opens contacts 7, 8; the caller then presses button A and proceeds with his conversation.

The last diagram, fig. 4, shows the circuit wiring used in a manual exchange. The normal position of the coin box is shown, but if the last caller has received his money back, then 6 will be in contact with 5 instead of 7. Contacts 3, 4 close, and 6 moves from 7 to 5 when three pennies are inserted; contacts 3, 4 only open if money is refunded, 6 and 5 remain closed. Contacts 3, 4 open and 6 move from 5 to 7 if money is deposited. Contacts 1, 2 open momentarily when the fourth and subsequent pennies are inserted. When the short-circuit across the relay R is removed, contacts 8, 9 close,

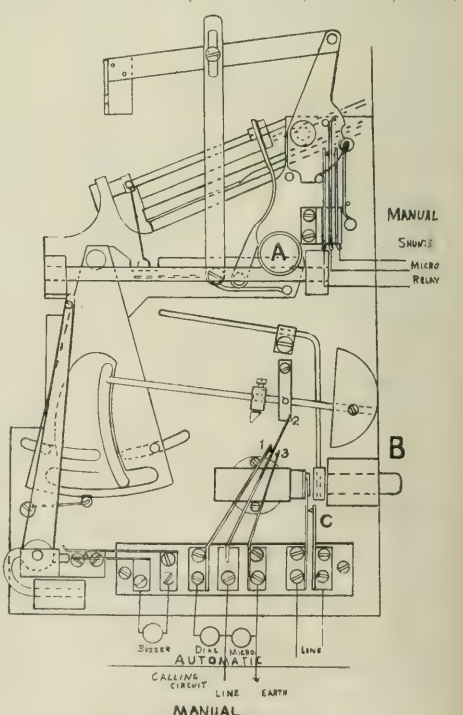


Fig. 2.—Coin-Collector Mechanism.

if the exchange operator depresses the special reversing key or answering cord. The cord circuit at the exchange answering position is fitted with a reversing key on the answering side.

The control of the payment is in the hands of the public, and the payment may always be recovered by the caller if the line is out of order. Further, any error in manipulation

is the fault of the caller, so that complaints are eliminated. It is particularly suitable for public call cabins that are not under official supervision, and is available for local and trunk calls with an indefinite number of coins of more than one denomination, the insertion and encasement of which are notified automatically and without delay to the telephonist.

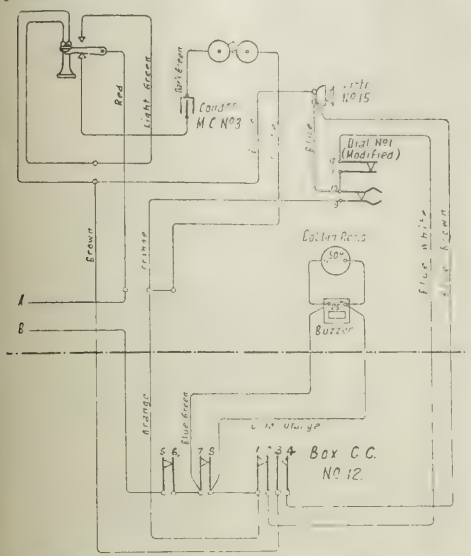


Fig. 3.—Circuit Wiring for Automatic Exchange.

Telegrams can be despatched by its means at any hour, and correct payment received for them, and it is applicable equally to automatic and to manual exchanges (both c.b. and l.b.).

It lowers the cost of each call originated through it by: (*a*) increasing the operator-hour efficiency of public instruments fivefold (French Government report); (*b*) eliminating attendants in charge of groups of public call cabins; and (*c*) increasing the cabin revenue by allowing a larger clientèle to use any busy public cabin in a given time.

Low establishment and maintenance costs are claimed for the device, which does not require any exchange or other modifications for automatic exchanges, and only a slight one for manual exchanges. It is easy to manipulate, and it rejects foreign or spurious coins. As the control of the suspended payment remains in the power of the caller up to the very instant of accepting the call (and paying in or refusing the call and re-imbursing the money), the possibility of complaints is practically eliminated. Further, as the speaking circuit is not available until the payment has been finally encased, it is impossible for the public to defraud the Administration.

Where required, a counter attachment (fitted inside the box, but with a dial visible to the subscriber) can be added to register the number of effective communications obtained, and can be used as a check on the accounts of the Telephone Administration, or to allow proprietors of shops, offices, &c., to allocate amongst tenants or departments the correct number of effective calls from a single branch exchange in the building. If a call is not accepted and the money is re-imbursed to the caller, the counter does not register a call.

INTERNATIONAL ELECTROTECHNICAL COMMISSION.—GENERAL MEETINGS.

International Rating for Electrical Machinery.

The I.E.C. method of rating (i.e., 50 deg. C. rise continuous maximum rating with no sustained overload) was accepted at a plenary meeting held in 1913, and shortly afterwards the British Engineering Standards Association issued its Standardisation Rules (B. S. Report No. 72, 1917) based entirely on the I.E.C. rating, and covering all sizes and types of electrical machinery, with the exception of traction motors.

Subsequent to the war and in spite of repeated efforts, British industry has found itself unable to conform to these rules in the case of a considerable portion of the electrical machinery made in this country.

In the case of motors and generators for ordinary industrial purposes, the fact that more than 95 per cent. of British business related to machines for which the industry demanded a sustained overload (generally 25 per cent. overload for two hours) could not be ignored, and the Committee of the B.E.S.A. charged with the revision of the British Standardisation Rules was faced with the necessity of departing from the recommendations of the I.E.C.

At the express request of the British National Committee of the I.E.C., meetings of the I.E.C. Advisory Committee on Rating have been arranged to take place in Geneva, from November 20th to 26th, when the whole situation with regard to an International basis of rating for electrical machinery will be reviewed.

In addition, it is expected that matters in connection with standard pressures for transmission and insulators will be discussed at this meeting, and there will probably be an unofficial conference dealing with conditions necessary to secure public safety in the installation of lines for transmission and distribution of electrical energy.

The following members of the British Committee will be present at the meetings:—Sir Richard Glazebrook, K.C.B. (chairman of the British National Committee); Mr. E. G. Batt; Mr. A. R. Everest; Mr. Frank Gill; Major H. C. Gunton, M.B.E.; Mr. P. V. Hunter; Mr. J. S. Peck; Mr. C. Rodgers, O.B.E.; Mr. Roger T. Smith (delegate).

Delegates from the United States are now on their way to Europe to attend the Geneva meetings. Dr. Mailloux, President of the Commission, has reached Europe, and the following members of the American Committee are on the way to Geneva:—Mr. C. L. Collins; General George H. Harries; Mr. H. M. Hobart; Mr. F. V. Magelhaes; Dr. C. H. Sharp; Mr. C. E. Skinner; Dr. S. S. Wheeler.

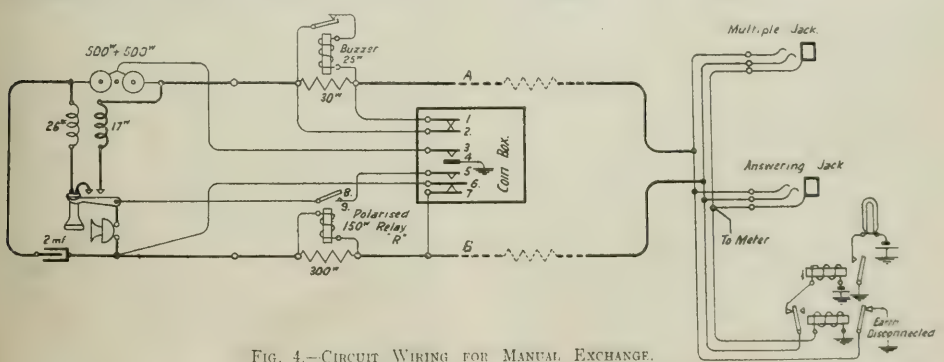


Fig. 4.—Circuit Wiring for Manual Exchange.

The Indian Government will be represented by Mr. J. V. Meares. Colonel R. E. Crompton, C.B., hon. secretary of the I.E.C., will also be present with Mr. C. le Maistre, C.B.E., general secretary, and Mr. Percy Good, secretary to the British Committee.

What a Fog Costs.—According to the twenty years' average, December is London's foggiest month with ten days, October second with nine, while January and November have each a fraction under nine days of fog. To a big town fog is the most expensive of weather. First comes the enormous cost of lighting. In London a day's fog means that the gas and electric light companies have to supply gas and electric power to a value of over £7,000 in excess of the normal requirements. The loss to those engaged in surface traction is very heavy. The total loss in omnibus and tramway fares during a day of thick fog is reckoned at about £2,000. The only transportation company that profits by fog is the Underground, which gets most of the traffic that would otherwise have gone by 'bus or tramcar.—*Daily Mail.*

NEW PATENTS APPLIED FOR, 1922.

NOT YET PUBLISHED.

Copies of Specifications may be obtained by Messrs. Sexton-Jones & Phelps, Patent and Trade Mark Agents, 28a, High Holborn, London, W.C.1.

24,281 "Centre-[illegible] Arbors or Cassette Bases." L. Winston. October 27th.

24,287 "[illegible] Apparatus for the Ventilation of Rooms." G. W. Sexton and [illegible]. October 27th.

24,290 "[illegible]." P. G. A. H. Voigt. October 27th.

29,296. "Electric accumulators." P. G. A. H. Voigt. October 27th.

29,297. "Variable mutual inductances." Anode Wireless and Scientific Instruments, Ltd., and J. H. Keyner. October 27th.

29,[illegible] "[illegible]." J. Sexton and A. Reyrolle & Co., Ltd. October 27th.

29,343. "Electro-deposition of metal." T. R. Harris. October 27th.

29,356. "Magnetic cut-outs." Rolls-Royce, Ltd., and F. H. Royce. October 27th.

29,371. "Sound amplifiers for telephones, &c." H. Ayliffe. October 27th.

29,[illegible] "[illegible]." R. H. [illegible] Gesellschaft mit beschränkter Haftung (trading as Siemens-Schuckertwerke Akt. Ges.). October 27th.

29,387. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 27th. United States, April 5th.

29,391. "Electric coils." B. J. Galloway. October 27th.

29,407. "Magnetometers." Eastern Telegraph Co., Ltd. October 27th.

29,431. "Radio receiving systems." British Thomson-Houston Co., Ltd. October 27th. (United States, October 28th, 1921.)

29,439. "Winding, forming, &c., devices for coils for dynamos." B. Gill. October 28th.

29,446. "Electric motor." N. Shenstone. October 28th.

29,475. "Sparking plugs." J. A. Mills. October 28th.

29,477. "Electric telegraph apparatus." F. J. Perrott. October 28th.

29,478. "Wireless receiving apparatus." H. S. Walker and G. W. Hale. October 28th.

29,482. "Sparking plug." J. Darroch and G. D. Shearer. October 28th.

29,488. "Moulds for manufacture of glass caps for electric incandescent lamps, &c." L. S. Vello. October 28th. (Spain, October 29th, 1921.)

29,489. "Moulds for manufacture of glass caps for electric incandescent lamps, &c." L. S. Vello. October 28th. (Spain, October 29th, 1921.)

29,500. "Incandescent electric lamps, &c." L. S. Vello. October 28th. (Spain, October 29th, 1921.)

29,501. "Surface wiring for electricity distributing systems." T. H. Martin-Harvey. October 28th.

29,514. "Electric vacuum tubes." Siemens & Halske Akt. Ges. October 28th. (Germany, October 29th, 1921.)

29,515. "Electric switches." British Thomson-Houston Co., Ltd. October 28th. (United States, October 28th, 1921.)

29,520. "Multiplex telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. October 28th.

29,521. "Railway signalling." Automatic Telephone Manufacturing Co., Ltd. October 28th.

29,541. "Electric power-transmission systems." A. M. Taylor. October 30th.

29,548. "Case for dry batteries, &c." F. H. Brookes. October 30th.

29,564. "Searchlights for vehicles." S. Grebel. October 30th.

29,574. "Contact rolls for electric welding apparatus." H. Imrie (F. G. Gale). October 30th.

29,580. "Variable resistance unit." W. J. Cameron. October 30th.

29,583. "Electric glow-lamp holders, &c." H. C. Tudor. October 30th.

29,584. "Thermionic valves, &c." W. J. Polyblank. October 30th.

29,602. "Motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 30th.

29,611. "Thermally-actuated device for controlling electric circuits." P. W. Baker. October 30th.

29,613. "Electric insulators for fuse carriers." W. Gee. October 30th.

29,617. "Electric flash-light." G. I. Johnson. October 30th.

29,641. "Variable inductances." British Thomson-Houston Co., Ltd., and R. C. Clinker. October 30th.

29,646. "Head-lights." I. Arthurs and R. E. Jackson. October 30th.

29,651. "Electric heating appliances." Automatic Telephone Manufacturing Co., Ltd., and C. H. Archer. October 30th.

29,657. "Radio receiving apparatus." R. E. H. Carpenter. October 30th.

29,677. "Reception for wireless telegraphy, &c." R. W. Robson. October 31st.

29,680. "Vacuum tubes." E. Y. Robinson. October 31st.

29,695. "Electric lanterns." G. B. Burnside. October 31st.

29,746. "Systems of electric distribution." F. W. Le Tall (Westinghouse Electric and Manufacturing Co.). October 31st.

29,768. "Electro-magnetic apparatus for operating relay contacts, light signal mechanisms, &c." General Electric Co., Ltd. (Hall Switch & Signal Co.). October 31st.

29,769. "Sockets for electric incandescent lamps." General Electric Co., Ltd. (Hall Switch & Signal Co.). October 31st.

29,770. "Electric luminous discharge tubes." General Electric Co., Ltd., and J. W. Ryde. October 31st.

29,775. "Signalling systems." Western Electric Co., Ltd. (Western Electric, Inc.). October 31st.

29,780. "Commutating gear of electric machines." English Electric Co., Ltd. October 31st.

29,781. "Sparking plug." G. F. Sieath and M. S. Stevenson. October 31st.

29,805. "Electric time fuses." W. Eschbach. October 31st.

29,839. "Electric driving power applied to clocks." S. J. Wise. November 1st.

29,851. "Loud-speaking telephone installations." A. Fontana and C. Hering. November 1st.

29,[illegible] "[illegible]." A. L. Ferry. November 1st.

29,872. "Rectifying devices." A. R. Angus. November 1st.

29,876. "Electric advertising, &c., apparatus." F. H. W. Cox. November 1st.

29,880. "Multiple terminal adaptor devices for wireless telephone receiving instruments, &c." A. G. Clark and W. O. Heyne. November 1st.

29,881. "Electric switchgear." British Thomson-Houston Co., Ltd., and H. Trenchham. November 1st.

29,882. "Electric propulsion of ships." British Thomson-Houston Co., Ltd., and A. A. Pollock. November 1st.

29,883. "Electric propulsion of ships." British Thomson-Houston Co., Ltd., and A. A. Pollock. November 1st.

29,[illegible] "[illegible]." A. Kessler. November 1st.

29,[illegible] "[illegible]." [illegible]. November 1st.

29,909. "Magneto-electric machines." A. Massey-Allen and R. B. North. November 1st.

29,921. "Burglar and fire alarm." D. C. Hancock. November 2nd.

29,950. "Electric connector." J. Wilson. November 2nd.

29,954. "Oscillating electric fans." A. E. Angold and A. H. Railing. November 2nd.

29,964. "Vehicle lamps." E. W. A. Webb. November 2nd.

29,982. "Current collectors for dynamo-electric machines." J. H. St. H. Mawdsley. November 2nd.

29,988. "Contact spring sets for telephone systems, &c." W. E. Goodwin and [illegible]. November 2nd.

30,026. "[illegible]." [illegible]. November 2nd. (Italy, November 3rd, 1921.)

30,029. "Electric fittings." British Thomson-Houston Co., Ltd., and H. C. Wignall. November 2nd.

30,056. "Electro ignition devices for internal-combustion engines." R. Bosch Akt. Ges. November 3rd. (Germany, April 28th.)

30,073. "Mine signalling visual indicator." R. S. Gardner. November 3rd.

30,075. "Electric switches." C. C. Garrard, A. H. Railing, and W. Wilson. November 3rd.

30,082. "Electric switch plugs." R. Crust. November 3rd.

30,085. "Means for deadening noise of tramcars." A. Loré. November 3rd.

30,095. "Electric cable joint boxes." J. C. Lee. November 3rd.

30,102. "Incandescent electric lamps." R. Andersson. November 3rd.

30,113. "Telephone exchange systems." G. Deakin and Western Electric Co., Ltd. November 3rd.

30,115. "Electric fuses." W. Clark. November 3rd.

30,116. "Electric switches." W. Clark. November 3rd.

30,139. "Electro-magnetically-operated horns." H. W. F. Ireland, J. Lucas, Ltd., and O. Lucas. November 3rd.

30,145. "Electric switches." P. H. Waller. November 3rd.

30,147. "Colour control systems for projectors." British Thomson-Houston Co., Ltd. November 3rd.

30,149. "Directional submarine sound receivers." Signal Ges. November 3rd. (Germany, October 9th.)

30,150. "Mixed internal-combustion and electric propulsion systems." Sulzer Frères Soc. Anon. November 3rd. (Switzerland, August 12th.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

10,285. "Start-up printing telegraph system and apparatus therefor." E. C. R. Marks (Morkrum Co.). April 7th, 1921. (187,247.)

13,288. "The Automatic Quick Tape Telegraphic Device." Dr. A. Meissner and W. Buse. May 10th, 1921. (187,261.)

13,714. "Electrical controlling devices." M. Walker. May 17th, 1921. (187,264.)

16,271. "Interference tubes for phonographs and telephones." M. E. Wolvekamp. June 13th, 1921. (187,276.)

17,449. "Electric lamp holders." H. B. Prentice. June 27th, 1921. (187,282.)

18,364. "Outside containers or boxes of electrical storage-batteries or accumulators." I. E. Kohlmeyer. July 6th, 1921. (187,287.)

18,707. "Electric measuring apparatus of the moving-iron type." Da and Dutilh (firm of). March 31st, 1921. (177,757.)

18,934. "Electric light fittings." J. Scott. July 13th, 1921. (187,302.)

18,999. "Indirect lighting unit." A. J. Stephens (W. A. Dorey). July 14th, 1921. (187,304.)

19,010. "Water-tight interlocked electric switch and plug-and-socket connection." J. Scott. July 14th, 1921. (187,306.)

19,145. "Switches for electric circuits." A. West & Co., Ltd., and V. Breeze. July 15th, 1921. (187,316.)

19,163. "Electric motors for the direct driving of slowly-rotating shafts." C. Lott. January 17th, 1921. (174,138.)

19,260. "Devices for testing the insulation of electric three-phase high-tension conductors." F. Brennecke. July 16th, 1921. (187,322.)

19,543. "Electric-distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 20th, 1921. (187,337.)

19,661. "Light-ray projector." H. Sefton-Jones (W. A. Dorey). July 21st, 1921. (187,340.)

20,718. "Regulation on long-distance electric transmission lines." A. M. Taylor. (Addition to 170,619). August 4th, 1921. (187,356.)

20,850. "Power transmission mechanisms of electrically-driven vehicles." W. E. Moore. August 5th, 1921. (187,360.)

21,105. "Directional wireless apparatus." N. F. S. Hecht. August 9th, 1921. (187,363.)

21,564. "Glass-working machines." British Thomson-Houston Co., Ltd. (General Electric Co.). August 13th, 1921. (187,374.)

21,624. "Alternating-current dynamo-electric machines." R. Townend, J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. August 15th, 1921. (187,377.)

23,760. "Electric switches for wireless-signalling apparatus." H. R. Rivers-Moore. September 6th, 1921. (187,415.)

24,693. "Thermal switches for electrically-heated apparatus." Aktiebolaget Birka Regulator. September 30th, 1920. (169,696.)

26,549. "Electro-magnetic brakes." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 7th, 1921. (Addition to 162,745.) (187,439.)

26,887. "Current-transmission devices for ball-bearings in electrically-driven rail vehicles." J. Schmid-Roost Ball-Bearing Works, Ltd. November 6th, 1920. (171,366.)

26,901. "Electricity measuring instruments." H. Lucas, E. J. B. Danks and O. A. Miller. October 11th, 1921. (187,441.)

28,016. "Electric railway motor control systems." Metropolitan-Vickers Electrical Co., Ltd. November 5th, 1920. (171,085.)

28,123. "Sparking-plug for explosion motors." A. O. M. Lofgren. October 24th, 1920. (170,890.)

28,659. "Thermionic valve transmitters for wireless signalling." B. H. N. H. Hamilton. October 28th, 1921. (187,457.)

29,269. "Compression device for electric transformer windings." Allmanna Svenska Elektriska Aktiebolaget. March 8th, 1921. (176,754.)

29,446. "Electrically-driven vehicles." G. Meyfarth and Soc. Anon. des Ateliers de Secheron. November 30th, 1920. (172,288.)

30,160. "Motor Lamps." E. H. Venables. February 9th, 1922. (187,476.)

33,121. "Sparking plugs." J. E. Temple. December 9th, 1921. (187,501.)

35,078. "Earthing choking coils or voltage transformers for high voltages." E. Pfiffner. January 5th, 1921. (173,759.)

1922.

2,589. "Electric sound-producing horns." T. S. Rogers. October 20th, 1921. (Divided application on 27,822/21.) (187,531.)

4,270. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. February 14th, 1921. (175,629.)

9,236. "Means for attaching conductors to electric insulators." G. V. Lewis. March 31st, 1922. (187,547.)

15,049. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 6th, 1921. (182,779.)

15,201. "Electrical transformers." Metropolitan-Vickers Electrical Co., Ltd. June 3rd, 1921. (181,011.)

17,819. "Loaded signalling conductors." Western Electric Co., Ltd. August 16th, 1921. (184,781.)

19,742. "Construction of electrode for electric welding." A. E. White (Elyria Iron and Steel Co.). May 18th, 1921. (Divided application on 13,961/21.) (Patent of addition not granted.) (187,561.)

18,587. "Metallic vapour lamp." Dr. P. Eversheim. July 10th, 1920. (Divided application on 166,144.) (182,807.)

19,742. "Transmitting instrument for start-stop printing telegraph system." E. C. R. Marks (Morkrum Co.). April 7th, 1921. (Divided application on 187,247.) (187,562.)

19,743. "Receiving instrument for start-stop printing telegraph system." E. C. R. Marks (Morkrum Co.). April 7th, 1921. (Divided application on 187,247.) (187,563.)

THE

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AT HOME AND ABROAD.

WE have now passed through a Parliamentary election which may largely decide the course of public affairs for several years to come.

After so many restless and unsettled years it is not surprising that the great majority of the electors prefer peace and tranquillity at any rate for the present rather than sensational and costly alleged panaceas. Peace and tranquillity are not incompatible with the removal of evils and grievances of certain sorts, indeed they can only be secured as we courageously face some of the most outstanding evils of our day. To our mind the most immediately serious one of all is that of unemployment, and we believe our conviction to be shared at any rate by the largest two parties in the newly-elected House of Commons because they represent the employing and employed interests in the nation. Peace in industry is what has been sorely needed, much talked about, and frequently negotiated for. Does not the present constitution of parties bring the ideal much nearer realisation if they will only see the wisdom of putting their heads and hearts together in regard to so vital a matter?

The mere facts that the Election is a thing of the past, and that the best and the worst are known, may alone do something to restore confidence and equanimity where previously there was a certain degree of nervousness which naturally restricted enterprise and expenditure, and therefore hampered industry and trade. There may be certain special ways by means of which enlightened official action may lead to less unemployment, but whatever may have been contemplated by the late Cabinet and whatever may be on the tables of permanent officials in the shape of new proposals for adoption by the new Government, we feel it to be most essential that new encouragement and backing should be given to those who, acting under Government authority and control, are responsible for the development of our overseas trade. Happily this constructive, trade-promoting, employment-producing department was saved, under pressure from those who knew what its potentialities were, when some of the Geddes cuts were being put into effect. But something more than the mere saving of the department from execution is required. What is important now is that our legislators and the public, too, should have a practical understanding of the valuable service that such a Department is capable of rendering. Under war conditions we listened to Cabinet Ministers and others as they held forth in regard to the great schemes that were to be carried into effect whereby we were to secure far better and far more extensive Governmental trade representation in all parts of the world. But the changes that have taken place in the Cabinet representation of the Department of Overseas Trade during the last few years have been so frequent that it has seemed to be treated more as a Cabinet Minister's plaything than a serious part of the Government service. May we hope for more stability there now, so that those at the Head may devote them-

selves zealously to the ways in which continuity of policy, and that policy *progressive*, may be assured! We have always regarded Governmental activities of this class in aid of Colonial and foreign trade encouragement as being an investment which would pay for itself again and again, and it is interesting, to say the least of it, that Sir Eric Geddes, with whose name was associated the proposal that Governmental activities should lessen, is nominated as the next president of the Federation of British Industries whose schemes for export trade organisation are of such importance and promise.

The importance of our Trade Commissioner service is no new theme with the Electrical Review. We were deeply disappointed when the proposals for extending this service were whittled down. How many good intentions of the last few years have come to naught! Yet we do not know that we are more concerned about the reduction of the early scheme than we are about the lack of recognition that exists regarding the value of the services of Trade Commissioners, when men of experience and ability are chosen, if they can be given such status and powers of action as will enable them to build up an influence as Ambassadors of British commerce. Our prolonged interest in Colonial and foreign electrical trade has brought clearly before us the usefulness of His Majesty's Trade Commissioners, and has caused us to take a larger view of their office. We have not the slightest hesitation in saying that far greater successes than we have noted might have been achieved if greater freedom and opportunity had been accorded.

There are many things that matter more than the answering of questions and the preparing of annual reports; these, of course, are essential, but they are by no means all.

Elsewhere in this issue we publish several Colonial and foreign electrical articles which but for pressure upon our space and lateness of the mails would have appeared in our "Jubilee" issue. Among these is one relating to New Zealand's electrical programme for the future. New Zealand has been a name to conjure with here for some time past because British factories have been receiving most helpful contracts therefrom providing employment for our workpeople. When, therefore, one of the most urgent questions before us as a people is the finding of useful and profitable work, it is only right that we should state that in regard to the electrical contracts referred to it is within the knowledge of the Electrical Review that the Department of H.M. Trade Commissioners was able to use valuable influence in securing that this very desirable business should find its way to British electrical manufactories for execution.

We hope that by means of the foregoing comments we shall impress those responsible for the appointments and status of our foreign trade representatives with the potentialities that this part of our national organisation possesses for producing work for British hands and food for British stomachs.

The Theory and Practice of Salesmanship.

Mr. Attwood's lecture at the E.D.A. Salesmanship Conference, on November 17th, certainly got to the heart of things to a degree which none of the previous lectures had equalled. That, perhaps, was because it was of a general and not of a particular nature. Largely, it was a repetition of obvious truths, and yet the strength of Mr. Attwood's position in urging the obvious was in the fact that the commercial side of the industry needs a good deal of boosting to make it at all on a par, as regards efficiency, with the technical side. The lecture dealt with first principles of salesmanship, and but for the lecturer's oratorical manifestations might almost have been regarded as too elementary, at any rate at the beginning, yet it is only by close attention to first principles in commerce as in science that the object aimed at can be secured. Speaking broadly, the lecture ought to have been delivered to the staff people in the electrical industry who have the actual selling to do. We do not know how many such were present, but it is a fair assumption that the majority present were those who had to employ salesmen. The lecture, and the subsequent two, are not likely to fail of their object on that account, for it must have driven home to all who heard it the foolishness of imagining that to get sales only needs a good article, and that the person whose job it is to sell needs nothing more than a knowledge of the article he is selling. There appears to be a little controversy as to whether a salesman can be made or whether he must be born. Obviously there must be a right type of man to begin with, but if Mr. Attwood has done nothing more than drive home that even the man with a *flair* for selling must be trained, then he will have done good service to the industry. Apart from that, the outstanding point made in the first of these three lectures by one outside the industry, and who therefore came to the task with a new point of view, was that the public was not being adequately kept in touch with what electricity and electrical apparatus had to offer. That is the fundamental starting point, because without that aid the best of salesmen will find their task an uphill one. Few, if any, of the general public read the trade papers, and we confess to a feeling that general advertisements in the daily Press, even with ingeniously worded slogans, are almost useless. Something much more precise and specific is required. The thousands of households that use electricity for lighting only are in themselves a promising field for the operations of the electrical salesman, and means can easily be devised for getting into direct touch with them. That is only one small instance. There can be no two opinions that the public is far too ignorant on electrical matters, and one of the first objects of these conferences should be to change that, and quickly.

Standardisation of Cookers.

The action of the I.M.E.A. in calling conferences throughout the country to stimulate the use of domestic electrical apparatus will certainly lead to useful results. The meeting for the Greater London area took place at the Institution of Electrical Engineers recently. The results must, we think, be judged more by the usefulness of the discussion than by any definite conclusions arrived at. The purpose of these meetings is mainly to deal with the standardisation of cooking and other domestic apparatus. But, so far as the London meeting was concerned, the feeling seemed to be that rigid standardisation was hardly a practical proposition, anyhow at the moment. This, perhaps, will be generally agreed since there is still a considerable variety of opinion as to details of design of cookers, and we can easily understand that the supply industry and manufacturers generally are unwilling to commit themselves straightway to finality. At the same time, even if standardisation cannot be put into actual practice at the moment, it is certainly important that it should be kept as an ideal. Even if the details of cookers and other apparatus cannot be actually stereotyped, the main lines of design might be agreed. The great thing is to aim at standardisation and to take every opportunity of getting nearer and nearer to it.

Unless certain broad types generally approved throughout the industry can be evolved, electric cooking will never go forward by leaps and bounds. In the first place it is obvious that until manufacturers can go in for mass production, the cookers will never come down to bed-rock prices. Further, the difficulty over types of cookers and the constant changes taking place in design all militate against enthusiasm on the part of supply undertakings and electrical contractors in pushing cookers. There is a feeling of uncertainty that ought to be dispelled and which would be dispelled if something like standardisation came along. As everyone knows, a vast amount of money has been spent in experimenting with electric cooking, a good proportion of which has led up blind alleys. We are surely now getting near the time when good and bad propositions can

be sifted out, and the present move of the I.M.E.A. is certainly a much-needed one. It is to be hoped that, although the results at the moment may be inconclusive, the ideal will still be kept in mind and continuous efforts made to approximate to it.

Shortening Procedure.

The issue of a supplementary Memorandum by the Electricity Commission in regard to local inquiries indicates a most praiseworthy intention, namely, that of abbreviating as far as possible the procedure at the public inquiries devoted to examining reorganisation schemes under the Electricity Supply Act. We can always take it for granted, of course, that the Electricity Commissioners are desirous of economising their own time in these inquiries and also of saving expenses to other people. But this view is often not shared by the people who are taking part in the inquiry, in fact some of the inquiries have been scandalously long, and certain parties have occupied the time of the Court to a quite unwarranted extent. The Greater London inquiry, for instance, lasted 26 days and over 12,000 questions were asked, to say nothing of counsels' interpolations. And then to put the lid on the whole thing, certain criticisms were directed obliquely at the Commissioners for involving these litigious-minded parties in big expenses!

The present Memorandum as to procedure is mainly directed to Second Inquiries, a good many of which are now coming along. These Second Inquiries will be held under Section 5 (4) of the Electricity (Supply) Act, 1919, when any scheme which the Commissioners have formulated or approved after a First Inquiry will be finally submitted. It is to be hoped that all parties who propose to attend Second Inquiries will give very diligent heed to the Electricity Commissioners' polite intimations contained therein. In the first place, they say that "it is unnecessary that previous evidence should be repeated at the Second Inquiry"; that any parties may make general statements on any point of principle dealt with in the schemes, but unless they want to do so they need not support this by evidence. The procedure suggested by the Commissioners is to take each of the clauses in the scheme or the draft Order and hear representations.

Further, the talk about expenses has evidently been borne in mind by the Commissioners, and they say that while the matter is entirely at the discretion of the parties interested, unless important new issues are to be raised it would not ordinarily appear necessary for parties to be represented by counsel—a suggestion which should save time as well as money.

The I.E.E. Meetings.

Experience tells us that to comment on the proceedings at the "informal meetings," even with the most friendly intentions, may bring down upon us a stern reproof; nevertheless, we are impelled once more to run the risk, in view of recent observations.

These meetings were initiated largely for the purpose of inducing the younger members of the Institution to take part in discussion, the procedure being freed from the formality which necessarily reigns at the ordinary general meetings, and the speeches not being reported in the Press. The success of this policy was unquestioned and immediate; excellent discussions have been held, and the plan has been adopted not only at some of the provincial Centres of the Institution, but also by other engineering bodies. (By the way, we believe the Junior Institution of Engineers should have credit for the original idea.) But apparently the privacy of the meetings did not prove altogether satisfactory; the Press, of course, did not report the proceedings, but an official précis was issued, and this has now developed into a pretty full report—over 1,000 words. Moreover, there appears to be a tendency for "front-bench" members to take part in the discussions to an increasing degree. No doubt they have the right to do so—and the Committee has the right to issue a report to the Press; if the present procedure satisfies the [illegible] bers for whose benefit the informal meetings were started, well and good.

On the other hand, a change is taking place in the ordinary general meetings: in London the President has abandoned the practice of calling upon members by name to speak in the discussions, and now looks to [illegible] to take the initiative; and at Manchester the Chairman is appealing to the "smaller men" to take part in the discussions. These, it will be noticed, are steps in the direction of the "informal meetings" procedure. We do not suppose that they will go further; but it is interesting to observe this tendency at both classes of meeting to approximate to a common pattern.

Britain and the Italian Market.

In a report to his Government on the pump trade in Italy, the Canadian Trade Commissioner, Mr. W. McL. Clarke, makes a rather disconcerting statement regarding Britain's share in this business. His assertion seems to merit investigation both by our pump manufacturers and by our electric motor builders. After recalling that a not inconsiderable part of Italy's pre-war demand for hydraulic machinery was supplied by Great Britain, he adds that while we continue to hold a certain amount of this trade, he has been informed that it has always been difficult for the English manufacturer to obtain any large share in the pump business, as "most English pump makers do not manufacture electric motors, and it would not be a paying proposition to buy electric motors in order to sell the pumps, as the motor and fittings generally cost more than the pump itself." It seems here to be implied that there is not sufficient co-operation between the British pump-makers and electrical manufacturers to enable them to put forward a comprehensive tender at a competitive price. On the contrary, we believe that these two branches of the engineering industry act in close consultation, and we cannot think that their co-operation results in nothing more than the loading of the combined quotation with too heavy commission or otherwise spoiling the chances of obtaining export orders. Perhaps the firms principally concerned will put their Italian customers right on this point. Mr. Clarke has a further criticism to make on the subject of Britain's part in selling pumps overseas. He says that English centrifugal pumps are not usually suitable for coupling direct to electric motors, as they are not designed for the speeds at which motors run. Here is another point that needs correction. The whole matter is of particular interest at this juncture, because Germany, which has been dumping hydraulic plant in the Italian market, is unlikely to be able to continue such a policy very much longer, and there should consequently be an opportunity for Great Britain to regain her pre-war position.

The E.T.B.I.

On November 29th the Festival Dinner of the Electrical Trades Benevolent Institution will be held, Sir James Kemnal presiding. We hope that it will be well patronised, not only because it is always an interesting and enjoyable function, but also, and still more, because it is designed to promote the interests of those who are unable to fend for themselves. It is, in fact, the only occasion of the kind in the electrical year, at any rate in London. This Institution should fill a great blank in the human organisation of the electrical industry, for it was founded to care for those members of the industry who do not fall within the scope of any other benevolent fund—those who are neither professional men nor members of a trade union; but it cannot adequately fill that gap unless it is provided with adequate funds, and it is the duty of every [illegible] to help to increase its resources. Those who cannot attend the Festival will do well if they send a donation to the funds; and those who can do neither can still serve the Institution in other ways if we all do a little the future of the Institution is assured.

NEW ZEALAND'S ELECTRICAL DEVELOPMENT.

The Programme for the Future.

Mr. R. W. Dalton, His Majesty's Trade Commissioner, has been good enough to supply the Electrical Review with the following information:—

New Zealand is rapidly becoming of importance, electrically, out of all proportion to the size of her population. The first large scheme to be undertaken was that at Lake Coleridge, as to the possible success of which there was, at the time, considerable variance of opinion. The Government, however, determined to carry out the work, and there is no doubt now that the scheme has been extraordinarily successful; so successful has it been, in fact, that the demand for power in the Christchurch district has necessitated the trebling of the plant, and a still further set is now in process of installation. Further, in order to provide a reserve of water power, the Harper River has been diverted into Lake Coleridge. The success of this scheme has encouraged the Government to develop other and even more important schemes.

The Government is itself determined to control the production of energy, but under its scheme it will allow the formation of Electric Power Boards, which will deal with the distribution of energy supplied to them at sub-stations, for the districts which they cover. It is intended, in the first place, to concentrate on the North Island, and the schemes to be developed are intended to provide the whole of the island with electric power. These schemes are at Mangahao, Waikaremoana, and Arapuni. These main stations form a triangle, the Mangahao station being intended mainly for the Wellington province, the Waikaremoana station for Napier, Hawkes Bay and the east, and the Arapuni scheme for Auckland and the west. The stations will, however, be linked and will form reserves for one another. It was at first intended to develop the Mangahao scheme only at once, but it was afterwards decided to put in a small instalment of the main plant at Waikaremoana and, later still, owing to very strong representations made by the Auckland district, it was decided to develop Arapuni. The contracts for the installation of plant at Waikaremoana and Mangahao have already been let, and the Public Works Department is now at work on specifications for Arapuni.

Similarly to other countries, New Zealand has suffered from the severe depression of the last two or three years, but partly because she is a producer of primary products, she has felt this depression less than most other countries. Nevertheless, she has had to economise very severely both in general government and in other ways. Her public works policy has been very severely cut down, but in spite of that there has been practically no check in the hydro-electric programme. In fact, as has already been stated, this programme has been developed rather than curtailed.

This will indicate the importance which New Zealand attaches to the development of hydro-electricity. The works involved for the completion of all three schemes in the North Island will probably entail an expenditure of close on £20,000,000 before the power is available actually at the door of the consumer. It will therefore be obvious that there is ahead a very important market in New Zealand for all things electrical.

It seemed likely during the war period that American firms, owing to the advantage which they obtained in New Zealand as a result of the war, would be able, after the war, almost to monopolise the business in New Zealand in this branch of trade, which was likely to be one of the most important trades of New Zealand for some years. It is very gratifying, however, to know that since the war American firms have by no means secured the advantage which was threatened: in fact, in the contracts which have already been let by the Government, almost the whole of the plant has been ordered from British firms.

The large British firms have taken very much more interest in the New Zealand market since the war. Two, at least, have opened their own offices in New Zealand, and two or three others have made special investigations in New Zealand. The interests of the manufacturers of the large plant are therefore being well looked after, but there is a grave lack of interest in the market on the part of the manufacturers of small motors and supplies. The demand for these smaller articles is rapidly growing, and when the big schemes are finished there will be a very widely-extended market for these goods. At present, America is still securing a very large proportion of the trade, and some more active steps on the part of British firms are necessary.

To show how urgent the need for active campaigns is, it may be stated that it is hoped that the Mangahao scheme will actually be in operation by the end of 1923, and the other schemes will certainly be pressed forward with a maximum of speed. The completion of all the three schemes will mean the availability of electrical energy at every point in the North Island, and it is



Mr. R. W. Dalton,
H.M. Trade Commissioner in New Zealand, who is now in England.

intended to serve not only the towns themselves, but also the dairy farmers in the "back blocks." In fact, the Government hopes to find one of its largest markets amongst the dairy farmers who, it is contended, will be in a position to use electric power for driving their milking machines and separators, as well as for other purposes.

In addition to the schemes actually initiated by the Government, the plant at Horahora, which belonged to the Waihi gold mines, has been purchased by the Government, and is being considerably extended.

When the North Island is provided for, the Government will be able to pay further attention to the South Island, which is in need of some big scheme to serve the southern portion of the island. In the meantime a licence has been given to the Southland Electric Power Board to erect a plant at Lake Monawai. The intention is, later on, fully to develop Monawai, as the water power available is very large.

Apart from the Government schemes, the municipalities in New Zealand, who were held up during the war and who have therefore been unable to provide for the present demand of their districts for power, are

now developing their own works. In practically every centre in New Zealand electric power is at present very scarce, and in some places it is rationed out with considerable care. Large contracts have already been placed for the development of these schemes, and further contracts will be necessary before the large towns are adequately provided for.

In view of all this development, it is urgently necessary that electrical firms in this country should regard New Zealand, not as a small market with a population of only one and a quarter millions, but as a country with very important electrical possibilities much in excess of what might be indicated by its size. In addition, both the Government of New Zealand and the local authori-

foreign firms. Thus the market is favourable from two points of view, first, that there is growing a very

firms have already realised the advantages offered, and those who have taken an active interest on the spot

expect to secure such contracts without direct representation, preferably by a branch house, but if this is not possible, then by

agents.

THE HASTINGS ELECTRICITY UNDERTAKING.

RECENT EXTENSIONS.

The Hastings electricity works occupies the unique position of being probably the first undertaking of its kind to commence operation in the United Kingdom, its date of inauguration being March, 1882, since when it has been in continuous use. The original station was installed and worked by the late Mr. Robert Hammond, and the works still occupies the site that was chosen 40 years ago, although little now remains of the original scheme, except the outer walls of the building.

The original plant consisted of Brush series lighting dynamos, which generated electricity at a pressure of 2,000 volts, and were driven through countershafts by under-type locomotive engines. All the arc and incandescent lighting throughout the town was supplied by these dynamos, the incandescent lamps in consumers' premises being arranged in groups of 20 in series, so as to allow the pressure of 2,000 volts to be carried right into the consumers' premises; public street lamps were also arranged in series.

In 1890 the Electric Lighting Co. obtained a Provisional Order, and then commenced to remodel the plant. The series lighting dynamos were replaced by rope-driven Brush-Mordey single-phase a.c. generators, and the distribution system was arranged to supply energy through transformers placed on consumers' premises.

The undertaking was purchased by the Hastings Corporation from the Electric Light Co. on January 1st, 1899. In the first year of successful operation under municipal control the price of electricity was reduced by approximately 25 per cent., thus bringing the price to something equivalent to that charged in other towns, which naturally resulted in a considerable increase in the number of consumers. At this time the plant consisted of three 100-kW and two 220-kW Brush sets, and one 500-kW Parsons turbo-generator. It is interesting to note that this plant is in commercial operation to-day. The Parsons turbo-generator was very successful in reducing the generating costs, its steam consumption being 22 lb. of steam per kWh at full load. Some idea of the great progress that has been made in turbine plant during the last 20 years can be obtained by comparing the steam consumption of this set with that of the Brush-Ljungström turbo-alternator which forms part of the present extension—namely, less than 13¾ lb. per kWh.

The boiler plant consisted of three Babcock & Wilcox land-type boilers and two marine type; the marine boilers were equipped with Green's economisers, but owing to the lack of available space these were not used with the land-type boilers.

The rapid growth of the undertaking was made the subject of a report by the borough electrical engineer, Mr. Russell F. Ferguson, to the Electricity and Public Lighting Committee in January, 1921, an immediate extension of plant being of vital necessity; sanction from the Electricity Commissioners having been obtained for carrying out the work, tenders were accepted by the Council on August 5th, 1921, but as no alteration could be commenced before the winter peak load was over, the contractors did not start work till the end of February, 1922.

The present extensions, the official opening of which was performed by the Mayor, Ald. W. J. Fellows, J.P., on November 8th, include a 1,125-kW Brush-Ljungström turbo-alternator, fig. 3, with steam at 170 lb. per sq. in. at the turbine stop valve, 475° F. total steam temperature, and exhausting into a vacuum

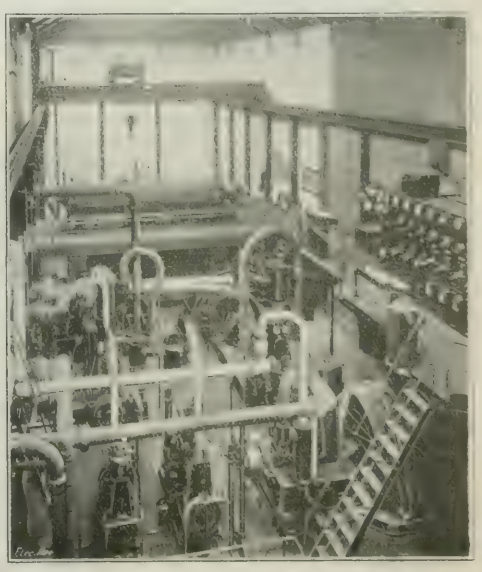


Fig. 1. Generator Room at Hastings

of 28 in. (bar. 30 in.). The set has an overload capacity of 25 per cent. for two hours, and runs at a speed of 3,000 r.p.m. The two alternators operate in parallel, and are wound for a combined output of 1,125 kW 2,000 volts, single-phase, 100 periods, at a power factor of 0.9. The turbo-alternator is mounted on a Brush surface condenser, which has a cooling surface of 2,

sq. ft. and a capacity of 15,350 lb. of steam per hour, and is capable of maintaining a vacuum of 28 in. (bar. 30 in.); 2,300 gallons per minute of cooling water at 80° F. are required. The cooling tubes are ⅝ in. diameter and 12 ft. long, the condenser containing 1,070 tubes. The auxiliaries of the condenser comprise a three-throw Brush-Edwards air pump 12 in. diameter

by 10 in. stroke, running at 120 r.p.m. A lift pump is driven off the air pump crank shaft for pumping the condensate to the hot well. The air pump is driven by a Bamsted & Chandler 9 b.h.p. single crank, non compound, double acting, forced lubricated engine running at 600 r.p.m. This engine works under the same steam conditions as the turbine, and is capable of delivering the power required when exhausting against a back

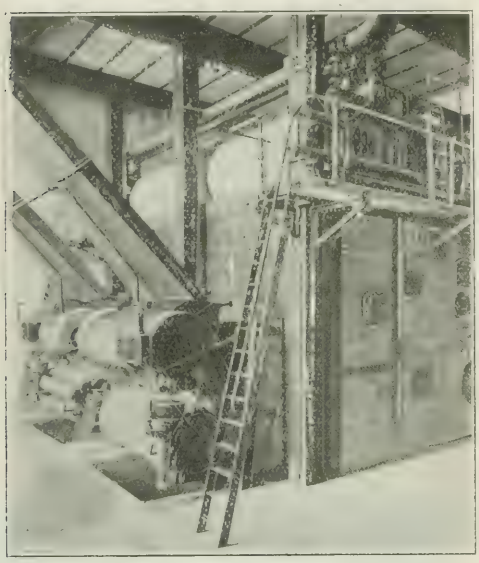


Fig. 2. Stirling Boilers.

pressure of 10 lb. per sq. in. above atmosphere. The alternators are provided with a duplex-type exciter shunt-field regulator mounted on the front of the switchboard gallery, and fitted with concentric hand wheels. For filtering the cooling air to the alternators, a Cleworth, Wheal wet air filter is provided. It is driven through gearing by a 1-h.p. 100/110-volt d.c. motor, and is connected to the alternators by means of sheet steel ducts.

The boiler plant, fig. 2, was supplied by the Stirling Boiler Co., Ltd., and consists of two boilers, each boiler having 255 main tubes, 3¼ in. outside diameter, the heating surface being 2,644 sq. ft. The total length of 3¼ in. tube in the boilers is considerably in excess of one mile. The total heating surface of the boilers is 5,288 sq. ft., and is remarkably great for the space occupied, namely, height 19 ft., width 20 ft. 3 in. each, back to front, 20 ft. Each integral "U" type superheater has an effective heating surface of 177 sq. ft., and is situated immediately behind the front bank of water tubes. The headers are at the top, and the return caps are out of contact with the products of combustion. The working pressure for the plant is 180 lb. per sq. in., the steam being superheated 100° F. The rated evaporation per boiler is 10,000 lb. of water per hour, but this may be readily exceeded.

The mechanical stokers are by the Underfeed Stoker Co. They act under a combination of forced and natural draught; the grate surface of each stoker is 57 sq. ft., and the normal coal consumption per grate 12 cwt. per hour. The coal is stored in hoppers in front of and above the boilers, it is fed to the stoker hoppers by chutes, and is regulated by duplex coal valves. Lea coal meters are fitted to and driven by the mechanical stokers. The boilers are fitted with the usual Dewrance mountings, but, in addition, Crosby automatic feed-water regulators are fitted.

The "Mon'lithcrete" floor over the new boilers is an extension of the old coal store, and has a capacity of 500 tons of coal, the mechanical stokers being fed from this floor by hoppers. The flat roof supports a 10,000-gallons Fawcett reinforced concrete water tank, upon which is mounted the cooling tower.

So far as was possible local labour was employed. Messrs. Hayhurst & Wright, of Hastings, as sub-contractors of the Fawcett Construction Co., Ltd., executing the whole of the general builders' work. All the pipework in connection with the turbo-alternator, condensing plant, and cooling tower has been manufactured and erected by Messrs. Aiton & Co., Ltd., of Derby. The steam and feed water piping is made from solid drawn tubing, the flanges on the steam pipes being welded on electrically by the carbon-arc process, the feed-water pipe having flanges screwed on. All branches are welded to the main pipes. The blow-off, auxiliary exhaust, and air pump discharge pipes are manufactured from lapwelded tubes with flanges screwed on and branches welded. The whole of the circulating water pipes and the main exhaust pipes are made up from mild steel plates, all joints and flanges being electrically welded. The blow-off tank was also made up from mild steel plates, with electrically welded joints, this tank afterwards being encased in concrete.

The cooling tower, by the Premier Cooler & Engineering Co., Ltd., was specially designed to suit the restricted space available on the power station roof, and is capable of reducing the temperature of 130,000

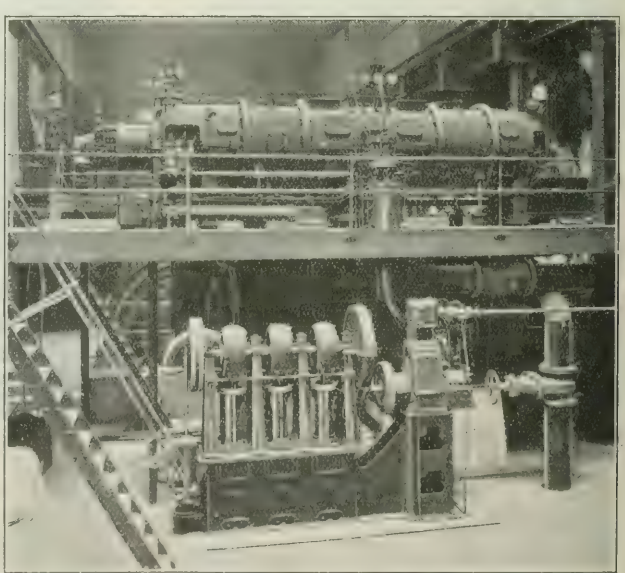


Fig. 3. Brush-Ljungstrom Turbo-Alternator and Condensing Plant.

gallons of water per hour from 99 to 80° F., when the air temperature is 55° F., and the humidity 75 per cent. The tower is designed primarily for forced draught, but special provision has been made for operating on natural draught at light loads; under forced draught conditions the air to the cooler is supplied by two steel-plate fans 9 ft. in diameter, mounted on one common

shaft, and driven by a high-speed engine of Messrs. Bumsted & Chandler's make. The fans are of the propeller type, absorbing at the shaft under normal conditions not more than 24 b.h.p.

In conclusion, it may be said that during the year 1922 the energy generated amounted to 1,947,769 kWh, the total maximum demand being 1,082 kW; the total connections amounted to the equivalent of 136,111 30-watt lamps, and the total number of consumers was 4,005. The average length of service of six of the members of the staff is 33 years; the station superintendent has been with the undertaking since its commencement in 1882, and the average length of service of 13 of the workmen employed [illegible] years [illegible] record.

The extension [illegible] operated in the present [illegible] gathering by the Mayor's mention of the [illegible] valve. It was stated that the extension had been carried out within the estimate of £51,000, and it was explained that the scheme was only a makeshift pending the reconstruction of a central station for the supply of electricity in bulk to the town and district. If the present demand continued, the station could only last for a few years, and the hope was expressed that Bexhill, Battle, and Rye would arrange to take a supply from a central station at Hastings.

THE HOMECOMING OF ELECTRICITY.

By J. W. BEAUCHAMP, M.I.E.E., Director and Secretary of the British Electrical Development Association.

(*Concluded from page 737.*)

Methods of Charging for Electricity Supply. This particularly fascinating subject has held the attention of the electrical engineer from the beginning of the public supply of electricity; commencing probably with the classic investigations of Wright, it has developed into a science intimately bound up with the economics of generating and distributing electricity, and the investigations made upon it have thrown a most valuable light upon the underlying principles of charging for most services and commodities.

It has been argued by some that we have obscured the whole subject by too much scientific treatment, and that the best thing we could do would be to import into the business an outside commercial expert who, unhampered by detailed knowledge of our basis of costing and of our past tariff history, would immediately evolve some simple and attractive method of charging which would revolutionise the business.

It is by no means certain that this would really be the case. One can imagine that a Selfridge, asked to devote his attention to the commercial side of the electrical industry, would in a short time become so fascinated with its characteristics and with the precise and illuminating way in which electrical engineers are able to ascertain the cost of this or that supply that so far from undoing our work and presenting us with some magic method of selling, he might rather return to his own field of activity and endeavour to introduce multi-part tariffs into the commerce of silk stockings or food! or, at least, go back with the fixed intention of applying many of the electrical engineer's methods of analysis to his own business.

The period of ten years before the war was notable for the activity of tariff builders; it saw the work of the "point fivers" and the growing activity of those who perceived the great future of electricity supply. At one time we had reached the stage when a well-known and most energetic supply manager boasted that his tariff list contained such a number of different forms of charge that it was impossible that any potential user of electricity could fail to find one of them suitable and attractive to him.

We have gone a long way since then, and now the movement is all in favour of simplicity.

The increase in the use of electricity for power has helped very much; methods of charging for large industrial supplies have crystallised around the maximum-demand system, collecting a fixed charge per annum in relation to demand and a further charge for the kilowatt-hours used, generally in association with sliding scales on coal and other variables.

We are now in the process of adapting these methods to domestic supply, and already some half-a-dozen comparatively simple and attractive tariffs are struggling for supremacy in this direction

The method devised a long while ago by Mr. Long, of Norwich, is perhaps in most extensive use in this country, and is still extending; in spite of certain [illegible] backs, it has the merit of extreme simplicity, and appeals to the non-technical user.

It is probable that with modifications to overcome risk of trouble due to change in the rateable value of premises, varying often rather widely from their electrical needs, this system will extend considerably, or at least run closely with the "assessment" method, where the fixed charge is based upon capacity connected, or the Dundee "floor area" method, which has distinct advantages.

Broadly, there appears to be a growing tendency to insist upon an annual fixed charge, to associate it with normal lighting requirements, or at least with the value of the account for normal lighting under present circumstances, and in addition to this to handle all the cooking, heating, and other applications by means of one, or perhaps two, running rates per kilowatt-hour.

Engineers are being confirmed in the principle of fixing their subscription charge on lighting requirements by growing experience of the very high diversity of other uses of electricity in the home.

It is interesting to remember that when gas was first supplied in a public way it was sold on the contract system for lighting at some small rate per burner per year—a burner at that time being something of the nature of a pin hole in an iron pipe.

The gas people have found their problem simpler because of their ability to store gas—to make it at a steady rate and yet be able to deliver it at a fluctuating rate to suit users' needs. Whether they will continue in this happy position remains to be seen; already it is stated that in some large cities the gas cookery peak is so heavy on Sundays as to need the firing up of a few extra retorts, and the consumer fluctuations are beginning to outstrip the capacity of the gas holders.

The problem appears to have arisen also in certain parts of the new world where natural gas is supplied, the cost of the gas being small compared with the expenditure on storage and distribution.

Here gas has been sold, particularly in large quantities for operating central heating boilers, on a multi-part tariff, an initial charge being made in accordance with the maximum rate of use, and in some cases also a service charge, then in addition the gas is sold at a rate per cubic foot.

There can be no doubt about the fairness of these methods of charging; the only problem before us is to make them sufficiently simple in practice and to base our calculations rather upon averages than upon individuals, to regard a street of houses as a group, and to look at maximum demand on feeding points rather than on individual terminals.

One thing at least has emerged from the work of recent years—that the straight contract system is no solution of the problem; in the past we were frequently reminded of the general use of electricity in small houses

on the Continent, that in such cases meters were not employed, everybody was well pleased to buy the light at some small rental per week or month; but investigation showed that in many of these cases it was impossible for the consumers to obtain any other kind of light from a central source, electricity could only be replaced by oil or candles. Moreover, having been used to these crude methods of lighting, the people accepted an indifferent, fluctuating, and roughly installed system of electric lighting with a satisfaction which they would certainly not express in this country, where in most places a good gas supply is always available.

The growing use of electricity for heating and other purposes, and the increasing understanding of it by the people, has made it almost impossible to offer an unrestricted supply, as is done in the case of water; excluding gross waste, the water requirements of a household are well defined, although here again as the populations increase and the use of water grows with the freer installation of baths and other conveniences, it seems possible that the authorities may have to reconsider the position. But in the case of electricity, it becomes so easy to convert it into power or heat and use it in many convenient ways, even for the purposes of small trading, that to give an unrestricted supply for a fixed charge is likely to prove a disastrous policy and to be inequitable as between one user and another.

A multiplication of meters we do not want, but apparently for a long time to come tariffs must centre around the use of at least one unit-recording meter. If we are able in this way, particularly as electricity areas extend and linking-up is carried out, to operate a single and uniform flat rate for the kilowatt-hour over large areas, and to secure adequate payment for differences in distance and density of demand by means of varying fixed charges, we shall be well on the way to a tariff which will be safe for the undertaking and satisfactory to the user.

Generally in the making of tariffs, particularly where the domestic load is to be encouraged, the temptation to reduce lighting rates or charges made in relation to lighting should be resisted; people will pay a fair price for electric lighting to-day, and that fair price should be secured. To make a lighting rate 1d. or 2d. lower than it really need be does not benefit the business, but may restrict its development by rendering it more difficult to obtain funds for the development of mains, the carrying-out of "service work," and the offering of a low and competitive rate for heating and cooking.

We have as data our known costs of supply, and the fairly well-known costs which would be achieved if the supply were to develop in this or that direction; these act as a general guide in tariff making, but the real indication comes to us from the rates charged for competitive media, fuel and gas. In short, we must give more and more attention to the value of the service rendered, keeping lighting charges fairly well up and depressing heating and power charges, and with regard to power it is well to bear in mind that the value of [illegible] to the user depends upon what he does [illegible] and not the relative position which his power bill occupies in the total cost of production.

[illegible] we find districts where people to-day are paying 6d. a unit for electric power; there are others where they [illegible] will need to pay 1½d. for some purposes, and [illegible] had the supply cheap at 1d.

It is not easy to meet all these conflicting conditions, but they are matters of the closest consideration, and the tariff [illegible] must never forget that there are only a very few cases [illegible] already cut rates for electric [illegible] are necessary [illegible] with most of its applications it is [illegible] to provide ample service facilities [illegible] A tariff competitive with [illegible] will bring business [illegible] efficient service facilities may result in no development at all.

In the meantime [illegible] to some extent need to [illegible] while [illegible] are taken; [illegible] attractive tariff [illegible] the load curve, improvement in the load curve makes it easier to frame tariffs, and may even bring us to a stage where we can simplify the best of our present methods.

The last two years have seen an improvement in the position with regard to tariff making, largely as a result of the work of the British Electrical Development Association and the very sympathetic assistance which has been given to it by the Electricity Commissioners.

Already Grimsby has obtained powers to approach the Commissioners with forms of compulsory multi-part tariffs, and the latest Electricity Bill also contemplates and provides for wider variations in methods of charging than have yet been possible.

It does not seem too much to hope that another two or three years will see many desirable changes, and a much wider use of the multi-part tariff, particularly if its advantages to the consumer can be supported by relatively high maximum flat rates; there can be no doubt that if the authorities become seized with this idea and meet the desire of the industry by keeping up the statutory maximum flat rates, there will be a great growth in the use of the multi-part tariff, and of special night rates for off peak load and similar facilities so desirable at the present time.

Throughout the whole history of tariff making we have from time to time run up against the "business man," on a municipal committee or board of a supply company, who fails to perceive why electricity should be sold at more than one price; arguing that it is the same electricity that lights a lamp or cooks a steak, he demands that cost should be divided by units and everyone charged on the average resulting. A year's experience of this method would probably surprise him and effect some extraordinary changes in that average price.

Vexatious as these discussions are, they have done much to spread knowledge of tariff making and the underlying basis of supply economics which, after all, are very similar to those which rule other businesses, even if they are not recognised as doing so.

One must hope that this subject will continue to be as attractive to engineers as it has been in the past, and it would not be too much if the Institution were to call for one paper per year on electricity tariffs. There are still plenty of members particularly well able to produce good papers on this subject or write books upon it; there is need for a thorough graphic, if not mathematical, analysis of the whole subject, bringing it up to date and showing the relation between the various simple tariffs dictated by expediency, and the underlying principles upon which they are constructed.

Pre occupations of the Engineer.—At the present time when commercial development of the electrical industry is interesting a great many people, many of them not particularly well acquainted with its past, it is desirable that one should keep in mind the history of the business and the place which the engineer and his assistants have filled in it successively for thirty or forty years.

Our actions and mental attitude towards life and work are largely influenced by experiences met upon the road by which we have travelled.

In the early days, and for many years after the introduction of the public service of electricity, engineers were concerned with the technique of the business; they were obliged to work closely with the manufacturers of plant and material, and discover gradually how difficulties could be overcome, only to encounter new difficulties as the business grew.

Their work was a mixture of design, or the criticism of design, and the adaptation of inadequate plant to new conditions, and they were obliged to regard not only the generating station, but the distribution net work and even questions of wiring and appliances for consumers' use.

Later as business grew and widened they were confronted with a variety of problems concerning administration, accountancy, management of staff, and all the [illegible] questions of remuneration and working conditions which were brought to a head by the war, and

which happily to-day may be said if not to be solved, at least to have been brought out of chaos into something resembling a system.

Still later the attention of supply management has been distracted by political considerations, national and local; much time and energy has been expended on dealing with proposals for the unification of electricity supply, warring interests have claimed thought and labour which under simpler circumstances could have been devoted to the development of the business.

Over the whole period the managing engineer has been obliged to give attention to the relation between the financier, generally a layman, and the industry; whether working for a board of directors or a municipal body, he stands in the dual position of servant and adviser.

However, after many years during which the engineer has been in the position of building his boat whilst it rushed through rough waters with ever-increasing speed, it does at last appear that a clear line of action is emerging; slowly the various branches of the business are crystallising out. It is recognised that the commercial and technical sides must to a great extent be separated, although under single executive management.

There are now groups and associations representing manufacturers, contractors, and the different sections of the supply industry, dealing with technical, legal or administrative matters, and more recently paying attention to trade conditions and to propaganda; all these bodies to-day are stronger and more respected than ever before; there is also between them a growing sense of common interest, and it seems obvious that if nothing occurs to disturb the economic life of the country, we shall within a few years have the satisfaction of belonging to the most valuable, the most powerful, and the most widely appreciated of all the public services.

PROGRESS IN ILLUMINATING ENGINEERING

The opening meeting of the 1922-23 session of the Illuminating Engineering Society was held on November 14th, Mr. W. R. Rawlings presiding. This was the first occasion on which the Society had met since the redecoration of the premises of the Royal Society of Arts, and much interest was evinced in the lighting of the hall, which has been considerably modified. A new feature is the removal of the frescoes on the ceiling, which is now white, and the main lighting is effected by four pendant semi-indirect units, using alabaster bowls. Improved arrangements have also been made for the operation of the lantern, and an ingenious device has been provided to enable the central dome skylight to be more or less curtained by the lantern operator.

As is usual at the first meeting of the session the Illuminating Engineering Society devoted the evening partly to reports of progress and partly to the exhibition of novelties. Mr. L. Gaster, in his review of events during the vacation, made special reference to the contents of the third report of the Departmental Committee on Lighting in Factories and Workshops. He explained that the original scheme of the Home Office Committee had been somewhat curtailed owing to the demand for national economy, and it was therefore essential that its aims should be fully understood. It was hoped to arrange for papers to be read before several scientific societies and trade associations, with a view to making these aims more generally familiar. Reference was next made to the report of the Miners' Nystagmus Committee which had fully endorsed the view taken at the Society's discussion in 1920 that inadequate lighting was the main cause of this disease. The work of the Committee had given a great stimulus to the design of improved miners' lamps. Street lighting was another subject that had been exciting some attention, improvements having been made in various thoroughfares in London, and the relation of lighting to accidents was being studied by the London "Safety First" Council. Investigations in the United States had led to the conclusion that over 17 per cent. of the accidents occurring at night were due to inadequate lighting. It was intended to devote a meeting of the Society on December 12th to a full discussion of street lighting problems, and the co-operation of other bodies interested would be welcomed.

Mr. Gaster also referred to the large number of papers on lighting presented at the annual convention of the American Illuminating Engineering Society in September, and mentioned the use of "artificial daylight" in the Milwaukee Art Gallery as an interesting development. The co-operation of architects in lighting matters was highly desirable, and the Royal Institute of British Architects had recently [illegible] formed by the Central Electrotechnical Council in Russia.

Mr. J. W. Lawrie then presented a report by the Committee on Progress in Electric Lamps and Lighting Accessories. He pointed out that the most important [illegible] duced during the past year. Another step of importance was the introduction of [illegible] 40 watt enabled [illegible] proving very acceptable for shop-lighting, and "daylight" lamps, giving a spectrum closely approximating to daylight, had proved convenient for industries where colour-matching was of importance. A third line of development had been the improvements in gasfilled projector lamps for kinematograph work, flood lighting, &c. Lamp manufacturers were now in a position to meet all demands without drawing on foreign supplies of raw material. Makers of fittings were working in close co-operation with lamp makers, and there was now a wide variety [illegible] this field a novel development had been the introduction of bowl fittings having a clear glass canopy all moulded in one, so as to be practically dustproof, and thus eliminate the greatest objection to the open bowl.

The remainder of the evening was occupied by demonstrations of various novelties in the lighting field. Captain E. Stroud exhibited a new form of illumination-photometer which has some interesting features. The whole apparatus is in the form of a tube, within which the dry battery is concealed, a small ammeter being mounted at one end of the apparatus and the observation tube at the other. Observations are made by the aid of a modified Lummer Brodhun tube, and measurements of brightness, as well as illumination, can readily be made. The instrument was devised by Mr. D. H. Tuck. Captain Stroud also showed a new product of the Holophane Laboratory, the "Filtelite" fitting, which is a totally-enclosed semi-direct unit having a bowl divided into three distinct areas, giving a soft and pleasing effect.

Mr. Hobson then showed the latest development in the hospital inspection lamp devised by Mr. J. B. Reiner, which has now assumed a very portable and compact form. The lamp is the outcome of experiments in which leading ophthalmic surgeons and members of the Illuminating Engineering Society have taken part, one of the chief difficulties to be overcome in this form of lamp being the formation of a clear spot, of high and even brightness, by the action of lenses in front of a metal-filament lamp capable of being run off an ordinary supply. The lamp is expected to be of great value in eye hospitals.

Mr. W. Plummer demonstrated the latest type of "Ceag" miners' lamp, in which a material improvement in the distribution of light has been secured, owing to the absence of the obstructing pillars. Another feature is the use of an adjustable reflector, by means of which the filament can be screened at will and the light concentrated in any desired direction.

Mr. S. O. Pearson gave an interesting demonstration of the "blinking" of neon lamps, when shunted by a condenser; by adjusting the electrical characteristics of the circuit very wide variations in the flashing period can be secured, and the device may prove useful in connection with luminous signs.

Mr. E. T. Ruthven Murray showed some [illegible] his form of luminous sign, consisting of designs or lettering stencilled on the back of plate glass and illuminated by tubular lamps at the top or bottom. Designs in gold or colours can now be executed and made to "stand out" brilliantly illuminated. Several neat designs, suitable for use with ascending and descending lifts, one showing the actual position of a lift in a multiple-story building, were included in these exhibits.

Captain W. J. Liberty gave a brief description of the lighting of the new Port of London Authority's building, illustrating his remarks with a series of photographs, taken by Mr. J. S. Dow exclusively by the actual light in the rooms. Most of the rooms utilised alabaster semi-indirect bowls, the walls being panelled in dark wood, with highly ornamental carving.

Other items included the exhibit of some "Ediswan" lamps in "Astra" intensities and the demonstration by Mr. Chas. Selz of a method of impregnating silk lamp shades, so as to obtain better translucency, freedom from prejudicial effects of dust, and comparative protection against fire.

What is a Volt? According to the *Bulletin* of the Ontario Electric Power Commission of Ontario, the following definition recently appeared in a Toronto [illegible]: "There were six holes in a brick wall, through which entered, passing along copper wires encased in pipes [illegible] mover. They are called 'volts,' and volts [illegible] bounds. 'Leaps' of power; but the lesson [illegible] that practically the power pressure may be [illegible] in the direct current."

THE MORWELL POWER SCHEME.

By H. R. HARPER, Chief Engineer, State Electricity Commission of Victoria.

Speaking as an engineer engaged in the task of providing for the electrical needs of a State, I think I cannot do better in sending a message to engineers, whether at home or abroad, than to remind them of the great evolutionary changes that have taken, and are taking, place in the scope of the great public utility in which we are all interested, namely, electric supply.

There are many of us engaged in this industry who are mindful of the struggles to establish electric supply undertakings in the '80 s, when light was the only field for exploitation, opposition was keen and determined, the outlook was extremely circumscribed, and little or no encouragement was forthcoming from the Legislature.

Since those days of narrow vision and application, the business of electric supply has developed into a key industry, serving the needs of the community for light, heat and power in every department of life.

No longer can it be considered as belonging solely to the category of purely municipal functions. The demand for power for industrial purposes and for main-line electrification is a factor which is tending to break down municipal boundaries within which we were prone to believe electric supply could only properly function. The generation and transmission of electricity is no longer the sole prerogative of the borough council—it has become the concern or responsibility of a greater authority. It is therefore incumbent upon engineers of supply undertakings to encourage the taking of broader views in providing for the requirements of the future and to remember that municipal rate aiding is of much less importance than the ever-widening distribution of cheap energy for industries, transportation, &c. Further, the national need for the highest efficiency in the production as well as distribution of electricity calls for the abandonment of the idea that the requirements in each municipal area are necessarily best served by a plant whose operations are confined solely to such area. To obtain the best results to-day, generating plants require to be favourably situated with regard to coal and water supplies, and to be of the largest capacity commercially attainable. With high-pressure transmission lines, such plants may be capable of serving the needs of more than one municipal area, and should certainly be designed to meet the requirements of railway electrification and essential industries, both of which are outside the province or scope of any one municipal body.

The Board of Trade Report (1919) on the Electric Supply Industry was the first important step towards the realisation that the industry was of national importance, and had grown beyond its municipal limitations. In this report it was proposed to divide the United Kingdom into a limited number of districts, each to be governed by a representative District Electricity Board, which was to have had conferred upon it the functions to generate and transmit electricity to existing distributors, railway companies, essential industries, etc. It seems a matter for great regret that public opinion was not interested, or municipal opposition was so great, that this great opportunity of reorganising the industry upon national lines was lost. However, there may be many ways of arriving at the same objective, and it may be hoped that the proposal that the various supply authorities in a given district should voluntarily associate themselves into a joint authority for the production and transmission of energy will place the industry upon a basis productive of the highest efficiency.

It was with a similar objective that the overseas Governments of New Zealand, Ontario, Tasmania, and Victoria embarked upon their national schemes of generation and transmission. Three of these States are harnessing the water power resources, of which each has an abundance, while Victoria is launching a scheme for power production by the utilisation mainly of her extensive and cheaply operated lignite measures, considerable information with regard to which has already been conveyed to readers of the Review. The State Government has constituted itself the sole producer of electrical energy, and has created a Commission to undertake the establishment of power houses and the construction of transmission lines to convey the energy not only to the capital, but to other centres of population in the State. In carrying out this task, the needs of the country districts are not being overlooked, it being the desire of the Commission to make available to such districts a convenience which, up to the present, has been enjoyed only by the town or city dweller. This has been made possible by the fact that the Government of the State owns an enormous deposit of lignite situated at Morwell, 90 miles from Melbourne, which will satisfy the needs of the State for many hundreds of years. This is one of a number of similar deposits situated in various parts of the State, and their efficient utilisation for power and heat purposes should not only ensure the prosperity of this part of Australia as a great industrial centre, but also make the State self-contained in the supplies of fuel for its own purposes.

The State itself will be a large consumer of its own energy, for the railways, both suburban and country, belong to the State. The suburban (Melbourne) railways have already been electrified, and with cheap power available, it will not be long before electrification will be extended to the country lines.

The fact that the Morwell lignite deposit averages about 174 ft. in thickness, with an overburden of about 30 ft., makes it possible to win the fuel for the power house which is being established on the field at what will seem a remarkably low cost, *viz.*, about 2s. 6d. per ton. This will result in a very low variable charge in the energy production cost, *viz.*, 0.053 pence per kW-hr. generated at the power station for fuel, water, coal and ash handling, &c. Of the total cost of energy production, the standing charges, including capital charges, maintenance, &c., at the power station, will amount to about 80 per cent. Hence, from a cost point of view, the State scheme will resemble a hydro-electric system, and the low variable charge will make it possible to transmit the energy considerable distances with economy. Already one branch transmission line—120 miles long, 44,000 volts—is being constructed to carry a load as small as 1,500 kW to a country district, and lines in other directions are under consideration for similar purposes. In the first stage of the main scheme, about 50,000 kW will be transmitted to Melbourne at 120,000 volts, and when stepped down to 22,000 volts at the terminal station, it is estimated that energy at this voltage will be available at about 0.48d. per kWh for a 42 per cent. load factor. For industries requiring large blocks of power of high load factor, facilities will be granted to enable them to settle near the Morwell power station, where 100 per cent. load factor energy could be made available at about 0.18d. per kWh at the power station busbars.

Provision has been made for ready extension up to 150,000 kW at Morwell, and when the demand exceeds this, power stations can be established on the same lignite deposit, or on other fields up to any capacity that the future may require.

The geographical situation of Australia is such that, provided her population increases rapidly, she must learn to manufacture not only the majority of her wants, but some of the wants of the vast multitudes in the East. There is every indication that immigration is going to be accelerated. Consequently, the electrical developments of Victoria during the next decade promise to be on a very large scale, and with cheap and adequate power available, the industrial future of the State is assured. This is a point not to be overlooked by British manufacturers who may be considering the establishment of branch works in the Commonwealth.

A CATHODE-RAY OSCILLOGRAPH.

The cathode-ray oscillograph which was demonstrated on November 16th by Mr. R. Wedd (for the President) at the Institution of Electrical Engineers, comprises a vacuum tube, at one end of which the cathode rays are generated, striking a fluorescent screen at the other end, on which they appear as a sharp green spot. The electrons for the rays are provided by a heated oxide-coated filament.

The anode is a small metal tube placed immediately in front of the filament, and is raised to a positive potential of 300 V with respect to the filament by means of a battery of dry cells. The electrons from the filament thereby acquire a considerable velocity, and some of them pass completely through the tubular anode, and fall on the screen. The rays, before reaching the screen, pass between two pairs of parallel metal plates set at right angles to one another. If the two plates of either pair are not at the same potential, the rays will be deflected in a plane perpendicular to the plates by an amount proportional to the difference of potential. If an alternating difference of potential be applied, the spot on the screen will be drawn out into a line. The rays can also be deflected if a pair of parallel coils be mounted outside the tube and a current be passed through them in series. The deflection will be proportional to the current.

It will be seen that this tube is a modification of the original Braun tube used in the experiments to determine the ratio e/m for the electron. It has the advantage that it can be

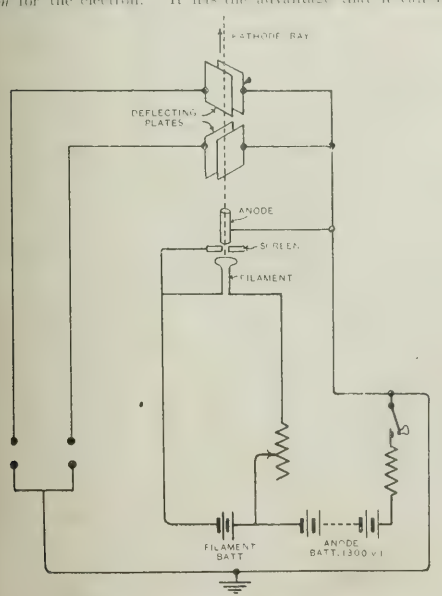


Fig. 1.—Diagram of Connections.

operated at 300 V instead of about 30,000 V as in the original tube, with the result that the rays are slower and can be more easily deflected.

The tube was used to show the characteristic of a thermionic valve. The valve was set up as an amplifier and a low frequency interrupter was connected through a transformer to the grid. The difference of potential between the grid and filament was applied to one pair of plates of the oscillograph, and the anode current was passed through the deflecting coils. The other two plates were short circuited together.

The two deflections were so arranged as to be at right angles, and as they were proportional respectively to the grid voltage and anode current of the valve at any instant, the fluorescent spot traced out the grid voltage anode current characteristic of the thermionic tube when the interrupter was switched on. The effect on the characteristic of a change in the anode voltage of the valve was admirably demonstrated, the curve changing progressively as the anode voltage was changed.

The oscillograph tube can be applied to many other purposes, among which may be mentioned the following:—Examination of wave form of generators of all kinds; accurate comparison of two frequencies; investigation of iron hysteresis; investigation of the extent of modulation in radio telephony; and measurement of nerve reactions.

The main advantage of this form of oscillograph over other forms of electrodynamic oscillographs is that there is no appreciable inertia in the rays so that the tube can be used without introducing distortion up to the highest frequencies. By adjustment of the current which heats the filament, the spot can be sharply focused; and the effect can be photographed.

THE THEORY AND PRACTICE OF SALESMANSHIP.

The [illegible] by the E. Development Association [illegible] on the 17th. Mr. Wedmore, M.P., [illegible] the best [illegible] practice of salesmanship in relation to the electrical industry. Mr. A. F. Berry, of the British Electric Transformer Co., Ltd., [illegible].

Mr. Attwood said that [illegible] lay bare the elementary principles, with examples from the electrical industry, the second lecture would deal with creating new avenues for business, and the third lecture with [illegible] the relationship between the [illegible] through the medium of the salesman, the repair staff, meter readers, [illegible]. He showed in a simple manner how the interests of everyone connected with the supply of electricity and the manufacture and installation of apparatus were bound up together. The point he stressed considerably was that, whether it was electricity or apparatus, what was being sold was service, and that the customer must be spoken to in terms of service, and not in terms of price or apparatus. Incidentally, he urged that all those who came into contact with the customer should be encouraged to talk about electricity and, as an example, he [illegible] meter readers alone could speak and make known the advantages of electricity to millions of people every year if they made it a practice to talk [illegible] they came into contact during their calls. That would be sowing seed, and much more of this was wanted. He added that a great deal of the fog in his mind as to electrical apparatus had been cleared away as the result of a chat he [illegible] had with Mr. Berry, and his desire to possess electrical apparatus had been awakened.

The lifeblood of the electrical business was business building, and not business getting. There was a great difference between the two, because it was necessary, not only to get business, but to keep it, in the shape of repeat orders. He did not think the electrical industry had yet fully appreciated that. They seemed to think that it was good enough to have good stuff, but they were not alone in that respect. He did not believe in the theory that good goods would sell themselves; they would not, and the position in the electrical industry at the moment was that they were not "making known" to the public sufficiently, and when they had made the selling side as efficient as the manufacturing side the public would appreciate it all the more. Selling was very largely a matter of persuasion, but to bring that into full effect it was essential that the salesman should thoroughly study human psychology, because 90 per cent of selling was handling the other man, and very few salesmen had given this aspect of the question much thought. They handled their customers in an intuitive manner, many of them quite successfully, but they could not explain how they did it, yet it was possible to organise selling scientifically. He did not agree that salesmen were born and not made. Salesmanship was being taught, although it was necessary that the person being trained should have a liking for the work in the first place. In a discussion of the laws of persuasion Mr. Attwood repeated that good salesmanship was selling on service and not on price, and the latter should always be kept in the background as long as possible. He took as an example an electric cooker costing £18. If a customer was told the price at the beginning he would probably say it was a big one, but if the service of the cooker was emphasised and explained the customer would gradually have less regard to the price, and come to think that he would rather have the cooker than the £18. That was the ultimate one to have in view. No one bought a cooker or any apparatus because it was a piece of apparatus, but because of the service he hoped to get from it; salesmen should, therefore, speak to customers in terms of service, and not of price. At the same time, the mistake should not be made of talking the customer into a sale and not clinching it before he had been talked out of it again.

Detailing the steps by which a salesman should proceed, he said it was first necessary to rivet attention, then to arouse interest, next to create desire by appealing to the imagination, and then to effect the sale. In this connection he urged that the deal should be a square deal; the real objective was not selling, but to make the customer appreciate that he could make money by buying any particular piece of apparatus, or could get some advantage out of it in the case of electric cooker in the shape of greater cleanliness and comfort, for instance. The country was over-run with 19th century habits, and the biggest difficulty of the electrical industry was to change these habits. It was a big job, and was [illegible] a mental problem, and that was why the successful salesman must make a close study of human psychology [illegible] human himself. The objective of the E.D.A. was, he understood, to place the whole business on a higher [illegible] until they raised the plane upon which selling [illegible] not be regarded as a profession. Unless that were done they would not get the revenue, and consequently the results that were possible from the capital and brains that had been put into the industry.

[illegible] Mr. Attwood said he would give [illegible] to the points he had made [illegible]

[illegible] there was, he believed, a real demand and did not [illegible] service they could not [illegible]

[illegible] the lecturer or say how to [illegible] a salesman having to get [illegible] a salesman might assist his card [illegible] of the buyer.

Mr. E. Sharp differed from the lecturer in saying that price should be kept till the last. There were often [illegible] to the price, and in [illegible] pamphlets offered in these advertisements. In many cases the buyer insisted on knowing the price at once.

Mr. Young related an instance of a sales expert who quoted a price for his services and subsequently offered to cut it in [illegible] to appeal to him, and had given him rather [illegible] of experts, and it had a bearing on what Mr. Attwood had said about not selling on price. However, he confessed that the lecture had rather modified the view he had formed from that one experience.

Mr. L. L. Robinson, Hon. Sec., said the practical question was how they were going to bring home to directors of electricity supply companies and members of electricity committees what an important matter selling really was. All over the country there were undertakings which for years and years had generated electricity and obliged people by selling it [illegible] It had only been in recent years that the industry had realised that selling would enormously increase outputs and reduce costs; therefore salesmen must be properly trained and be paid salaries which would attract the very best men.

Mr. Attwood, on the matter of keeping back the price, said his point was to aim at selling on service rather than price, which, of course, had to be told to the customer some time or other. Mr. Warrilow had made a great mistake in doing the usual thing and trying to get at his man by sending in his card, and they must try unusual methods, because the ordinary methods did not bring success. Business cards he regarded as a nuisance, and too many salesmen failed because they insisted upon doing exactly what others had been doing for years.

THE INTERCONNECTION OF A.C. POWER STATIONS.

It will be recalled that the above-named paper was abstracted in our issue of March 3rd this year, since when Messrs. L. Romero and J. B. Palmer have read it on a number of occasions before the members of various Centres of the Institution of Electrical Engineers. On November 6th it was read at the Western Centre of the Institution, and what follows is an abstract of the discussion that took place.

Discussion at Cardiff.

Mr. L. L. Lloyd (Bute Electric Company) said the paper was particularly interesting to those in South Wales, as the line connecting the Aberaman and Bargoed Collieries was probably the first between two fair-sized stations in this country. [illegible] to be interlinked were under one authority, but he could imagine the difficulties that would arise when power stations were run by two different people who were not particularly friendly to each other; each would "pinch" the other's power factor. He [illegible] and on the cost of the two stations, and not on the power factor of the load at the receiving [illegible] With regard to interlinking the various systems in the district, Major David said [illegible] were responsible for the restrictions on h.p. transmission lines [illegible] point of view, Major David favoured synchronous condensers instead of boosters.

Mr. [illegible] disturbance occurred the gas engine-driven generators came off the bars.

Mr. W. Nairn (Bristol Tramways Co., Ltd.) found himself [illegible] power stations in this country. He considered the advantages were limited in practice. In the case of a strip or a burn out, interconnection might be of substantial advantage, but he thought that money could be better spent at the station where the shortage of plant [illegible]

Mr. J. W. Fidoe (Cardiff) suggested that when there was a probability of two stations being laid down, would it not be better when the second station was in view to generate at a sufficiently high voltage to obviate the necessity of using transformers on the interconnecting link at all.

Prof. W. Bacon (Swansea University) felt very diffident about discussing the paper after the hon. secretary's remark that discussion on the mathematics of the paper was tabooed. How was it they got such remarkably good annual load factors in America—was electricity there so cheap, or was everybody so rich that they never troubled to switch off?

Mr. F. Tremain (Chairman) inquired about the type of insulator used in America in order to avoid that incrustation which lowered the insulation so much in this country.

Mr. J. B. Palmer (joint author) said that both Major David and Prof. Bacon spoke as if the power systems in this country were too insignificant to be compared with those in America. That was not his (Mr. Palmer's) view at all. If Major David's dream did come true and he had to transmit from Bargoed to London he would find all difficulties would disappear; the thing that impressed him (Mr. Palmer) very much in America was that difficulties simply did not exist. Over there the stations came on just as the voltage requirements called for them, and there was no jealousy between stations—the load controller was a despot. Regarding whether it was advantageous to interconnect, personally, he agreed with Mr. Nairn, and a lot of "tosh" had been talked in this country, but there were other aspects. Spend money on generating plant if it was possible to put loads on to stations where otherwise they would be idle, but if it were possible for a station to import energy, why not let it do so? Power companies were in business to sell electricity, whether they purchased or generated it made no difference. In connection with the load factors on American systems, a large number of factors contributed to those very desirable figures, but they were really outside the scope of an engineer; they were subjects for the political economist. The standard of living was very much higher—the smallest workmen's dwellings were wired throughout with power plugs. In California, irrigation formed a very large portion of the load, and came on as soon as there was plant to spare, and where the incidence of load was controlled, the load factor was bound to be high. Railway electrification in the States was also on a scale which we on this side had not even commenced to think about.

Mr. L. Romero (joint author), in the course of his reply, said that on the Manchester-Salford interconnection lines at light loads the difference in power factor at the two ends of the line was very great, due to the magnetising current of the large transformers, which at light loads became an important proportion of the load transmitted. Power-factor transmission did not depend on the loads connected to the two stations, but purely on the voltage difference and the amount of power transmitted. The effect of a gas-engine missing its beat would simply mean that the other prime movers on the line would have to supply the power for that portion of time. Interconnection was conducive to both reliability and economy. He had been rather surprised at the remarks concerning the difficulty with the human element; where the interconnected stations were under one authority, the difficulties could be very easily overcome, where different authorities were concerned, a lot of good-will would have to be exercised.

Messrs. W. A. Chatten, Thomas, Jenkins, Morley Nowell, and C. T. Allan also contributed to the discussion.

Broadcasting in the U.S.A.—The Government is celebrating the first anniversary of licensed commercial radio broadcasting. There are 512 licensed stations in the United States. The number of receiving sets in use defies estimation.

A year ago there was one licensed broadcasting station in New Jersey—the Westinghouse plant at Newark. To-day there are twelve. The Westinghouse licence was issued in September, 1921, making it one of the first three in the country. Four of New Jersey's twelve stations are in Newark.

Many other states have more. California leads with sixty-six, Ohio has thirty-five, New York thirty, Pennsylvania twenty-nine, Texas twenty-eight, Wisconsin twenty-three, Kansas fifteen, and Michigan eleven. The rush of late comers to get into the field, a rush which was the more remarkable because broadcasting yields no profit except that of good-will, has in many districts all but disrupted, through interference, the service.

Applications for licences first began to pour into the Government radio bureau last spring. At the end of February, 1922, less than sixty broadcasting licences were in effect. Two months later well over 200 stations had been licensed. In May, ninety-seven additional licences were granted and, although this established a monthly record that has not since been exceeded, there is still no indication that the end is in sight. In October thirty-nine more prospective broadcasters [illegible] A. & T. Ltd.

LEGAL.

Claim for Electrical Work.

In the Shoreditch County Court, on November 10th, before Judge Cluer, Messrs. Bainbridge & Halesworth, Hackney Road, N.E., electrical engineers, sued Phil Solomon, Hackney Road, N.E., tailors and outfitters, to recover £8 7s. 6d., for electrical work done. Mr. Fior appeared as counsel for the defence. The defence was that the work was not done to the satisfaction of the Borough Council, and would have to be done again. The plaintiff, Mr. Bainbridge, gave evidence, and said he had to do the electric wiring of the shop. There was no fixed price, because defendant first wanted alterations done, and then decided on complete wiring. The cost came to £11 7s. 6d., and he had received £3. He had a letter from the Bethnal Green Borough Council to say that the work was approved, but admitted that in a later one it was complained that the distribution board was incorrectly connected. Supposing it to be so, it was only a twenty-minutes' job to put it right, but he had not done it as he could not get his money; nevertheless, he had offered to do it.

Judge Cluer said that if there was one little thing wrong it did not prevent the plaintiff's receiving the proportion for the work that was right.

The defendant said that his complaint was that the plaintiff had overcharged for the lights, and that some of the lights had gone wrong and it looked as though they all would go.

Plaintiff said that they had been burning night and day since he fixed them.

A witness said that he saw the work and found it improperly done, but the engineer afterwards gave a certificate to the effect that it was properly done.

Judge Cluer said this showed the value of such certificates. He would allow 7s. 6d. to put the distribution board right, and gave a verdict for the plaintiff for £8, and costs.

Electric Supply Corporation, Ltd., and Reduced.

Mr. Justice P. O. Lawrence, on November 14th, heard a petition by this Corporation for the sanction of the Court to a reduction of its capital by writing off £100,000 as lost or unrepresented by available assets.

Mr. Jenkins, K.C., stated that the company was formed in 1897 to carry on an electrical undertaking and the supply of light and power, and it had a very considerable business. The issued capital was £250,000, divided into shares of £5 each. It was proposed to reduce the capital to £150,000, divided into 150,000 shares of £1 each. Counsel stated that he had affidavits proving the loss.

His Lordship sanctioned the reduction.

British Thomson-Houston Co., Ltd., *v.* the N.L.O. Co.

In the Chancery Division on November 14th, plaintiffs had a motion for judgment in default of defence against the N.L.O. Co., of Walton, Liverpool, for an injunction restraining the latter from infringing their electric lamp patent.

Mr. Sandeman, for the plaintiff company, said the matter was in order.

Mr. Justice Russell made an order for an injunction as asked for.

Mr. Justice Romer, on the same day, made an order granting an injunction restraining the N.L.O. Co. from infringing the plaintiff company's letters patent for improvements in evacuated vitreous containers.

The matter came before the Court as a motion for judgment, no defence having been put in

Dryers, Ltd., *v.* Crypto Electrical Co., Ltd.

In the King's Bench Division, on November 20th, the plaintiffs, a Manchester firm, sought to recover £430, the value of machinery supplied to defendants. The case was heard by Mr. Justice Rowlatt, and it was agreed that defendants should open.

Mr. Langdon, K.C., said that a plant for the impregnation and drying of motor and dynamo insulation was ordered by the defendants under a contract made on January 14th, 1920. The delivery was to have been made in March, 1920, and defendants said that it was provided in the contract that liquidated damages of £5 per week should be paid during the period delivery was overdue. Secondly, it was arranged that the penalty should not become payable at all unless the mouldersr' strike, which was in progress, was settled within ten days of the date of the contract. At the time negotiations for settlement were still in progress, and in a sense the strike was settled the day before the contract, although defendants were content to take the date as January 22nd, 1920. In the claim the price was increased by 25 per cent., and plaintiffs said that this was permitted by the contract owing to an increase in wages. Defendants contended that an increase of 6 per cent. over a previous quotation covered wage increases between August, 1919, and January 14th, 1920. Counsel then read correspondence between the parties, and Mr. Ashton, K.C., on behalf of the plaintiffs, replied to the points raised.

His Lordship, in giving judgment, said that it was clear that the provision in the contract was for liquidated damages, and not for penalties. These damages were very difficult to estimate. It was contended by the plaintiffs that the strike was only settled when the men resumed work. The settlement arrived at by January 12th was subject to a [illegible] of the men, and could not be considered definite. His Lordship had not the least doubt that the strike was settled upon January 22nd within the meaning of the contract. With regard to the increases, it was true that the 6 per cent. addition covered awards of increased wages between August, 1919, and the date of the contract. But there was a subsequent increase; this, however, was awarded after the agreed date of completion of the contract, when plaintiffs were in default. A party with whom a contract to do certain work in a certain time was broken as regarded delivery was not bound to treat the contract as cancelled. He thought the buyer was entitled to say: "I will not cancel; I insist upon the whole contract, and the contract is for penalties."

Mr. Langham said that he and his friend had agreed a sum of £52 10s. for a pump belonging to the plant. The defendants had paid £200 into court. Mr. Ashton said that upon his Lordship's judgment the plaintiffs were entitled to £150. Judgment was, therefore, entered for the defendants, with costs, and it was ordered that £150 should be paid out of court to the plaintiffs and £50 to the defendants.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Estimating for Internal Wiring Contracts.

In your issue of the 3rd inst. "Randolph" calls attention to a Government publication entitled "Scottish Mode for the Measurement of Electrical Work, 1918," and states that the mode laid down embodies most of the methods advocated in my article on estimating for internal wiring contracts which appeared in your issue of September 1st.

Unfortunately this statement is incorrect, as Specific Rule No. 2 in the Scottish Mode absolutely violates the fundamental principle laid down in my article.

Specific Rule No. 2 deals with circuit wiring, and is as follows:—

"2. Circuit wiring shall be classified as:—
(*a*) Wiring to lighting points.
(*b*) Wiring to plug points.
(*c*) Wiring to 1-way switch points.
(*d*) Wiring to 2-way switch points.
(*e*) Wiring to intermediate switch points.
And Scheduled for a *rate per point*.

"In scheduling lighting points each outlet shall be rated as one point up to a maximum of three lights in one fitting placed at the outlet. Each additional three lights, or part thereof in the same fitting shall be rated as an additional point.

"In scheduling switch points, each switch shall be rated as one switch point up to a maximum of three lamps controlled by the switch.

"Each additional three lamps, or part thereof, controlled by the same switch, shall be rated as an additional switch point."

In practice how does this apply, and what is the result?

Let us assume that under a contract a certain wiring point is scheduled for a three-light fitting controlled by one switch; the purchaser later decides to have a four-light fitting in lieu of the three-light fitting, but retaining the one-switch control.

The result, under this Scottish mode of measurement, is that the purchaser, apart from paying the legitimate difference in cost of the larger fitting, has to pay for one extra wiring point and one extra switch point. Why, when no extra material or labour has been involved?

Surely a most unbusiness-like and reprehensible method, and against the law of equity.

It is a matter for regret that when an attempt was being made to improve the mode of measurement for electrical work greater advantage was not taken of the existing knowledge and experience of this subject.

Alan Kirk.

London, *November 3rd*, 1922.

The Development of Small Water Powers.

The article by Prof. Gibson, which appeared in last week's Electrical Review, is peculiarly interesting to me because the same subject has been my hobby for the last year. In fact, I am reading a paper on it before the (N.W.) I.E.E. Students at Houldsworth Hall, Manchester, on December 5th. I have even worked out, in more detail, a power scheme similar to that suggested by Prof. Gibson, namely, a number of automatic induction generators linked into one system.

I would like, however, to criticise his general scheme of lay-out (*i.e.*, one controlling station supplying magnetising current for all the generators), because the magnitude of this

lagging current which is consumed by an induction generator, in its combination with the generated leading current, results in a current vector of supply which has a still greater angle of lead—this is, of course, absolutely useless for an industrial load unless the controlling station supplies a large wattless current to negative the discrepancy between the power factors of supply and demand.

Under ordinary industrial conditions, the controlling station would require to have a nearly wattless kVA output, roughly equal to the kVA of the load, and the power output would never be negligible on account of the large copper losses involved. It would, therefore, appear that extra steam-raising and turbine plant could be installed and the total load supplied from the same station, with an increase in initial cost far less than that of the entire hydraulic development.

I would suggest that the power factor of each induction generator be corrected to about unity at its terminals by an electrostatic condenser, the voltage be set, and the supply of magnetising current ensured, by large synchronous motors or rotaries in the load, the frequency be stabilised by water-turbine governors—and a steam station thus be rendered unnecessary, except from the hydraulic point of view, when it would be free to supply only power current.

Ian M. E. Aitken, B.Sc.

Portobello, *November 18th*, 1922.

Steam Condensing Plant.

I should be much obliged if you would give me a little of the valuable space in your paper to reply to a letter which appeared in your issue of November 10th, on steam condensing plant, written by Messrs. H. Fothergill & Co. My reason for this request is that I am thoroughly familiar with the Delas jet, as well as a considerable number of other makes, which are at present being sold in this country and abroad.

The first impression I obtained from Messrs. H. Fothergill and Co.'s letter was that the Delas air extractor, as manufactured by Messrs. Cole, Marchent & Morley, Ltd., has already established for itself such a strong reputation as compared with other steam jet air extractors, that the makers of other types are compelled to endeavour to defend the position, and the rather peculiar tone of the letter would have induced me to anticipate that Messrs. Fothergill & Co. are probably interested in a competitive steam air jet extractor and should have some knowledge of this type of apparatus, but its context seems to prove otherwise.

Messrs. Cole, Marchent, & Morley Ltd., in claiming a steam consumption 20/25 per cent. better than that of other types of steam jet air extractors, have summed up the results of tests made by an eminent and independent engineer in this country, and it is evident that Messrs. H. Fothergill & Co. would like to check these results, but the method they suggest would not give the desired result. It is proposed by them to carry out tests on three plants in commercial use, which include the turbine, condenser and the C. M. & M. Delas air extractor.

My 15 years' experience with condensing plants (although 15 days would have been sufficient) would lead me to anticipate that this method of testing would not give any comparative result.

First, the vacuum in the condenser does not depend only upon the air extractor. It depends more, if anything, on the temperature and amount of water used for the condensation of a given amount of steam. It also depends on the surface of the condenser per pound of steam to be condensed. Again, the design of the condenser is important, the velocity in and cleanliness of the tubes, and last, but not least, the weight of air sent into the condenser by direct leakages in the turbine or pipe lines, and with the steam used in the turbine.

If Messrs. Fothergill & Co. make an opportunity to have the above statement checked, they will, I expect, come in line with me if I suggest that Messrs. Fothergill's method of test could be compared to a test of the resistance of two electric wires by winding them into electric fires and putting them in two different rooms with a different number of open windows in each room, and then measuring the final room temperatures to check the thermometer indications.

About the second part of the letter dealing with the Delas patents, I believe Messrs. Fothergill & Co., when they say that putting water on an ejector is well known. I remember seeing an old fireman very long ago putting a wet rag on an injector which would not start working.

Without criticising the British Patent No. 157221, I can say positively, with the experience I have had with the Delas ejector, that it is quite one thing to water-jacket the diffuser and quite another to design the diffuser correctly to take advantage of the water-jacketing, and the combination of the diffuser and water-jacket used in the C. M. & M. Delas ejector is protected very well by numerous Delas patents.

May I say, in conclusion, that I have knowledge of a firm which tried to put water around its ejector to improve it, with the unforeseen result that there was a considerable fall in the vacuum, and, in fact, the water-jacketing was a considerable disadvantage to the jet.

To give the great stability of working and the maximum efficiency in steam consumption which is obtained in the Delas jet, the combination of the water-jacket and a convergent parallel diffuser is essential, and it would be found by firms which experimented on these lines that even more than this was necessary to get the remarkably good results which have been obtained with the Cole, Marchent & Morley product.

R. Velut.

Wembley, *November 17th*, 1922.

Shift Engineers' Salaries.

Your correspondent, "Fed up," talks about the grievances of the 20,000-kW station men; but what about the class A stations? Last year there were over 140 class A and under stations, all of which will in time qualify for class B. This year seven do so, by extensions, and everyone from grade one to grade seven gets an increase of £30 per annum by the E.P.E.A. schedule. But the shift engineers by the same schedule get nothing. It seems to me that all that the shift engineers get is the increase of responsibility due to increased plant, while grades one to seven get the increase of £30, and nearly all of these men got more than twice as much increase as the shift engineers in the first application of the schedule.

Waiting to be Re-classified.

November 17th, 1922.

In connection with the recent correspondence on the above subject, may I suggest that your valuable paper is not the correct medium through which these grievances should be voiced? General meetings of the E.P.E.A., or the correspondence columns of the *Electrical Power Engineer* are the channels through which most good will accrue to those with a grievance.

I am an industrial member of the E.P.E.A., and, as such, have received perhaps less *direct* benefit than any shift engineer breathing; but to "write to the REVIEW about it" would be just about as logical as would my running to a greengrocer's to get my boots repaired. I think that E.P.E.A. members with a grievance might remember:—

1. That the majority of readers of the REVIEW are not directly interested in the rights or wrongs of the shift engineer or any other special class of engineer;

2. That they are doing the Association, and themselves, no good by making public grievances which, however slight actually, will in some quarters be not only misconstrued, but magnified and considered evidence of a lack of unity and strength in the Association.

At any rate, shift engineers have an excellent opportunity of obtaining redress if they use their voting power judiciously at the forthcoming committee elections. I may say, however, that though I attend my Section general meetings regularly, I have not yet heard any dissatisfaction expressed by any of the shift engineers present. I take it, therefore, that the aggrieved ones are either in a minority, or else that they are very backward in coming forward—in which case the Association is not to blame, but only themselves.

Industrial.

November 12th, 1922.

Further to the letter of "Welfare"—it is questionable whether the E.P.E.A. *has* improved the lot of its members permanently. Some of them, yes—the majority, no. The number of generating stations multiplied by four gives us approximately the charge-engineer element in the kingdom. Compare this number with the membership of the E.P.E.A., and you will find it is a big percentage (it is, incidentally, the only apparent reason for keeping him bottom dog). This large percentage claims that its prospects are being ruined by the provision in the schedule which states: "The *highest* paid charge engineer shall be Grade 8." If this is not slamming the door in the face of his prospects as a charge engineer, what is it?—and why on earth should a "Trade Union" put the highest paid in the bottom grade?

The charge engineer, therefore, says the E.P.E.A. has *not* improved his lot."

In a large number of stations, Grade 3 is the next Grade above Grade 8. If some Anti-Waste candidate or Ratepayers' Protection Association asks, "why," who can answer it? If the charge engineer does not get a higher grade, then the Grade 3 man is booked for a fall to, say, Grade 5. Where will *his* permanent advantage be? These two cases directly affect more than half the membership, and indirectly the rest.

As "Welfare" says, there's still a lot to do, and to quote "Fed-up," let's get on or get out.

Four Shifts.

November 13th, 1922.

I am pleased to note that there are at least a few of the shiftmen who can really see how the E.P.E.A. have left the shift engineers little better off than pre-war. The question arises: What are the Grade 8 men doing to bring their anomalies prominently before the N.E.C.? The previous correspondents obviously share my view that the efforts to secure justice are both feeble and deplorable. It is more

surprising, now that there is a new schedule on the way, that there are no amendments for improving the grading of charge engineers. Yet there are no comments from the hand of shiftmen who, I have concluded, have not even the pluck to voice their grievances before their own committees. I feel sure that if the N.E.C. saw that the men were in real earnest it would awake to the fact that something must be done.

Midland Counties.

November 12th, 1922.

I should like to support your correspondent "Fed Up" in his suggestion that reductions of charge engineers' salaries should cease.

So far, charge engineers have only had the honour (?) of getting everybody else very fat salaries, while they themselves have got absolutely nothing, but the insult of being degraded to the bottom of the list.

Isn't it time charge engineers got together and did something for themselves?

Ex-Service Man.

November 20th, 1922.

I offer my heartiest support to your correspondents "Fed Up" and "Fair Play."

Let us decidedly get on, or get out.

Shift Wallah.

November 20th, 1922.

Instrument Transformers.

"S.M." in his interesting article on instrument transformers, in your issue of November 10th, has endeavoured perhaps to cover too large a field for a single article, and from some of the data given it would appear that the "switchboard" pattern only has been considered.

For instance, referring to the design of current transformers, a "usual" figure of 600 ampere turns is given for the primary winding, but, in fact, no experienced designer would allow less than 1,000 for a transformer to stand a load of, say, 40 volt-amperes, even supposing the core to be of the jointless or "ring" type, and from 1,200 to 1,500 primary a.t. is often desirable where accuracy over a considerable range of output and frequency is required.

This, of course, somewhat limits the use of the "straight through" transformer, desirable as its simplicity may be, since with 1,000 amps. the loss of accuracy due to low primary a.t. hardly justifies their installation, except for the operation of ammeters, and simple protective devices.

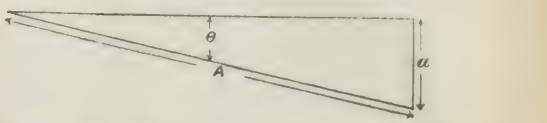
There appears also to be a slip in the v.a. ratings given for various instruments; for example, the volt-amperes consumed by the pressure elements of an indicating wattmeter are given as 20, and for a wattmeter and voltmeter, 14—in fact, 6 less than that of the wattmeter only. Presuming "indicating" to have been written in error for "integrating," the balance left for the voltmeter is still zero.

Transformers having twin secondaries are mentioned, one secondary being used for indicating instruments and protective devices, and the second for integrating instruments. This design, however, would not appear to be very desirable in practice. The reason usually put forward for adopting such a procedure is that the integrating instruments may be adjusted, repaired, &c., without the risk of interfering with the purely protective circuits. Since, however, the total ampere-turns in the secondary must always equal the primary ampere-turns (less a negligible per cent. representing the magnetising a.t.), any current which does not flow in the one secondary must necessarily flow in the other, and with two similar secondary windings the current in each will be inversely proportional to the impedance of their respective circuits. There is thus no fundamental difference between this design and the placing of two 5-ampere instruments in parallel on a 10-ampere secondary—obviously an unstable arrangement. Should the instrument on one side be removed for repair, the current settings of the protective devices on the other will be effectively halved, unless the disused ends are short circuited, in which case the bulk of the secondary current will flow through the short-circuited winding, and but little through that feeding the relay.

This objection may be overcome by the use of a transformer wound with a single primary winding, and having two secondaries, each wound on a separate core. Such transformers are actually obtainable, and by their use the aforementioned difficulties may be avoided, and at the same time the use of entirely separate circuits for the instrument and the protective apparatus is permissible.

The instructions given for measuring the phase angle of current transformers are so meagre as to be almost unintelligible. Apparently the method advocated is to take a reading on a phase-shifting transformer with the secondary wattmeter reading zero, and again with the primary wattmeter at zero. The necessity of the former reading being taken, however, is not pointed out, and in any case with a good transformer the change in reading would be extremely small.

A more accurate method is to set the phase-shifting transformer for zero reading on the primary and note the reading on the secondary with a low reading wattmeter. The latter divided by the voltage used to excite the instrument gives the "out of phase" component of the secondary current in amperes, from which the phase angle is easily extracted.



For very small angles the vertical, or "out of phase" component, may be taken as equal to the phase angle expressed in radians, whence (see figure) θ (in $\times 0.57.3^{\circ}$). Where $a = 0.5$ amps. and A = out of phase component.

Since, however, the volt elements of the two wattmeters may have themselves slightly different phase angles, extreme accuracy cannot be hoped for with the apparatus as described by the author, and a differential wattmeter is desirable. I hope in the near future to describe a simple yet accurate testing apparatus used by Messrs. Everett, Edgcumbe & Co., and constructed on the differential principle.

Francis E. J. Ockenden.

London, *November 18th*, 1922.

Electrical Trading Relations.

I see from Mr. Warrilow's letter and various reports in the Review, that the Electrical Development Association is trying to increase the demand for domestic electrical gear.

It so happens, however, that in my journeyings up and down the town the only sign I have seen of its activities has been an impressionist poster of a falling chimney—displayed in a barber's shop window in Green Lanes, Hornsey. I hadn't time to stop and read the words, but I presume the picture is symbolical of the E.D.A.'s intention of coming down like a thousand bricks on the discount sharks who are keeping the prices of electrical necessities out of the reach of the majority; keeping up the impression that electricity is a luxury for the rich only. Mr. Warrilow says it is time to cry a halt in the scramble between the manufacturer, superfactor, wholesaler, and retailer, to get at the man who actually uses the stuff. It will be time to cry, anyway, if we don't adopt some means of cutting out some of that "house that Jack built" series of profit-takers.

Recently I spent many happy hours on a stand at an electrical exhibition trying to sell some really good electric irons, well worth 14s., for a guinea. By superb salesmanship I got the old ladies on the stand in dozens ironing their hankies and what-not, and cooing and clucking with delight. Then with brassy stare or painful blush, according as I felt defiant or, defenceless, I had to tell them the price, and they all promised to come back and buy one when they had had a look round. They are all still looking round. The beauty of it is that those irons could have been sold at a comfortable profit for 14s., but for the "necessity" of protecting the trade.

More power to the E.D.A. elbow say I; the more chimneys it drops on the trade the better I shall like it.

Weary Salesman.

November 20th, 1922.

Mr. W. E. Warrilow's letter under the above heading, which appeared in your issue of the 17th inst., curiously enough forestalled by a few hours an important point touched upon by Mr. Wallace Attwood in his address at the E.D.A. on the 17th inst., when he emphasised the fact that if progress is to be made in the sale of electrical appliances, there must be a united front of all those parties concerned which form the link between the supply company and the buying public.

Whilst fully endorsing Mr. Warrilow's remarks, I am of the opinion that there are equally important factors to be taken into consideration, some even of more importance than the co-ordination of manufacturers, wholesalers and retailers, if real progress is to be made in the widespread use of electricity amongst the public. They are:—

First, and most important, the necessity of supplying electricity at a figure competitive with gas.

Secondly, the educating of architects on the necessity of designing and equipping all new buildings in such a manner that they can be readily adjusted with every form of electric labour-saving domestic appliances. The rising generation of architects has to be convinced that the day of the open grate and the coal kitchener is passed.

Thirdly, the sale to the public of all electrical appliances of the kind where special technical knowledge is required to overcome the prejudices of old-fashioned methods and to obtain the best results from the use of such appliances should be left mainly in the hands of manufacturers or their agents, until such future time when there will undoubtedly exist a recognised "Official Registration of Contractors," consisting of men who possess a good standard of technical knowledge and practical experience of all matters relating to their profession.

Being myself connected with a firm of contractors, I feel better qualified to ventilate my views under heading three in preference to those under one and two.

Item one is forcibly endorsed by Mr. Hugo Hirst, the chairman of the General Electric Co., Ltd., in his remarks on p. 697 of your Jubilee issue of the 17th inst.

Item two is a subject which, in my opinion, can be best tackled by a joint working committee of representative members of the electrical industry and members of the various architects' associations.

Electric lighting, and all that appertains to it, is that branch of the electrical industry about which the general contractor possesses an intimate knowledge, undoubtedly from the fact that it is the branch which has been longest in existence and most developed.

Therefore, I say, the manufacturer should leave this field wholly in the hands of the contractor, who is well able to tackle all problems connected therewith. By this suggestion I mean that no manufacturer or wholesaler should supply any installation materials of any nature whatsoever, including fittings or lamps, direct to the user, whoever he may be.

On the other hand, I am of the opinion that the time is not yet ripe for all contractors to claim the right to have the whole field for the sale of cooking, water heating, and other specialised appliances where it is a matter of installing the same on a large scale, with the certainty of obtaining satisfactory results. Surely manufacturers' representatives with their specialised technical knowledge of the appliances they are handling are in a better position to tackle problems of this kind than the average contractor who in the majority of cases has had little practical experience in dealing with these matters.

Enormous damage has been done in the past in attempts to popularise domestic electrical appliances through the ignorance of unqualified salesmen.

I am confident that in time to come, when electricity can be supplied in all great industrial centres at a reasonable rate, the spade work of the manufacturers will reap an enormous harvest for the genuine contractor, and the time will then come when he will be justified in making the same demand to the manufacturers regarding the supply of cooking and other apparatus as he rightly does at the present time in connection with electric light supplies.

It may be that this letter will raise a certain amount of indignation amongst my *confrères*, but in spite of this I feel it incumbent upon me in the interests of the electrical industry as a whole to state my opinion.

H. F. Simon, A.M.I.E.E.

London, *November 21st*, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—W. Bennett, electrical contractor, Back Sitwell Street, Derby.—Trustee, Mr. E. W. Humphreys, Official Receiver, 4, Castle Place, Nottingham; released November 9th.

E. E. Mathers, electrical engineer, 10c, High Street, Doncaster.—Trustee, Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield, released November 14th.

W. Hurworth & A. A. Watmough (Hurworth, Watmough and Co.), electrical engineers, 41, Town Street, Horsforth, and 1, Back James Street, Harrogate.—Last day for proofs for dividend, December 4th. Trustee: Mr. H. C. Bowling, Official Receiver, 24, Bond Street, Leeds.

G. M. Hallett, electrical engineer, 7, King Street, Frome.—First and final dividend of 1s. 2½d. in the £, payable November 28th, at 18, Nicholas Street, Bristol.

F. J. Maitland (F. J. Maitland & Co.), electrical engineer, Albion Yard, Millgate, Wigan.—First and final dividend of 2s. 2½d. in the £, payable November 24th, at the Official Receiver's offices, 11, Dale Street, Liverpool.

Busfield & Co. (a firm), electrical engineers, late of 215, Padiham Road, Burnley.—Receiving order made November 9th on creditor's petition.

F. L. Perrin, electrical engineer, 57, Wellingborough Road, and 5, College Street, Northampton.—Receiving order made November 10th on debtor's own petition. First meeting, November 30th, at the Official Receiver's office, Northampton; public examination, December 5th, at the County Hall, Northampton.

W. Ford (Redditch Electrical Accessories Co.), electrician, Central Chambers, Unicorn Hill, Redditch.—First meeting November 23rd, at the Official Receiver's office, Birmingham. Public examination December 11th, at the Court House, Birmingham.

J. R. Gough, electrician, late of the "Aberdeen," Scarborough.—First meeting November 23rd, at the Official Receiver's office, Scarborough. Public examination, December 19th, at the Court House, Scarborough.

H. M. Wollman, electrical factor, of Greasboro Road, Parkgate, Rotherham.—Trustee, Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield, released November 13th.

Frank Porter, electrical engineer, 17, Goldhawk Road, Shepherd's Bush, London. This debtor attended on Tuesday before Mr. Registrar Mellor at the London Bankruptcy Court for public examination upon accounts showing liabilities £766, against assets valued at £225. Replying to Mr. Armstrong, Assistant Official Receiver, the debtor stated that in August, 1921, he and another person, who provided the only capital of £40, commenced business at the above address under the style of "Porter & Simpson." The partnership was dissolved in October, 1921, and witness continued the business alone until last July when, being pressed by creditors, he filed his petition. Lack of capital and business experience brought about the failure. The examination was concluded.

Company Liquidations.—The Yorkshire Incandescent Electric Lamp Co., Ltd.—The Receiver (Mr. J. A. Couper, of Leeds) has issued a statement in regard to this matter. He says that every endeavour has been made to reconstruct the company on such a basis as would enable a substantial payment to be made to the creditors. The debenture holders have given every assistance, but the affairs of the company are so much embarrassed that their endeavours have not met with success. As the desired arrangement could not be brought about, the first mortgage debenture holders have appointed him as Receiver on their behalf, and he is now forced to realise the assets. It is apparent that they are not sufficient to realise a sum which will result in a payment of 20s. in the £ to the holders of the second mortgage debentures after the claims of the preferential creditors and the first mortgage debenture holders have been met in full. As the second mortgage debenture holders, for whom he is also acting, cannot possibly receive payment in full, there will be no available funds for the ordinary creditors of the company. The statement of affairs shows as follows: Preferential creditors, £1,371; first mortgage debentures, £5,200; interest to date, £330; second mortgage debentures, £3,000; interest to date, £200; estimated available funds (subject to expenses of realisation), £1,653; estimated deficiency on second mortgage debentures, £1,547; sundry creditors (including London County & Westminster & Parr's Bank, Ltd., which is guaranteed by the directors, £7,975), £16,200; contributories, £2,000; estimated deficiency, £19,746. Cash in hand stands at £6; bills receivable, £123; sundry debtors (as per the books, £2,163), estimated to realise £1,300; expense debtors, £130; stock-in-trade (£2,402), expected to realise £2,300; plant and machinery (£3,304), expected to realise £2,200; Gluhfadenfabrik, Switzerland, deposit, £100; Belle Vue Glass Works (buildings) (£4,687), expected to realise £2,500; plant (£300), expected to realise £125; patents and goodwill, £900; total as per company's books, £14,111, estimated to realise £8,554.

Swift Electrical Co., Ltd., 6, Cork Street, Old Bond Street, W.—The report of Mr. J. Barwick Thompson, Official Receiver and Liquidator of this company, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities of £2,745, assets valued at £1,066, and a deficiency of £2,479 with regard to contributories. The winding-up order was made last April on a creditor's petition. The company was registered as a private company in October, 1919, with a nominal capital of £3,000 in £1 shares, and was formed for the purpose of trading as electrical engineers, and manufacturing and dealing in electrical accessories. The whole of the 800 issued shares were taken by the directors for cash. No established business was acquired, but Mr. John Henry Butler (who, with Messrs. Leonard John Evans and Henry Edward Leigh) promoted the company, states that his co-promoters were experienced in the electrical trade, and were in a position to introduce customers to the company. Towards the end of 1920 the company was in need of financial assistance, and on October 18th, 1921, a debenture for £800 was issued to Mr. Butler to secure an advance of that amount. In January last a Receiver was appointed, who had realised the estate and paid off the debenture bond and interest. The unrealised assets consist of book debts, most of which appear to be bad. The failure of the company is attributed to the fall in demand for electrical accessories, in consequence of which the stock had to be sold at a loss.

Globe Supplies (Electrical), Ltd.—Winding up voluntarily. Liquidator, Mr. E. Russell, 69, Milton Street, E.C.

Modern Electrical Supply Co., Ltd.—A meeting of creditors was called for November 22nd. Particulars of claims should be sent to the liquidator (Mr. R. Stephens), 31, Lombard Street, E.C., by November 25th.

Standard Electric Sign Co., Ltd.—A petition for the winding-up has been presented to the High Court by Mr. H. J. Davis, 9, Winter Avenue, Thorpe Bay, a creditor, and will be heard in London on November 28th.

Saxby & Farmer, Ltd.—Winding up voluntarily. Liquidator, Mr. R. Payne, 82, York Road, Kings Cross, N.1. Meeting of creditors, December 4th. Particulars of claims to the Liquidator by December 30th. All debts and liabilities will be paid in full in due course.

Troughton & Simms, Ltd.—Winding up voluntarily. Liquidator: Mr. R. M. Peat, 11, Ironmonger Lane, E.C. Meeting of creditors, November 29th. Particulars of claims to be sent to the Liquidator by January 7th.

Dissolutions of Partnership.—Clampett & Jones, Manchester.—The notice appearing in our last issue was incorrect in one particular. It should have read that claims were to be sent to Mr. Williams (not that debts would be attended to by him). Mr. Williams is the accountant, but the debts have been attended to by the late partners. Mr. R. H. Clampett is continuing business as usual at 13a, Paton Street, Piccadilly, Manchester, while Mr. E. M. Jones is also carrying on business at Pigeon Street, Manchester.

Bright & Cox, builders and electrical engineers, Elmdale Road, Palmers Green.—Mr. W. R. Bright and Mr. S. D. Cox have dissolved partnership. Mr. Cox will attend to debts.

Trade Announcements.—The business of Webster & Sons, electrical engineers, of Folkestone, has been transferred to Mr. J. Cross, of 20, Cheriton Road, Folkestone.

Mr. T. E. Maggs has retired from the firm of Maggs and Gordon, electricians, of Houghton-Le-Spring, and the business will be continued by Mr. Alexander Gordon.

The London address of Messrs. Arthur Lee & Sons, Ltd. (Sheffield) has been transferred to 40-43, Norfolk Street, Strand, W.C.2. Telegrams: "Trubrite, Estrand, London." Telephone: Central 6943.

The Electrical Supplies (Liverpool), Ltd., of Liverpool, have appointed Mr. G. E. Goulborn, 40, Fairfield Avenue, Victoria Park, Canton, Cardiff, as their agent and representative for South Wales District. Mr. G. R. Croskell, 22, Eccleston Street, Wigan, has been appointed representative for Manchester, Wigan, and Bolton, &c.

Mr. A. Whittaker wants electrical catalogues at 3, Manor Road, Folkestone, where he is commencing business.

Catalogues and Lists.—The Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3.—An illustrated mailing card showing a selection of electrical appliances, including fires, small cookers, irons, kettles, &c.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet No. X2858, giving reduced catalogue prices of automatic circuit breakers.

Westinghouse Electric & Manufacturing Co., East Pittsburgh (Pa.), U.S.A.—Three illustrated pamphlets describing respectively electrical equipment for mine pumps (motors and controllers) safety switchboards with closed fronts, and automatic voltage regulators for a.c. generators.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—A fully-illustrated catalogue (120 pp.) of telephones and telephone accessories of every description. A number of views of actual installations appear, and an index to the catalogue is appended.

The Enterprise Manufacturing Co., Ltd., Electric House, Grape Street, Shaftesbury Avenue, W.C.2.—A net trade price-list of cables, conduits, switches, cut-outs, lampholders, fans, and other electrical accessories and appliances.

The Imperial Engineering Co., 56, Darlington Street, Wolverhampton.—An illustrated price list of boiling rings, fires, water-heaters, and toasters.

The Hotpoint Electric Appliance Co., Ltd., 21, Berners Street, Oxford Street, W.1.—An illustrated and priced pamphlet setting out special terms for salesmen and others in purchasing "Falco" 5280 cookers.

Quickways, 30, City Road, E.C.1.—A pamphlet advertising "Argentum," a silver-plating preparation.

Messrs. Shenton & Co., Ltd., 68 and 69, Shoe Lane, E.C.4. —A fully-illustrated and priced catalogue of "Supreme" electrical novelties, including pocket and torch lamps, lighting fittings, miniature motors and dynamos, steam engines, &c.

Messrs. A. Verey & Co., Ltd., 27, Buckingham Gate, Victoria Street, S.W.1.—List No. 110, a comprehensive priced catalogue of electrical materials and accessories.

The Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—List of reduced prices of switch and fuse gear, and two pamphlets dealing with domestic appliances.

Electrical Conduits, Ltd., Anchor Works, Birch Street, Walsall.—A net price list of conduit and conduit fittings, tumbler switches, lampholders, lighting fittings, &c.

The Skefco Ball Bearing Co., Ltd., Luton, Beds.—An abridged catalogue of bearings of all types. Fully priced.

Ironclad Switchgear Co., Ltd., 23, Queen Anne's Gate, S.W.1.—A mailing card advertising the firm's switchgear.

For Sale.—Messrs. H. Butcher & Co. have been instructed by Messrs. Edwardes Bros., of 20, Blackfriars Road, owing to re-arrangement of partnership, to sell by auction, on December 7th and 8th, at 21, Upper Ground Street, S.E., the stock-in-trade of new electrical accessories, cable, switchgear, &c.

By direction of the Disposal Board, Messrs. Bruton, Knowles and Co. will sell by auction at H.M. Filling Factory, Hereford, on December 5th and 6th, engineers' plant, railway rolling stock and material, &c., and on December 14th and 15th, electrical plant, new electrical stores, fittings, &c. (See our advertisement pages to-day.)

The Warrington Exhibition.—Mr. Harry Rogers, of Friargate, Warrington, has sent us a photograph of the stand held by him in the recent electrical exhibition at Warrington. The display was of a comprehensive nature, including all kinds of electrical heating, cooking, lighting, and labour-saving appliances.

Electric Welders for the United States.—Some surprise has been created in Norway by the publication of advertisements by an American firm inviting applications from electric welders who would be willing to proceed to the United States. One correspondent of the Norwegian newspaper states that it is regrettable for an attempt to be made to deprive Norwegian industry of some of its trained men, while another representing a native welding company, states that as soon as there being a scarcity of welders in the United States there should be a superabundance of them at present.

The A.E.G.—At the recent annual meeting of the A.E.G., in Berlin, an attempt was made by various shareholders to obtain an increase in the rate of dividend to 10 per cent. at the expense of the works' maintenance fund. In refusing to entertain the suggestion, it was pointed out, on behalf of the board, that there were constant requirements in the direction of the replacement of plant and machinery in the electrical manufacturing industry, and that therefore the amount set aside for depreciation ought to be kept on the pre-war gold basis level. But that was impossible, and it could be understood that many works had anxieties in consequence of gradually consuming their substance, which would later on lead to difficulties in the replacement of machinery and buildings. In the case of the A.E.G., however, the situation was somewhat different; the company's profits were derived from so many sources that it would probably always be able at once to write off its capital expenditure on new machinery and plant. Nevertheless, the sum of 400 million marks proposed to be placed to the works' maintenance fund was the smallest amount with which the directors could be satisfied. After the approval of the accounts and rate of dividend, sanction was given to the issue of new ordinary shares for 300 million marks. A noteworthy event was the election to the board of representatives of the Phœnix Steel Co. and the steel merchant firm of Otto Wolff, of Cologne.

According to a Berlin "Exchange" telegraph dispatch, the great Electro-Metal Trust, founded in October by Otto Wolff, of Cologne, has effected a partial fusion with the A.E.G. It is stated that the new trust rivals in magnitude Stinnes's electro-metal concern, but is less closely united.

Insurance by Industry.—Mr. Bonar Law's statement that he hoped to see further progress in the maintenance of unemployed by the various industries has aroused considerable interest in business circles, says *The Times*. Inquiries among prominent manufacturers showed that there was general agreement with the principle, but the large number of unemployed in certain industries would make it impossible for these to carry the burden without State assistance. It is recognised that insurance by industry would have a steadying influence on the workers, who would be relieved of the fear of unemployment. The Federation of British Industries proposes to issue a report on the subject shortly.

New Business Premises.—The Enterprise Manufacturing Co., Ltd., recently moved from its premises in Bishopsgate to much larger and more central quarters at Grape Street, Shaftesbury Avenue, W.C.2. The new "location" consists of five floors, each of which is devoted to a particular branch of the firm's business. The principal occupation of the firm is the production of exhaust fans. The company also acts as agent for the Vincent Switchgear Manufacturing Co., Ltd., the Stearn Electric Lamp Co., Ltd., Messrs. Barton & Son. (conduit and fittings), and Messrs. S. Hodgson & Co. (motors and dynamos), and examples of the products of these firms are exhibited in the showrooms. The store rooms are fully stocked with electrical material, accessories and appliances, and included in these is a consignment of fans for the 1923 season.

Messrs. Falconar, Cross & Co. have recently completed extensive alterations at their premises, 7 & 9, Ridley Place, Newcastle-on-Tyne, where they carry on business as electrical contractors, specialising in the equipment of ships, factories, town and country houses, and other buildings, as well as repair work and electrical supplies of all kinds. A few months ago a new department of the business was organised to deal solely with the supply and repair of electrical equipment for motor cars. Ample facilities are provided for the repair, replating and recharging of all types of batteries, and for the fitting, repair and adjustment of dynamos, starters, and other electrical accessories used on cars. A handsome new front has been erected, with a window about 40 ft. long, for the display of goods; the showroom on the ground floor is fitted with a selection of fittings, domestic appliances, &c., all connected up for demonstration, and adjoining this are the general and works offices, which overlook the store and garage; other offices and stores are located on the upper floors. Separate entrances from Vine Lane at the rear give access to the stores and workshops, and also to a garage which will house four or five cars on which electrical equipment is being repaired or installed.

Electrical Christmas Gifts.—A recent issue of the Toronto *Electrical News* shows that the Canadian electrical appliance manufacturers and dealers are fully alive to the possibilities of increased sales during the Christmas season. Several pages are devoted to the subject, and a wide range of possible electrical presents is illustrated. A list of more than 150 appliances and accessories is given, and these are classified under the following heads:—"General Servants in the Home"; "Mostly for the Young People"; "Radio Accessories"; "Electric Conveniences and Luxuries," "Invalid and Sick-room Comforts"; and: "Electric Automobile Fittings." The most striking feature of electrical gifts is that, like any other gift, they are obtainable at prices to suit everybody.

Book Notices.—" The King's Engineer," No. 1, April, 1922 (28 pp.). London: King's College Engineering Society. Price 2s. 6d.—This is the first number of a journal which is to be published annually by the King's College Engineering Society and the Engineering Branch of the King's College Old Students' Association. It is interesting to note that the Engineering Society was founded in 1847, the 75th anniversary address (which is reproduced in the journal) having been delivered in February last. Articles contained in this issue include " ' Administration ' as a Qualification for Engineers," by Brig.-Gen. M. Mowat; " Improving Two-Stroke Internal Combustion Engines," by Mr. R. C. Wallace; " Prospects in Branches of the Profession," by Mr. C. H. Wordingham, C.B.E.; and " The Sladen Valley Waterworks," by Mr. H. F. Colman (abstract). In addition, there are numerous notes dealing with social functions, other institutions, and matters of interest to old students.

" Motor Headlights " (39 pp.). Cambridge: The University Press. Price 2s. 6d. net.—This is a series of fourteen papers, reprinted from the *Transactions* of the Optical Society, dealing with improved designs of motor headlights to minimise dazzle, and describing devices which may be applied to existing types of lamps.

" La Force Motrice Electrique dans l'Industrie," by E. Marec; pp. viii+643, 541 figs.; price 55 fr. " La Radio Telephonie," by C. Tochè; pp. 4+98, 44 figs.; price 10 fr. Paris: Gauthier-Villars et Cie.

" Lubrication and Lubricants," by J. H. Hyde; pp. x+114, 37 figs.; price 2s. 6d. net. " Incandescent Lighting," by S. I. Levy; pp. x+129, figs. 22; price 3s. net. London: Sir Isaac Pitman & Sons, Ltd.

" Electrical Transients," by C. E. Magnusson, A. Kalin, and J. R. Tolmie. Pp. viii+193; figs. 161. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

" Where to Buy Everything Electrical " (104 pp.). London: S. Davis & Co. Price 2s. 6d. post free. October, 1922, edition.

Messrs. Constable & Co., Ltd., have sent us their November list of new and forthcoming books, including several of a technical nature.

" M. & C. Machine Mining," November. Glasgow: Mavor and Coulson, Ltd.—One article in this issue describes the linking-up of two collieries by machine mining. There is also a letter from a German engineer regarding machine mining in his country, and a description of the firm's 3-phase chain coal-cutter.

Small Lighting Plant Contracts.—Messrs. Truslove and Co., Colchester, have recently received an order for a 4-5-kW " Truslove " lighting set and a complete lighting installation for Aylsham Union, Norfolk. Another set, together with a lighting installation, is being put into the Earl of Warwick's residence at Beer, South Devon.

Unemployment.—The number of persons on November 13th recorded on the live registers of the Employment Exchanges in Great Britain as wholly unemployed was 1,377,100. This was 10,326 more than in the preceding week, and 446,633 fewer than the figure recorded at the beginning of last January.

The number working short-time and drawing benefit for intervals of unemployment was 50,200 on November 13th, as compared with 49,631 on November 6th, and 934,786 on July 1st, 1921.—*The Times.*

E.D.A. Activities.—The Electrical Development Association has published a number of new and reprinted pamphlets dealing with many phases of the use of electricity. All of these are written in clear vigorous language, presenting the case for electricity in a very telling manner, and the illustrations are equally attractive. The E.D.A. is not content to say that electricity is " the thing " but gives reasons—economic or hygienic—why electricity should be used in all departments of life.

The British Industries Fair.—The preliminary arrangements for the booking of space and stands at the British Industries Fair (Birmingham) for the 1923 Fair, to be held from February 19th to March 2nd, are rapidly nearing completion. British manufacturers have flocked very readily to assist by their active support in making the 1923 Fair bigger and better than any of its predecessors, and it is anticipated that a very much larger number of Home, Colonial and foreign buyers will be in attendance at Castle Bromwich during the period of the Fair than on any previous occasion. The structural alterations that will make the permanent buildings of the Castle Bromwich Aerodrome the largest exhibition hall in the country are proceeding apace and will be quite completed by next February. The Council of the Fair is prepared to consider a few more applications for space. These should be sent to the General Manager, British Industries Fair, Chamber of Commerce, Birmingham, who can also deal with any other inquiries regarding the Birmingham Fair.

Chinese Note.—The Tung Lee Electric Light Co., Ltd., in Chekiang, has applied for licences of trade to the Ministry of Communications, and it is stated that the request has been granted.

Social.—On November 17th the annual dance of the Paisley Electricity Department was held at the Town Hall. There was a large company and the hall was illuminated by means of flood lights.

The Electrification of Russia.—The Scientific Technical Department of the Russian Council of Economy in Berlin is reported to be publishing in Russian a technical economic journal at No. 11, Lietzenburger Strasse, Berlin, 15. The journal is said to deal with many important problems, including the electrification of Russia. A recent issue contained articles by Professors Chatalin and Worobjiw on the electrification of Russian agricultural districts, the oil-field district of the Caucasus, and the suggested establishment of a bank for the promotion of electrical schemes.

Lead.—In their report, dated November 18th, Messrs. James Forster & Co. state:—" There has been little of interest to report. Business on the speculative side has been on a very small scale. Consumers have bought but little, and for export there is little demand. On the other hand, there is a considerable falling off in imports so far this month, as was to be expected after the very large arrivals in October. With anything like the average of arrivals of the last four months, however, there should be little chance of increase in values, but manipulation and speculation largely govern the market. Consumption in the electrical cable and allied trades continues good, but there is nothing very encouraging in the home trade for sheets and pipes."

Copper and Lead Prices.—Messrs. F. Smith & Co. and Messrs. James & Shakespeare report November 22nd:—No change in copper and lead quotations.

LIGHTING AND POWER NOTES.

Ambleside.—OPPOSITION TO PRICE INCREASE.—The Urban Council is opposing the application of the Windermere and District Electricity Supply Co. for a revision of its authorised prices for electricity.

Australia.—SYDNEY (N.S.W.).—According to the *Sydney Morning Herald*, the accountants to the City Council have submitted a report, in which they recommend that a separate department should be formed to deal with the actual sale of energy. Mr. Forbes Mackay, the city electrical engineer, is opposed to this arrangement, and has hinted that he would resign if it were brought into being.

There is much discussion with regard to a proposal to take a bulk supply from the Railway Commissioners as an alternative to erecting a new station, the first stage of which would cost about £1,000,000. Mr. Mackay has been asked to prepare an estimate of the cost of a new station, and at the same time the Commissioners have been requested to state their terms for a bulk supply.

Bexley Heath.—PROPOSED BULK SUPPLY.—The Urban Council has decided to continue negotiations with a view to obtaining a bulk supply of electricity from Woolwich or elsewhere.

Billingham.—APPLICATION FOR ORDER.—The Cleveland and Durham County Electric Power Co. has applied for an Order to enable it to supply electricity to the district.

Blackpool.—YEAR'S WORKING.—There was a net profit of £14,322 on the electricity undertaking during the past year, compared with a net profit of £8,180 in the previous year.

Chadderton.—ELECTRICITY ORDER.—The Electricity Commissioners have received an application for an Electricity Order which will enable the Urban District Council to purchase electricity in bulk and distribute it in the area.

Continental. ITALY.—A concession has been granted to the Società Forze Idrauliche Alto Brembo to utilise the waters of the upper part of the Brembo River to work five hydro-electric stations of a total capacity of 35,668 h.p.

RUSSIA.—On October 10th, the newly-equipped electric power station at Krivoi Rog was put in operation. The work of equipment occupied six months.

Chorley.—CONTEMPLATED ELECTRICITY SUPPLY.—The Town Council is to consider within the next few months the question of the supply of electrical power to the district.

Chosen.—SEOUL.—According to H.M. Consul-General at Seoul, the Kongosan (Diamond Mountains) Electric Railway Co. has obtained official permission to supply electricity to Seoul, and it is hoped to commence the supply from September of next year. The generating station of the company, in which a plant of 3,200 kW is to be installed, is nearing completion. This is situated at Chudairi, Kogen Province, a distance of 62 miles from Tetsugen (Corean; Cholwon), a station on the Seoul-Gensan railway, which is to be the terminus of the line; from Tetsugen to Seoul the distance is about 61 miles, so that the current will have to be transmitted a distance of over 120 miles in all. The total cost of the transmission line is estimated at nearly 4,000,000 yen. Construction work on the railway line itself is proceeding, and it is hoped to open the first section between Tetsugen and Kinka (Corean, Kimwha), a distance of 18 miles, during the course of next year.—*Eastern Engineering.*

Darlington.—YEAR'S WORKING.—There was a net profit of £4,295 on the electricity undertaking for the past year.

Doncaster.—New Plant.—On November 16th the extensions of the generating plant were formally inaugurated. The new plant, which has cost approximately £100,000, consists of two 3,000-kW turbo-generators and auxiliaries, and it is noteworthy that the space they occupy was formerly taken up by plant having a capacity of only 450 kW.

Lighting New Houses.—The Town Council has rejected a recommendation by the Housing Committee that three electric lamps should be supplied free of charge to each Corporation House on the Carr House site.

Dublin.—Proposed Co-operation.—A recent public meeting in Kingstown discussed the proposed amalgamation of the South Dublin townships as one corporate body with a joint electric lighting scheme. Mr. F. J. Mallins, who presided, said that Dublin Corporation was moving to annex the townships, but they would be better off with a scheme of their own, and the only possibility of the commercial success of an electric lighting scheme lay in having one power station for all. Intimation was received from the Kingstown Council that it was making new proposals for a supply of electricity in bulk, while the consulting engineers were at work on a revised scheme for the townships.

East Grinstead.—Loan Sanctioned.—The Urban Council has received sanction to a loan of £18,000 for the new electricity scheme.

Eton.—Protest Against Price Increase.—The Urban Council has decided to oppose the application of the Windsor Electrical Installation Co. for an Order to make permanent the maximum charge of 1s. per unit for electricity, with minimum payments of 15s. for each winter quarter and 10s. for each summer quarter. Steps are also to be taken in conjunction with other public bodies concerned to endeavour to get better terms for consumers.

Electricity Districts.—Local Inquiry.—In pursuance of the provisional determination of the East of Scotland Electricity District, the Electricity Commissioners will hold a local inquiry in the City Chambers, Edinburgh, on December 12th, 1922, at 10.30 a.m., and following days, with reference to the area to be included in the proposed district and to consider a scheme which has been submitted by the Corporation of Edinburgh for the formation of a Joint Electricity Authority for the area. Copies of the scheme may be obtained from the town clerk, City Chambers, Edinburgh (1s. 6d. each), also copies of supplementary particulars (10s. each). Any representations with regard to the scheme should be addressed to the Secretary, Electricity Commission, and to the Town Clerk, Edinburgh, not later than December 5th, 1922.

Procedure at Local Inquiries.—A memorandum as to local inquiries into electricity districts and schemes for the reorganisation of the supply of electricity therein under Section 5 of the Electricity (Supply) Act, 1919, has been issued by the Commissioners, who point out that they do not at present propose to lay down any rules of procedure, but they desire that unnecessary expense should be avoided, and that the inquiries should not be unnecessarily prolonged. In the first place, it is hoped that in the interval between the lodgment of a scheme and its consideration at a local inquiry it may be found practicable for promoters and objectors to confer with a view to adjusting differences or reducing them to a minimum, so as to shorten proceedings at the inquiry. The Commissioners suggest that parties need not be separately represented by counsel or otherwise, unless their interests are divergent, and then only to the extent of such divergence. With regard to witnesses, the Commissioners are of opinion that it should not ordinarily be necessary for more than one witness—representative of each class or group of promoting or opposing local authorities or companies—to be called as to policy. On the technical side of the scheme, promoters and opponents should bear in mind that, while the expert evidence should be adequate to support or criticise the scheme in its different aspects, the mere duplication of such evidence with the object of adding weight is unnecessary. The Commissioners propose that, where possible, there shall be only one local inquiry into both the area and the scheme for the district, and that this shall be the principal inquiry. When a scheme has been approved by the Commissioners as the result of such an inquiry, the proceedings at the further local inquiry required by Section 5 (1) of the Act should ordinarily be more or less formal or confined to specific points of controversy.

Enniscorthy.—Electricity Scheme.—The proposed electric lighting scheme for Enniscorthy was further considered by the Urban Council, when it was mentioned by the chairman (Mr. T. McCarthy) that the draft scheme prepared by Mr. McEntee, of Dublin, would cost £15,000, which, in his opinion, was too high, and would involve a serious loss. He suggested that Mr. McEntee be asked to prepare another scheme, to cost not more than £8,000 or £10,000. Mr Maher said the Wicklow scheme, for a town of about the same size as Enniscorthy, cost only £6,200. As regarded the Wicklow lighting area, Mr. Tobin said it was twice as large as theirs. It was ultimately decided to adjourn the matter for two months.

Fleetwood.—Peak-load Power.—At a meeting of the Council on November 16th the electrical engineer was empowered to interview power users with a view to obtaining a reduction of their consumption during the hours of peak load. The question of the terms and conditions for the future supply of electricity to the Blackpool Corporation for tramway purposes was referred to a sub-committee.

Harpenden.—Electricity Supply Agreement.—The Urban Council has sealed an agreement with the North Metropolitan Electric Power Supply Co., authorising the latter to distribute electrical energy within the urban district. It is hoped that a supply of electricity will be available for business premises by the end of the year.

Holmfirth.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £5,000 on account of £7,350 required in connection with the electricity undertaking.

India.—Hydro-Electric Project.—With the approval of the Government of India, the Government of Madras has sanctioned the grant, subject to certain conditions, to Messrs. Alfred Dickinson and R. D. Richards, on behalf of a syndicate formed of the above-mentioned gentlemen and Messrs. Balfour, Beatty & Co., Ltd., London, and the General Electric Co., Ltd., London, of a concession to utilise the water in the Pykara and Avarai Halla Rivers in the Nilgiris district for the generation of electrical energy for industrial purposes.—*Reuter's Trade Service* (Bombay).

Irish Free State.—Electric Lighting Orders.—Writing to the Kells Urban Council regarding a proposed electric lighting scheme for that town, the Free State Ministry of Industry and Commerce stated that it was obliged for the present to adopt the regulations in connection with Special Orders which governed the issue of Orders by the Electricity Commissioners in London. In the case of Kells, an inquiry was held some time ago, and the list of guarantees and other data had been received. The further procedure would be a little complicated, but, in the first instance, the Council would require to pass a resolution applying to the Ministry for a Special Order to enable the Council to generate and supply electricity.

London.—Battersea.—An explosion occurred on November 18th in a cable inspection box at the corner of Totteridge Road, causing interference with the supply of electric current for an hour. The heavy manhole cover was blown up, and portions of it smashed a number of windows and injured a woman and several children. Six persons were treated in hospitals for injuries arising out of the explosion.—*Morning Post.*

Lye.—Company's Obligations.—The Urban Council is communicating with the Midland Electric Corporation, reminding it of its obligation to lay mains in certain streets, and asking it to quote terms for lighting the main streets from Stambermill to the Hayes, the lamps to be affixed to the tramway standards.

Malvern.—Loan.—The Urban Council has applied for a loan of £3,500 for mains, sub-station, transformers, &c. The Council has received conditional consent from the Shropshire, Worcestershire, and Staffordshire Electrical Power Co. to supply electricity in the parish of Guarlford, which is in the company's area of supply.

Mold (Flint).—Electricity Order.—Application has been made to the Electricity Commissioners for an Order to authorise the Urban District Council to generate and distribute electricity within its administrative area.

Oxford.—Price Reductions.—The Oxford Electric Co., Ltd., has adopted the following reduced scale of charges for electricity:—Lighting, minimum charges of 12s. 6d. for each winter quarter for 15 kWh, and 8s. 4d. for each summer quarter for 10 kWh, next 250 kWh, 10d. per kWh; next 3,500, 6d.; next 2,000, 5d.; beyond, 3½d. Heating, 2½d. Motive power, first 2,000 kWh per quarter, 3½d.; beyond, 2½d. per kWh.

Weymouth.—Year's Working.—The report upon the working of the Weymouth and Melcombe Regis undertaking (engineer: Mr. G. Nicholson) for the year ended March 31st last records a total revenue of £29,467, as compared with £28,359 in the preceding year. Working expenses amounted to £22,810, as against £21,673, leaving a gross profit of £6,657 (£6,687). Capital charges absorbed £4,708, making the final result a profit of £1,949, slightly more than that of the previous year—£1,911. The capital expenditure during the year was £597, wholly taken up by mains and service. There was a slight decrease in the amount of energy sold, viz., from 1,202,591 to 1,173,056 kWh.

Yeovil.—Electricity Supply Scheme.—Messrs. Petters, Ltd., who obtained a Provisional Order for electric lighting, have informed the Town Council that all preliminary arrangements have been made for the formation of a company to carry out the scheme.

United States.—New York.—The largest turbine generator ever constructed in a single unit is now being built by the Westinghouse Electric & Manufacturing Co. for the new Hudson Avenue station of the Brooklyn Edison Co. The set will have a rating of 62,500 kVA, three-phase, 60 cycles, 13,800 V, at 80 per cent. power factor. The operating conditions

for the turbine will be 265 lb. steam pressure, 200 deg. Fahrenheit superheat, and 29 in. of vacuum. Two 70,000 sq. ft. surface condensers, probably the largest in existence, are also being constructed by the Westinghouse Co. for this new station. Each condenser will be served by two half-capacity circulating pumps driven by two-speed induction motors. The air-removal equipment will consist of Le Blanc air pumps and air ejectors. The ultimate capacity of the plant will be eight turbine-generator units. Distribution will be at 27,600 V. instead of at 13,800 V as in the other New York power plants, because of the difficulty of getting out sufficient circuits with the limited street space. The switch-house of the plant will use a vertical segregated phase arrangement of oil circuit breakers instead of the horizontal arrangement as at Hellgate and Calumet. Auxiliaries will be largely electrically driven, and a house generator will be used for supplying the essentials of auxiliary load. To ensure continuity of service a careful study is being made of the various systems of supplying power to auxiliary 'buses.—*Electrical News* (Toronto).

TRAMWAY AND RAILWAY NOTES.

Australia.—Victoria.—In connection with the work of converting the Melbourne suburban railway system from steam to electric traction, the Railway Commissioners anticipate that by the end of February all of the lines approved by Parliament in 1912 will be electrified, with the exception of the sections between Box Hill and Ringwood, and between Heidelberg and Eltham. The completed scheme will include the erection of the power-house at Newport with an installed capacity of 105,000 h.p.; the laying underground of 78 route miles of 20,000-V transmission cables, the erection of 51 route miles of overhead 20,000-V transmission lines, and the equipment of 346 miles of single track with 1,500-V d.c. conductors. In addition, 16 sub-stations, having a total installed converting capacity of 116,000 h.p., are being, or have been erected, and 710 motors and trailers fitted with electrical equipment. The electrified system, when completed, will comprise a total of 125 route miles of double track and 20 miles of single track.—*Reuter's Trade Service* (Melbourne).

Although the State Railways incurred a deficit of £19,100 during the 1921-22 period, this was the smallest loss for eight years. In 1914-15 the deficit was £842,436. The improvement is attributed mainly to the increased traffic brought about by electrification and the economies in working which resulted from the same cause. In the Railway Commissioners' report, abstracted in the *Industrial Australian and Mining Standard*, the following statement is made:—"The economic efficiency of electric train operation compared with steam locomotive working had enabled an average increase of about 35 per cent., as compared with the previous steam timetables, to be made in the total number of trains scheduled, the cost of which under steam traction would have been prohibitive, and the fast and frequent electric train service now provided during the slack hours had encouraged considerable additional traffic. On 95 route miles of electrified line, out of a total of 145 route miles, the extra traffic due to electrification (after allowing for the normal expansion that would probably have occurred had steam traction continued, and other factors) was valued at approximately £170,000 per annum, while the increase in the number of passenger journeys was estimated at 12½ per cent. Present indications were that the annual interest on the scheme will be offset by the increased traffic induced through the improved train service afforded by electrification. It was estimated that to run the present electric train mileage under steam conditions would require approximately double the quantity of coal now consumed at the power house to generate current for train operation. In addition, the coal for locomotives would require to be of a higher quality and would be relatively more expensive, while the advantage of the higher speed and the greater flexibility of the electric train would not be available under steam traction."

South Australia.—The report of the Adelaide Tramways Trust (municipal) for the six months ended July 31st, 1922, shows that the revenue amounted to £291,808, and operating expenses to £202,173, a gross surplus of £89,635. After the payment of interest allocations to reserve, &c., there was a net surplus of £30,092, making a total of £27,179 for the complete year.

Blackpool.—Year's Working.—The net profit on the tramways for the past year amounted to £6,132, against £144 in the previous year.

Darlington.—Year's Working.—There was a net loss of £2,016 on the working of the light railways during the past year.

Eston.—Railless Traction.—The Tees-side Railless Traction Board has applied for a Provisional Order authorising it to extend its system to Eston, and to empower the Middlesbrough Corporation and the Eston Urban District Council to borrow money for the purpose of the undertaking.

Glasgow.—Electrification of Subway.—The Town Council has decided in favour of the work of the electrification of Glasgow subway being let by contract as against by direct labour.

London.—"Underground" Extensions.—In addition to the large amount of work already arranged, the London "Underground" companies have drawn up further schemes of development estimated to involve an expenditure of £6,000,000. The main extension will be the continuation of the City and South London Railway from Clapham Common to Sutton, *via* Balham, Tooting, Merton Grove, and North and South Morden. This will give a continuous line from Edgware in the north to Sutton in the south. The Hampstead tube is to be extended to Waterloo and Kennington, by tunnelling under the river, and the line is to form a junction with the City and South London Railway at Kennington. The stations at Leicester Square and Piccadilly Circus are to be enlarged and improved, and additional facilities are to be provided at Waterloo. It is proposed to commence these works immediately Parliamentary sanction has been obtained.

Sunderland.—Wages Agreement.—The employés of the Municipal Tramways Department have agreed to accept reductions of 2s. in December and a further 2s. at the beginning of January. It is proposed to effect a complete revision in March next.

TELEGRAPH AND TELEPHONE NOTES.

Bulgaria.—Manufacture of Equipment.—By a Bill which has recently passed its first reading in the Bulgarian Parliament, the Government proposes to establish two companies to produce telephonic and telegraphic equipment for the State services. The capital of each is to be 5,000,000 leva, half of which will be held by the State. The object is to free the services from dependence upon foreign countries and to provide employment.

Opponents of the Bill state that the Government should have laid the matter open for international competition; and also that, in any event, the companies will produce sufficient material in three years to equip the whole of the projected services, and this work could easily have been provided for by the enlargement of existing State workshops.

China.—New Radio Stations.—Mr. Schwerin, president of the American Federal Telegraph Co., with four engineers, arrived at Shanghai on November 14th to begin the construction of a high-power radio station capable of transmitting messages round the world. His contract with the Chinese Government provides for subordinate stations at Kharbin, Pekin, and Canton. The Chinese Government is issuing bonds to cover half the cost, and will obtain possession of the stations in twenty years. The machinery is being made at Palo Alto, in California, and the construction of the buildings at Shanghai will be undertaken forthwith.—*The Times*.

France.—International Communication Conference.—The American Government is preparing for the general meeting of the International Conference on Electrical Communication, which it is expected will take place in Paris in the spring of 1923. At this general conference questions formulated and discussed at the preliminary conference held at Washington in October and November, 1920, will be taken up. Consideration of those questions at the Paris conference will be continued until an agreement has been reached by the representatives of all the Governments concerned. The American Government's preparations for the coming Paris conference are being made by an inter-departmental committee formed in Washington, consisting of representatives of the various Government departments which are directly interested in the questions to be discussed, and suggestions have been asked for by the Government from commercial interests and others whose experience in the use of the international telegraph service has brought to their attention certain phases of the question in which improvement should be made, or in which the service could be extended.—*Reuter* (Washington).

Radio Telephony.—Broadcasting.—The British Broadcasting Committee commenced a limited service at 6 and 9 p.m. on November 14th from Marconi House, the broadcasting station for the London area, call sign 2LO, wave length 360 metres, and the transmitter used was of 1½ kW. Transmission also commenced on November 15th from the Birmingham station that has been established at the Witton works of the General Electric Co., Ltd., by the Western Electric Co., Ltd. The power used is 400 watts and the wave length 420 metres. According to *The Times* Sir William Noble, chairman of the Broadcasting Co., intends that each evening there will be given a brief synopsis of the world's news, prepared by the four Press agencies acting together to supply the company with such a synopsis twice nightly. Then the Meteorological Department of the Air Ministry is supplying two weather reports. The first will be given directly the station opens, and the other between 9 p.m. and 10 p.m. In addition to this news there will be concerts, instrumental and vocal.

For the Manchester area the broadcasting station is at the Metropolitan-Vickers Electrical Co.'s Trafford Park Works, call sign 2ZY.

In addition to the above stations, on Tuesdays Writtle (Chelmsford) transmits messages between 7 and 8 p.m. on a 400-metre wave under the call sign 2MT, and between 3 and 5 p.m. on Sundays and 7 and 8 p.m. on Thursdays The Hague gives the *Daily Mail* telephone concerts on a wave length of 1,085 metres, the power being 400 watts and the call sign P.C.G.G.

Radio Telegraphy.—Automatic Transmission at Sea.—A memorable achievement in the history of radio communication has been placed to the credit of the Marconi International Marine Communication Co., Ltd., and the White Star Liner *Majestic*, which arrived at New York on November 14th. On approaching New York the *Majestic* cleared her Marconigrams to the Chatham (Mass.) radio station with high-speed automatic transmitting apparatus, this being the first time that automatic transmission has been used from a liner, and the innovation was made because of the large number of business and private messages which passengers on transatlantic liners desire to send when they are approaching the coast of America. Hitherto only hand transmission has been used by radio operators at sea, but the amount of traffic has recently grown so enormously on the *Majestic* that it has been found necessary to introduce automatic working. The *Majestic* is the first liner to be fitted in this way, and if the Marconi traffic on the other transatlantic liners increases to the extent it has done on the *Majestic* it is probable that they will also be fitted with automatic transmitters. The maximum speed of the automatic apparatus used is 240 words per minute.

Ships' Installations.—The Merchant Shipping, Prevention of Accidents: Safety of Life at Sea, Order in Council, November 3rd, 1922, has been issued (H.M. Stationery Office; price 2½d. post free), further postponing the coming into force of the Merchant Shipping (Convention) Act, 1914, until July 1st, 1923. The Act refers to the compulsory installation of radio apparatus on board ships.

South Africa.—Automatic Telephones.—The Union Government has given a £100,000 contract for automatic telephones to a British firm, says the *Daily Mail*, which explains that the award was made in spite of severe German competition.

Sweden. — Ships' Radio Installations. — The Swedish authorities are strongly enforcing a law prohibiting the operation of radio on foreign ships in Swedish territorial waters within ten nautical miles of a coastal radio station. Under the same decree foreign ships in Swedish harbours may not receive radio messages without the permission of the telegraph directorate.

Syria.—French Radio Co.—Under the name of "Radio-Orient," the Compagnie Générale de Télégraphie san Fils, Paris, France, has organised a subsidiary to handle business with Syria and other Asiatic countries.—*T. & T. Age.*

The Telegraph Service.—Cable Removal.—Post Office engineers have completed the removal, rendered necessary by coast erosion, of the English end of the Beachy Head-Dieppe cable to Eastbourne.—*Daily Mail.*

The Telephone Service.—New Scottish Exchanges.—At a meeting of the Postal Matters Committee of the Edinburgh Chamber of Commerce and Telephone Advisory Committee for Edinburgh recently a report from the district manager of the P.O. Telephone Dept. was received respecting recent telephone developments in the Edinburgh district. A new exchange, called "Museum," will be opened in Edinburgh, with 400 subscribers, to relieve pressure at the Central exchange, and afford more accommodation for new subscribers.

At North Berwick a new exchange has been installed in the Post Office and others have been opened at Ford, Greenlaw, and Longniddry, and new exchanges are under construction at Tarbrax, West Linton, and Kirkliston.

In the city of Edinburgh permission has been received to erect public telephone kiosks. The system of underground wires in Edinburgh has been greatly extended, particularly in the south of the city, and will enable new subscribers to be joined up with greater expeditition. An additional underground cable has been laid between Glasgow and Edinburgh, and is expected to be ready for use early next year.—*Scotsman.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Abertillery.—December 15th. Electricity Department. One 2,200-V, h.b. feeder, one 200-kW and one 30-kW converting sets, h. and l.p. switchgear; static transformers and l.p. switchgear, a.c. overhead and underground distributing system. (See this issue.)

Australia.—Melbourne.—December 20th. Victorian Railways. One 2-ton electric hoist.*

Perth.—January 17th. Postmaster-General's Dept. Telephone and telegraph apparatus, testing instruments, and protective apparatus.*

Barnes. — November 27th. Electricity Department. Turbo-alternator, with surface condenser and auxiliaries, rotary converter and transformer, h. and l.p. switchgear and connections. (November 10th.)

Brandon.—Electric mains in connection with housing schemes at Water houses and New Brancepeth Colliery. Messrs. Hays & Gray, architects, Wingate.

Edinburgh.—December 4th.. Electricity Supply Department. One 500-kW converting set. (November 17th.)

Glasgow.—November 28th. Tramways Department. 2,500/3,000 tons steel rails, B.S. Section No. 8; 500 tons fish-plates; 1,200 tons special section, 5-in. rail, and 21 tons fish-plates. Manager, Tramways Department.

Headington, near Oxford.—December 9th. Board of Guardians. Installation of electric lighting in the infirmaries, &c. (See this issue.)

India.—January 9th. Great Indian and Peninsular Railway Co. Electrification of Bombay suburban lines: Electrical equipment of coaches, overhead equipment of permanent way, and overhead distribution lines. (November 17th.)

Liverpool.—November 27th. Board of Guardians. Electrical supplies for West Derby Union. G. W. Coster, Union clerk, Union Offices, Brougham Terrace, Liverpool.

London.—H.M. Office of Works. December 1st. Electrical and mechanical labour in day work in the Liverpool district during three years from January, 1923. Contracts Branch, H.M. Office of Works, King Charles Street, S.W.

Barking.—December 19th. County of London Electric Supply Co., Ltd. Water-tube boilers for the Barking power station. (See this issue.)

Manchester.—December 4th. Electricity Committee. Two 2,500-kW, one 1,500-kW, and one 1,000-kW rotary converters, with static transformers; or, alternatively, motor converters, with switchgear, l.p. transformer, &c. Four 500-kW automatically-controlled rotary converters and static transformers; or, alternatively, motor converters, complete with the necessary switchgear and full automatic equipment. (November 17th.)

South Africa.—Johannesburg.—December 4th. South African Railways and Harbours Tender Board. Twelve months' supply of electric incandescent lamps.*

Malmesbury.—January 26th. Municipal Council. Electric lighting plant, including two 75-kW d.c. units, boilers, poles, battery, &c.*

St. Helier, Jersey.—Parish Assembly.—Concession for the establishment of an electricity undertaking to supply electrical energy for all public and private purposes within the Parish of St. Helier. (See this issue.)

Warrington.—December 11th. Electricity and Tramways Department. Motors. (See this issue.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

London.—The Edison Swan Electric Co., Ltd., has obtained contracts for the supply of incandescent lamps to the Admiralty, Air Ministry, and Post Office.

South Africa.—Electrification of the Glencoe-Pietermaritzburg section of the South African Railways. Further to our notes on p. 631 of the Electrical Review of November 3rd and p. 751 of November 17th. Contracts have been placed with the following firms:—

Turbo-alternators.—C. A. Parsons & Co., Ltd.
Boilers.—Babcock & Wilcox, Ltd.
Overhead equipment and cables.—Telegraph Manufacturing Co., Ltd.
Switchboard.—A. Reyrolle & Co., Ltd.
Automatic sub-stations.—South African General Electric Co., Ltd.
Automatic telephone exchange equipment for Maritzburg and Port Elizabeth (£100,000).—Siemens Bros. & Co., Ltd.

Yarmouth (Isle of Wight).—Town Trust. Accepted:—Electric lamps for the pier.—Mr. Tyler, of Newport.

FORTHCOMING EVENTS.

National Association of Supervising Electricians and Association of Engineers-in-Charge.—Tuesday, November 28th. At St. Bride's Institute, E.C. At 7 p.m. Joint lecture, "Where the Electrical Contractor and the Resident Engineer Fail Respectively When Dealing With Electrical Plant," by Capt. A. E. Penn and Mr. T. H. Windibank.

Greenock Association of Electrical Engineers.—Tuesday, November 28th. Visit Berryard's Sugar Refinery, Greenock. Wednesday, November 29th, at 22, West Stewart Street. At 7.45 p.m. Paper on "The Sperry Gyro Compass," by Mr. H. McComb.

Royal Society of Arts.—Wednesday, November 29th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "The Hot-wire Microphone and its Applications to the Problems of Sound," by Major W. S. Tucker, R.E. Monday, November 27th. At 8 p.m. Cantor lecture, "Brown Coal and Lignites," by Prof. W. A. Bone, F.R.S.

Electrical Trades Benevolent Institution.—Wednesday, November 29th. At the Trocadero Restaurant. At 7.30 p.m. Festival dinner.

Northampton Engineering College Engineering Society.—Thursday, November 30th. At the Institute, St. John Street, E.C.1. At 5.30 p.m. Paper on "Cinematography," by Mr. F. L. Best.

Chelmsford Engineering Society.—Thursday, November 30th. At the East Anglian Institute of Agriculture. At 7 p.m. Students' meeting.

Institution of Electrical Engineers.—Thursday, November 30th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Domestic Load Building. a Few Suggestions Upon Propaganda Work," by Mr. W. A. Gillott.

(North-Western Centre).—Tuesday, November 28th. At the Engineers' Club, Manchester. At 7 p.m. Paper by the late Dr. Kapp on "The Improvement of Power Factor," to be read by Prof. M. Walker.

(Liverpool Sub-Centre).—Monday, November 27th. At the University, Liverpool. At 7 p.m. Paper by the late Dr. Kapp on "The Improvement of Power Factor," to be read by Prof. M. Walker.

(North-Eastern Centre).—Monday, November 27th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Domestic Load Building. a Few Suggestions Upon Propaganda Work," by Mr. W. A. Gillott.

(Scottish Centre).—Saturday, November 25th. At the Grosvenor Restaurant, Glasgow. At 7 p.m. Smoking concert.

(South-Midland Centre).—Students' Section.—Thursday, November 30th. At 8 p.m. Visit to the Palais de Dance, Birmingham.

Junior Institution of Engineers.—Friday, December 1st. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Machines Used in Magnetic Separation," by Mr. H. G. Brown.

Electrical Power Engineers' Association (Southern Division).—Friday, December 1st. At the Institution of Electrical Engineers, Victoria Embankment. At 7 p.m. Lecture on "The Scope of Publicity in a Public Service," by Mr. J. W. Beauchamp.

British Electrical Development Association.—Friday, December 1st. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Second lecture on "Theory and Practice of Salesmanship in Relation to the Electrical Industry," by Mr. W. Attwood.

Institution of Mechanical Engineers.—Friday, December 1st. At the Institution, Storey's Gate, S.W. At 6 p.m. Thomas Hawksley Lecture, "Some Recent Researches on Lubrication," by Dr. T. E. Stanton.

London Electrical Engineers' Old Comrades' Association.—Friday, December 1st. At the Bridge House Hotel, London Bridge, S.E. At 7.30 p.m. Bohemian concert.

Association of Consulting Engineers (Incorp.).—Wednesday, December 6th. At St. Stephen's Club, Westminster. At 7 p.m. for 7.30 p.m. Annual dinner.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

To enable us to complete replies to queries received this week, we need the names of manufacturers or suppliers of :—

Porcelainite cement for fixing insulators to their supports.
The Chatterak telephone holder.
Helia Pressel switches.
Polarlite lamps.
Lissun insulating paper.

NOTES.

Model Engineers' Social.—An excellently-varied conversazione was organised by the Society of Model and Experimental Engineers at the Caxton Hall, Westminster, on November 15th. One of the most interesting features was an exhibition of members' work, in which patience and ingenuity were well represented. Among the exhibits were model boats and locomotives, miniature motors and dynamos, complete generating sets, wireless apparatus, and electric clocks. A number of firms of toolmakers and engineers also had displays, several small lathes of good design being present. Wireless apparatus was shown by Messrs. Leslie McMichael, Ltd., and Radio Instruments, Ltd. During the afternoon the Rouge Croix quartette rendered musical items in the Council Chamber, and after tea was served there were exhibitions of "magic" and a lantern lecture describing a motor tour through Kent and Sussex. From 7 to 11 p.m. dancing was the principal attraction, while for non-dancers a concert was given by a capable party in the Council Chamber. The arrangements were admirable, showing careful staff work on the part of the Secretary, Mr. F. H. J. Bunt, and his assistants.

Water Power in India.—At a meeting of the Royal Society of Arts (Indian Section) on November 17th, Mr. J. W. Meares, C.I.E., M.Inst.C.E., read a paper upon "The Development of Water Power in India." Sir Thomas H. Holland, K.C.S.I., was in the chair. In his paper Mr. Meares briefly reviewed the history of the subject, commencing with small developments in the Darjeeling district when water power was used both directly and electrically. Two of the original hydro-electric plants were still working. There were no further developments until early in the present century, when the Cauvery plant in Mysore was erected to meet the demands of the Kolar Gold Fields. The first Indian Electricity Act (1903) was drafted by Mr. Meares while electrical engineer to the Bengal Government, and two years later he was appointed electrical adviser to the Government of India. Several hydro-electrical schemes were brought into being during the first decade of this century, including that at the Mussoorie Hill station. In India difficulty is experienced on account of unforeseen floods, which may occur only once in as long as 90 years. A great landmark in the history of Indian water power was the commencement of the Tata Hydro-Electric Power Supply Co., which took the development of the Western Ghats water power in hand. The present Electricity Act became law in 1910, which, with its subsequent amendments, is acknowledged to be an up-to-date enabling Act with little red tape about it.

The first Hydro-Electric Survey was due to the foresight of Sir Thomas Holland, but owing to the ineptitude of the officials of local Governments it came to nothing, the information supplied being vague and useless. The first useful survey was commenced in 1918, and since then three reports (which have been reviewed in our columns) have been published. It is safe to say that at least 7,000,000 e.h.p. is in sight on the most conservative estimate, and on the basis of absolute minimum continuous power.

The inertia of local Councils has retarded development to an enormous extent by refusing to vote funds for the work. They appear to be quite content with their present state and look suspiciously on Western innovations.

Mr. Meares agreed with Mr. Arnall that the present interest rate of 4 per cent. allowed to be paid out of capital during the constructional period is not sufficiently attractive to capitalists and requires amendment.

The statistics of available power, &c., given in the Triennial Report (Elec. Rev., April 28th, 1922, p. 604) were summarised in the paper, and the speaker exhibited a map showing the distribution of water power in India.

In the course of his paper, Mr. Meares spoke of the lack of regard shown by the Government to the sanctity of contracts. He instanced a case where a number of engineers were engaged on a three-years' agreement, the Government promising to pay their passages out and home. After about five months it was found impossible to proceed with the work for which they were engaged, and so they were discharged with six months' notice, and the provision of money for their passage home was refused. He was glad to state, however, that upon appeal the Secretary of State ordered the payment of the passage-money for their return.

The chairman, in the course of some comments upon the paper, said that the coal deposits of India were being depleted to an extent which was causing grave anxiety. The exploitation of oil was increasing at a greater rate than the discovery of fresh sources. There was, therefore, an urgent need for water power development, but unless the Indians themselves supported hydro-electric schemes industry would ultimately fail altogether. He said that in all schemes irrigation systems would have to be studied, as any development might easily upset the carefully balanced formulæ.

Broadcasting and Acoustics.—In connection with the commencement of the official broadcasting service, a correspondent points out that one peculiar fact which has become apparent is that the acoustics of the room in which the transmitting apparatus is installed affect the actual transmission to an appreciable degree at times. A necessary preliminary to the obtaining of the best results will be the perfecting of the acoustic qualities of the transmitting room. Many things combine to make up the acoustic properties of a room—size, furniture, shape, &c. The transmitting room of one of the broadcasting stations now operating has a bare stone floor and bare walls. Worse conditions could not be imagined from the acoustical point of view. Though the reception from this station is splendidly loud, a great improvement in clarity and sonority of volume would be obtained by furnishing the room in the right way. At present there is a persistent ringing tone in reception, due undoubtedly to the heavy reverberation of sound waves in the transmitting room. This defect is very noticeable when strident music is being played. Numerous amateurs who have been receiving broadcast music at short range are experiencing difficulty in reducing the volume of sound to a comfortable minimum, especially when only head telephones are used. The loudness is sometimes painful and the usual methods of reducing strength are futile. One effective remedy, however, is to cut out reaction altogether. An aerial tuning inductance slightly larger than that designed for the actual wavelength concerned sometimes gives the desired diminution, and a large capacity condenser placed across the coil will facilitate tuning.

Automatic Train Control.—Lt.-Col. A. Mount, reporting to the Ministry of Transport upon an accident at Northampton (L. & N.W. Rly.), on August 26th, says that this was another illustration of the class of accident which would have been prevented by an automatic train-stop at the signal concerned. It appears that a passenger train shortly after leaving Northampton, ran into the rear of a goods train which had left the station some time before, derailing the brake van and four rear wagons. Immediately afterwards, an express goods train travelling in the opposite direction collided with the wreckage and its engine and front wagon were derailed. A further mishap was averted by the promptness of a signalman in pulling up an oncoming passenger train. Investigation established that the goods train with which the passenger train collided had been standing on the line for an hour after having been moved back past the "home" signal at Northampton. The signalman responsible for passing the passenger train through, was not aware that the goods train had been moved back, but he had put his signal at danger to hold up the train until a Northampton—Rugby fast train had passed. The driver of the former train failed to observe the signal, however, and ran on until his engine collided with the standing goods train.

The Electro-Harmonic Society.—The Ladies' Night concert, held at the Caxton Hall on Tuesday last week, was well attended, and proved very successful; Mr. Frank Gill, President I.E.E., occupied the chair, and there was a strong programme. Vocal items predominated, and perhaps it was partly for that reason that the only instrumental pieces—violin, 'cello, and pianoforte trios, by the Misses May—were especially appreciated. The new hall was more comfortable and homelike than that occupied last year, and with a little improvement in respect of attention to draughts should serve the Society well—in default of a larger one.

Russian Electrical Ploughs.—The Elektrozem is undertaking a number of experiments on a large scale with electric ploughs prepared by the Briansk works, in the district of Bogorod, where 250 dessiatines of land will be ploughed up. Experiments will be undertaken in other districts, as in the Government of Samara, where deep ploughing is required and where the land is very heavy, requiring careful ploughing for sugar-growing. Experiments will also be carried out in the Kostrom Government for grass-growing. At the same time, it is announced that a number of agreements are being drawn up for the electrical equipment of farms; and one with the Zootechnical Institute for similar equipment on the experimental fields at the station of Veschky on the Moscow-Windau Railway.

A "Wireless" Insurance Policy.—A radio. installation carries with it certain elements of risk, and is a very suitable subject for insurance, but there has hitherto been no special policy issued which completely covers the ground.

The Liverpool Marine and General Insurance Co., Ltd., has therefore issued a special prospectus which offers a policy at a moderate premium, covering the apparatus itself, including outside aerials and supports, to provide compensation for damage arising from numerous risks to which it is exposed, and also to indemnify the owner in respect of claims for compensation for personal injuries to or damage to property and goods of third parties, caused or alleged to be caused by breakdown of the aerials, supports, or any part of the installation.

Such claims arise in a variety of ways—to the outside aerial. standards or attachments, by lightning, storm, tempest, and malicious damage, and to the whole set by fire, lightning, burglary, housebreaking, larceny and other perils.

Third party claims are frequently a source of considerable trouble and may involve legal proceedings before a settlement is arrived at, and it is desirable to transfer the liability to an insurance company.

It is claimed that landlords will usually withdraw any opposition towards the erection of aerials on buildings on proof that the tenant is insured against damage to the building.

The object of the insurance is to provide, not against the inevitable, such as the wearing out of parts of the apparatus, but to afford provision for the multitude of risks, some undoubtedly serious, outside the control of the insured person.

Electrical Power Engineers' Association.—The fourth annual dinner of the South Coast Section of the Association was held at Brighton on November 11th. Mr. W. J. Jeffery (president) occupied the chair, and the guests included the borough electrical engineers of Brighton, Hove, Eastbourne, and Bradford, and members of local Corporation committees. Dr. Smith (Hove), in proposing the "Health of the Association," commended the excellent educational work it was carrying on, and made special reference to the high standard of the *Journal*. In reply, Mr. Jeffery said that their previous unorganised state was bad for the industry and for themselves. The Association had done much in the stabilisation of the industry. Mr. Cleary proposed the toast of "The Visitors," and Councillor Galliers (Brighton) and Mr. Bridges (Eastbourne) replied. The latter spoke of the importance which the Brighton undertaking would probably possess in the near future. Either Brighton or Hastings would eventually take over the Eastbourne undertaking. An excellent musical programme was provided.

Industrial League and Council.—The annual meeting of the above organisation is to take place on Wednesday, December 6th, at the Holborn Restaurant at 5.15 p.m. The annual dinner takes place at 7 p.m. The annual report for 1921-22 has just been issued.

Service Notes.—Major K. W. E. Edgcumbe, T.D., M.I.E.E., M.I.C.E., late of the London Electrical Engineers, has been appointed lieutenant-colonel of the new 11th Battalion A.A. Corps of Royal Engineers, from the 6th ult. Lieutenant-Colonel Edgcumbe was long associated with the London Electrical Engineers before the great war. He was promoted to field rank the month before the war broke out, and served in that rank and as temporary lieutenant-colonel. A number of subalterns who served with various electrical units, electric light companies, &c., in the war have been appointed to the Territorial Reserve of Officers. Amongst volunteer ratings called upon for instruction are some 50 petty officers to be trained as submarine detectors in the use of the very delicate apparatus employed therefor; also for instruction in radio telegraphy. Warrant Electrician F. R. Darley has been posted to the battleship *Emperor of India* on recommissioning from the 21st inst.

Dinner.—The annual dinner of the Apprentices' Association of the General Electric Co., Ltd., Witton, was held at the Magnet Club, Erdington, on November 21st. Many ex-members of the Association and ex-apprentices were present.

Fog Prevention.—Mr. Harris moved the following resolution at the meeting of the London County Council on Tuesday: "That it be referred to the Public Control Committee to consider and report how far fog in London is caused by the pollution of the atmosphere due to preventible causes; whether by a larger use of electricity for power and other purposes the atmosphere of London might be improved, and whether any and, if so, what further powers are required to deal with the emission of smoke in London."

Mission-airies.—Radio telephones and aeroplanes are to be used in hitherto inaccessible parts of China by missionaries of the Methodist Episcopal Church, says the *Daily Express*.

Electro-Farming.—A lecture on "How Electricity Helps the Farmer," is to be given on November 25th, at the Bedford Park Club, W., by Mr. H. A. Carney.

What is "Bulk" Supply?—The *Industrial Australian and Mining Standard* says that the Victorian State Electricity Commission defines the term "bulk supply" as either "an unusually large supply to a single consumer, or a supply to a distributing authority, such as a municipal council or a private corporation." This is the Commission's own definition of a term that is universally accepted as meaning a supply for re-sale, which is a very different thing. It has long been recognised by those conversant with the policy of the Commissioners that they have definite ambitions regarding distribution of electricity. If this definition is accepted, the Commission has authority to enter a district, otherwise unprotected, and supply any consumer, and thus undermine the commercial soundness of the undertaking, this eventually resulting in the taking over of distribution by the Commission. There is no explanation as to what is "an unusually large supply," and this also can be determined by the will of the Commission. There is evidence to lead one to suppose that the Commission at present regards a few kilowatts as "an unusually large supply," but this detail can obviously be adjusted at any time to suit circumstances as they arise.

Church Telephones.—Telephones for deaf members of the congregation is the idea of one of Eastbourne's preachers, the Rev. James Reid. He is installing in the pulpit of the Presbyterian Church a transmitter, which will carry his voice to receivers in the pews of those who need them. A committee is at present carrying out the plan, which has met with the enthusiasm of many who have hitherto found it impossible to hear, says the *Evening News*, a correspondent of which points out that while in Holland about 18 months ago he saw a similar arrangement at the church of Brock-in-Waterland, one of the "dead" cities of Holland.

X-rays from the Sun.—The French scientist, M. Henri Deslandres, director of the Paris Physical Astronomical Observatory, at a meeting of the Academy of Sciences in Paris appealed for international co-operation in a matter of great interest.

Rays of great penetrative power, including X-rays and radiations of high frequency, are known to be emitted by the sun and stars. The high-frequency radiations may give rise to signals which are received by radio equipment from time to time on the earth and have so far baffled the electrical experts.

These celestial radiations form only a very small part of the energy shot out by the sun and stars, but they possess many remarkable electrical properties. Some of their effects have been measured at an altitude of 30,000 ft (nearly 6 miles) and M. Deslandres suggests that these experiments should be repeated at several points of the earth at the highest possible altitude. Such experiments would be costly and the co-operation of the various nations would be essential to their success.

The Western Union Telegraph Co., North America, estimates that the disturbances connected with sunspots caused it a loss of £50,000 last year. It has, in consequence, decided to establish an astronomical section of its own to develop a system of precautions against sunspot disturbances.

Arrangements have been made with the United States Naval Observatory for a regular bulletin service on the condition of sunspots. In return for this service, the Western Union is preparing to collect information on a large scale on electrical currents, their strength and direction, and their apparent connection with sunspots.—*Daily Mail*.

The Marine and Small Craft Exhibition.—The Marine and Small Craft Exhibition and Congress began at the Royal Agricultural Hall on November 14th, and the exhibits, which fulfil every need of the yachtsman, included a collection of practical small craft. On the 15th inst. H.R.H. the Duke of York performed the formal opening ceremony by means of radio telephony from Buckingham Palace, and amongst the subjects dealt with at the Congress meetings was that of the "Equipment of Small Yachts with Wireless Apparatus," by Commander J. A. Slee, C.B.E., R.N. (Ret.) (Marconi International Marine Communication Co., Ltd.).

Amongst the exhibits of Mr. Geo. Spicer (Brentford) was a motor launch fitted with an aerial and a three-valve radio re-

ceiver by the Wilton Wireless Co.; he also showed two marine engines, a 25-h.p. Sterling and a 45-h.p. Kermath, both of which were provided with electric starters.

Messrs. Autoveyors, Ltd., had a large display of radio components, accessories, "loud-speaking" attachments, aerials, &c., suitable for use on small craft, punts, and houseboats; also cabinet type, valve, and crystal receivers, amplifiers, transmitters, &c., the firm being a distributing agent for nearly a dozen British manufacturers of radio equipment. In the centre of the hall a number of "loud-speaking" horns was suspended, and the firm demonstrated the reception of speech and music successfully.

Messrs. Edison Accumulators, Ltd. (London) had on view samples of all-steel accumulators, such as are used for ignition and lighting on small craft, for yacht lighting, and similar purposes.

Messrs. Dixon Bros. & Hutchinson, Ltd. (Southampton), showed amongst other engines a paraffin set coupled direct to a 1.5-kW generator.

The Langdon Engineering Works (Southampton) exhibited three sizes of petrol and paraffin electric lighting sets, the capacities being 1 kW, 11 h.p. at 35 V, and 14 A at 100/135 V, the generators being of various makes and connected direct to the engines.

The Evinrude Motor Co. (Eng.), Ltd. (London), showed two house-lighting sets, each being complete with a slate switchboard and a battery of accumulators. The larger "Madstrong" will produce 20 A at 40 V and 1,200 r.p.m., while the smaller "Evenlite" has a capacity of 500 W at 25 V and 1,000 r.p.m.

The London Electric Firm (Croydon) exhibited a petrol-electric generating set having an output of 500 W for yacht lighting, &c., in addition to a selection of searchlight and signalling projectors suitable for use on small craft that are fitted with electrical installations. The arc lamps are provided with a hand or automatic feed as required, or for lower voltages metal-filament lamps may be used. On this firm's stand, lamps, lamp-lowering gear, electric irons, kettles, stoves, and an electric soldering iron heater were to be seen.

The Electrically-propelled "Maryland."—Another record of the superiority of electric propulsion has been established. When returning from the Centennial Exposition of Brazil, the all-electric U. S. battleship *Maryland* made the 4,760-mile run from Rio de Janeiro to New York in ten days, seventeen hours, and fifty minutes, thereby breaking the former record.

However, the matter of eight hours' difference in running time by no means expresses the full significance of the new accomplishment, for this is revealed only on consideration of the vastly different weather conditions under which the two runs were made.

The best time of the *American Legion* was made in favourable weather; while the *Maryland* for nearly two days had to proceed against 75-mile-an-hour hurricanes. The violence of the ordeal is described in the *General Electric Review*, which points out that the high-speed endurance run of nearly 4,800 miles through tropical waters at an average sustained speed of 18.48 knots with a final spurt for four hours at 21 knots reflects especial credit on the engineer officers.

The chief importance of the voyage, so far as naval designers are concerned, lies in the fact that the *Maryland* is electrically driven and controlled and that the success of the run probably will determine that this form of power shall be utilised to operate many American battleships of the future.

"The long voyage provided an excellent test and proved that the *Maryland* can be handled with the greatest efficiency and economy," was Secretary Hughes' comment on the battleship's performance.

"I did not realise until this trip how superior the electric drive is to anything else," said Admiral Hilary P. Jones.

"The storm proved the value of the electric drive," said Captain Sellars. "That is automatically regulated, so no matter what seas we plough into the speed of the ship is maintained. During the storm we sometimes brought up against seas as if they were brick walls, but the *Maryland* went right through them. We only lost 0.8 of a knot at any time during the worst of the blow.

"When we ran up against seas that checked our way there was 8,000 more h.p. generated to bring the speed up to the normal 18 knots and keep it there. The automatic governor takes care of that, and all that is necessary is to set the motors at the desired number of revolutions, and they keep that speed. There is no racing, either, when the screws lift from the water.

"The ship picked up like a subway express; 800 yards from our anchorage we were doing eighteen knots."

While the foregoing enthusiastic comments were made with reference to her recent remarkable voyage, it is worthy of note that the satisfaction with her electric propelling machinery dates back to her builder's trials in June, 1921.

Cast Iron Research.—The British Cast Iron Research Association has published its first annual report, covering the year ended on June 30th last. It is stated that although there are 3,000 foundries engaged in the production of grey or malleable cast-iron in this country, only 202 of these have become members of the Association in spite of persistent propaganda. This is attributable in a large measure to the bad state of trade. The Council recommends the division of the country into sixteen foundry areas, each to have one representative on the Council for every hundred foundries. Sixty-six meetings of the Council and committees have been held during the year in Manchester, London, Sheffield, and Birmingham. Research, which is limited by finance, is being carried out in nine main directions. The year's work has included researches upon moulding sands and refractories, malleable castings, internal combustion engine cylinder castings, and shrinkage defects. Other ways in which the Association has been active include educational schemes, and the collection and arrangement of periodical information.

National Association of Supervising Electricians.—In continuance of this session's educational programme, the N.A.S.E. held a meeting at the St. Bride's Institute on November 14th, at which Mr. H. A. Hankey, of Marconi's Wireless Telegraph Co., Ltd., delivered a lecture on radio telegraphy and telephony, and demonstrated broadcast reception.

The fascinating nature of the subject attracted a very large audience, and the speaker had an intimate acquaintance with his subject. The lecture commenced with an explanation of the fundamental principles of the radio art, and by means of diagrams the nature of the types of waves employed was made clear. Mr. Hankey was very skilful in his method of steering a course between technicality and the elementary—a very difficult matter with such a subject. A number of lantern slides were exhibited, which gave an excellent impression of the magnitude which radio telegraphy and telephony have attained, views being shown of the Carnarvon and other large stations erected by the Marconi Co.

A special feature of interest was the description and views of the Inchkeith "radio lighthouse," dealt with by Mr. Franklin in a paper read before the I.E.E. last session. This is able to indicate the proximity and direction of a danger point to vessels at sea, by means of directional short-wave radio-telegraphy, over a range of about ten miles.

The lecturer dealt with the importance of the thermionic valve and explained its construction and action. The demonstration of telephonic reception was given with the aid of a simple single aerial, stretched from one end of the hall to the other, and a multi-valve receiver and loud speaker. The evening marked the commencement of official "broadcasting" from Marconi House, but owing to certain questions relating to copyright, &c., it was only possible to distribute items from the evening newspapers, during two separate half-hours. The result was very successful and speech was as clear as the present form of loud speaker allows.

The lecturer had numerous questions put to him by members of the audience, all of which he answered very satisfactorily. He said that the use of an insulated-wire aerial was of doubtful advantage judging by his own experience. He also expressed doubt as to the efficiency of a lighting installation when employed as an aerial.

The chairman, Mr. W. E. Highfield, in proposing a vote of thanks to Mr. Hankey, traced the growth of telegraphy and telephony and said that the radio art still had endless possibilities.

Atmospheric Energy.—In a letter to *The Engineer*, Mr H. R. Kempe works out the energy stored up in the atmosphere, on the basis that one cubic foot of air, expanding into absolute vacuum, could give out 5,188 foot-pounds. He finds that the energy contained in a layer of air one foot deep over the whole surface of the earth is 1.13×10^{23} foot-pounds, which is sufficient to produce 1,000,000 horse-power for 6,530,000 years.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Hon. Member.—At the meeting of the Institution on November 16th it was announced by the President that the Council had that day unanimously elected Prof. John Ambrose Fleming, M.A., D.Sc., F.R.S., of the Pender Electrical Laboratory, University College, London, an honorary member of the Institution.

Informal Dinner.—It has been arranged for members of the Institution to dine together informally on December 7th at the Engineers' Club. Members who desire to be present should inform the secretary as early as possible of their intention.

Liverpool Sub-Centre.—A popular lecture on "Broadcasting" was given in the Arts Theatre of the University by Mr. A. P. M. Fleming, C.B.E., M.Sc., to members and friends, totalling 625, on November 13th.

North-Eastern Centre.—*Students' Section.*—A meeting of the North-Eastern Students' Section was held at Newcastle on November 10th, when Mr. F. G. C. Baldwin, chairman of the North-Eastern Territorial Centre, gave the students an address on "Efficiency." Mr. W. N. Kilner was in the chair, and there were present 42 members and two visitors. The next meeting is on December 1st, when Mr. W. Owen will lecture to a joint meeting with the North-East Coast Institution of Engineers and Shipbuilders and the Mining Institution, on "Distortion in Wireless Telephony."

Scottish Centre.—At a recent meeting of the Scottish Centre, when Mr. A. S. Hampton, president, delivered his inaugural address, the subject dealt with was the economic aspect of railway electrification. Mr. Hampton pointed out that the electrification of railways had improved the position so far as short-haul traffic was concerned, and, generally speaking, the existing electric lines had adjusted themselves to paying their way and creating new traffic. Mr. Hampton also referred to the greater utilisation of the available water power in Scotland, and pointed out that there was a limit to the length of the transmission line and a point at which the advantage of the hydro-electric power station was wiped out. The lecture was illustrated with a number of lantern slides.

East Midland Sub-Centre.—At the third meeting of the 1922-23 session of the Sub-Centre at Loughborough, on November 21st, a paper was read by Prof. W. Cramp, D.Sc., entitled "Some Recent Research in Electrical Engineering," in the course of which the construction and use of a balance for the accurate determination of field intensity, reading to one line per square centimetre, was described, including the use of the balance to prove the Biot-Savart law. The effect on the characteristics of an induction motor of including in the rotor circuit extra self-induction, such as is the case when a machine is used as a synchronous induction motor was explained, as were also tests carried out upon the action of a new balance dependent upon a radio-active disk. A comparison was made of two commercial rectifiers, namely, (*a*) the Tungar rectifier, which depends upon the ionisation produced by a tungsten filament, and (*b*) the J. and P. rectifier, which depends upon purely magnetic and mechanical principles.

A new mine signalling system, designed by Mr. G. M. Havey, with the object of getting rid of the contact spark by making the circuit non-inductive by the use of a thermionic valve was described; also a method of measuring and recording the received signal strength in radio telegraphy, depending upon the measurement of the change in the anode current by means of an Einthoven galvanometer with a special balancing arrangement. The calculation of the eddy currents in the sheaths of single core lead-covered cables was dealt with. More accurate methods of predetermining the flux in the air path of a magnetic circuit were pointed out, and a comparison of these with older approximations was made.

Institution of Mining Engineers.—The thirty-third annual general meeting was held on November 16th and 17th. The re-elected president, Prof. Sir John Cadman, K.C.M.G., D.Sc., in his address, reviewed the progress of this branch of engineering, showing how the improvement of mechanical appliances in mining had multiplied the output and reduced the casualty rate. With the Institution of Mining and Metallurgy the Institution had decided to form an Empire Council of Mining and Metallurgical Engineering. The sister institutions in the British Isles and the Dominions would be invited to co-operate and become equal partners. The objects of the Council would be to promote safety and economy; to raise the professional status of the mining engineer; to convene periodical congresses, &c. The president was confident of the success of the scheme.

Birmingham and District Electric Club.—Members of the Club paid a visit to the Witton works of the General Electric Co., Ltd., on November 10th, and were much impressed with the resources of the works, and were particularly interested in the development and research laboratories and the new 22,000-kVA set under construction for the Birmingham Corporation. After the visit the usual monthly meeting was held, when there was an animated discussion upon the paper read at the previous meeting by Mr. F. R. Unwin, A.M.I.E.E., on 'Alternating Current Apparatus." The discussion centred largely on the question of unity power factor.

Chelmsford Engineering Society.—On November 9th a lecture on "Wireless Telephony" was delivered by Mr. H. M. Dowsett, M.I.E.E., chief of the Testing Department, Messrs. Marconi's Wireless Telegraph Co., Ltd. The lecturer lucidly explained various types of transmitting microphones and the latest type of transmitter which will be used at Marconi House for broadcast telephony. The interest of the lecture was considerably added to by lantern slides, which were specially prepared, included in which were slides showing the latest types of transmitters with their theoretical diagrams of connections, also receiver diagrams. The lecture concluded with a description of the various types of receivers suitable for the reception of telephony, and during the evening concerts from Writtle and Marconi House were heard with the aid of frame aerials and three independent loud speakers.

Radio Association.—A meeting of the trade section of the Radio Association was held at the Hotel Cecil on November 20th as a result of a previous meeting of the Association on November 10th, which was attended by a large number of radio manufacturers and traders. At that meeting the necessity for immediate steps to be taken in order to protect the special interests of manufacturers and traders were clearly manifested. The second meeting formulated a plan of campaign to attain this end, and discussed the best way of taking up with the Broadcasting Co. and the Postmaster-General such matters as are likely, it is said, to be a menace to the welfare of the radio industry of this country. The meeting was called to confirm resolutions passed at the previous meeting, to nominate additional members of the *pro. tem.* Committee (Trade Section), and to issue instructions to the committee for immediate action.

It was an entertaining meeting, says the *Daily News*. After Prof. A. M. Low and Colonel L'Estrange Malone had explained the object, members of a second body—the Wireless Manufacturers' and Traders' Association—protested that they had a committee which had been waiting for six weeks to meet the Radio Association. After a lively discussion the secretary of the Traders' Association virtually took the meeting out of the hands of the Radio Association, and an entirely new association was formed. Members of both the other organisations were recommended to join it at once. A committee was immediately appointed to draw up plans of action against what was described by a speaker as "the dictation of the Marconi people." A manufacturer then announced that yet another association for British manufacturers only would be in being in a week or so. After this the meeting broke up, leaving the elected committee in session. The amalgamation of the Wireless Manufacturers' and Traders' Association with the Radio Association was agreed to, the name of the new association to be "The Radio Manufacturers' and Traders' Association, Ltd., by guarantee."

Greenock Association of Electrical Engineers.—A large attendance of members greeted Mr. S. A. Stigant, A.M.I.E.E., when he read his paper on "Transformer Breakdowns." The subject was treated very fully, and numerous lantern illustrations of actual breakdowns, electric wave phenomena, graphs of mechanical stresses, &c., clearly demonstrated the lecturer's points. Protective devices and oils were also discussed.

Faraday House Old Students' Association.—The annual dinner of this Association was held at the Hotel Cecil on November 17th, Mr. P. V. Hunter, C.B.E., president of the Association, being in the chair, and amongst those present were:—Mr. Ll. B. Atkinson, Sir Tom Callender, Mr. R. S. Downe, Dr. W. H. Eccles, F.R.S., Dr. Ferranti, Mr. F. Gill, Mr. Haydn T. Harrison, Sir Ernest Hughman, Mr. R. W. Hughman, Mr. W. W. Lackie, Colonel Morcom, Mr. A. Page, Mr. G. W. Partridge, Mr. C. C. Paterson, Mr. G. Scott Ram, Dr. A. Russell, Captain H. Riall Sankey, Mr. A. M. Sillar, Mr. F. E. Smith, F.R.S., Mr. W. O. Smith, Sir John Snell, Mr. C. D. Taite, Mr. C. P. Sparks and Mr. C. H. Wordingham. The toast of "Faraday House and its Old Students" was proposed by Mr. Gill. Dr. Russell, in reply, stated that the College had a very successful year, and quoted interesting and instructive figures with respect to the war service students sent to the College by the Government, showing that the money had been well expended. Of 72 who had completed their training at Faraday House, 68 had been placed in appointments in the engineering industry, and four were now waiting to obtain posts. The College sports teams were flourishing, and although the theoretical course only lasted two years, yet several of the students took the London B.Sc. in engineering, two of them taking honours last year. They had also been successful in the open competition for posts in the Engineer-in-Chief's Department of the Post Office. He attributed much of their success to the wholehearted co-operation of the many important engineering companies and borough electrical undertakings to which the College is affiliated. Mr. C. D. Taite proposed the "Guests," and Sir John Snell and Captain Sankey replied. Finally, Sir Tom Callender proposed the toast of "The Chairman" (Mr. P. V. Hunter), who made an interesting and amusing reply. An excellent musical entertainment finished up a most enjoyable evening.

"Old Centralians."—A meeting of the Old Students' Association of the City and Guilds' Engineering College, Manchester Local Branch, and a smoking concert will be held at the Grand Hotel, Manchester, on December 1st, at 7.30 p.m. Tickets, 2s. 4d. each, may be obtained from Mr. J. P. Clifton, "Cargill," Springfield Road, Sale, or the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park.

Junior Institution of Engineers.—"The Development of Ball and Roller Bearings" was the subject of a lecture delivered by Mr. A. W. Macaulay at the Institution Rooms on November 10th. The lecturer commenced by referring to the recent contributions of Messrs. Palmgren and Heathcote, and, after briefly describing the progress of development and design of both types of bearings during the past 20 years, offered tentative suggestions for commercial tests. Four principal suggestions for the conditions under which the commercial tests should be carried out were (1) to submit the bearing to 100 hours' continous running under pure radial load at 1,000 r.p.m., with the intention of subjecting the balls and races to such a number of revolutions in a reasonable time as would just produce flaking from excessive fatigue, the result to be the average obtained from at least half a dozen bearings; (2) the test load to be twice the listed capacity; (3) the probable life under other loading to be derived from the cubic law, *i.e.*, the life at normal listed load (half test load) would be 800 hours, and so on; (4) these severe conditions representing an admission of a definite life to a bearing must be considered in relation to the majority of applications in actual service.

Appointments Vacant.—Switchboard attendant for the Newport Corporation Electricity Dept.; junior switchboard attendant for the L.C.C. Tramways Dept. (See "Official Notices" to-day.)

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also [illegible] tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Senator Mr. [illegible] who has been ill for the past three weeks, is still unwell and has been compelled to cancel all engagements for the remainder of this month.

It is stated that Mr. Neville Chamberlain, M.P., has resigned his seat on the boards of the Birmingham Small Arms Co., the Daimler Co., and Elliotts Metal Co. on accepting the office of Postmaster-General.

Mr. Taylor, who has just been elected Provost of Cumnock, after being a member of the Council for 16 years, took over in 1901, in partnership with his brother, the business of George M'Cartney & Co., which has added many departments to the business since the date mentioned, and is manufacturing the "Orb" electric switches. Provost Taylor has charge of the commercial side of the business.

Mr. A. F. Harrison, of the City of London Electric Lighting Co., Ltd., has been appointed a vice-president of the Chartered Institute of Secretaries.

Sir Robert Horne, K.C., M.P., who held the office of Chancellor of the Exchequer and various other offices in the late Government, has been elected a director and vice-chairman of Baldwins, Ltd.

The *Daily Dispatch* of Manchester announces that an important change in the personnel of the Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, has been made by the appointment to the chairmanship of Sir Philip Nash in place of Mr. J. Annan Bryce, who has been the chairman of the British Westinghouse Co. (now Metropolitan-Vickers) for a good many years, and is retiring on the ground of ill-health. "It is understood that Sir Philip will take an active part in the control of the company. Sir Philip Nash is one of the best-known locomotive engineers in the country. He was head of the Great Northern locomotive department, and from 1899 to 1915 chief in the same department for the East Indian Railway. He rendered valued service to the Ministry of Munitions, and in 1916 became Deputy Director-General of Transport in France. He is a member of the Institute of Civil Engineers, and holds distinguished Belgian, Italian, and American Orders for various services."

Mr. L. F. Bickell, city electrical engineer of Port Elizabeth, South Africa, is visiting Great Britain, and expects to arrive about January 8th. He requests that any communication be addressed to him c/o Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C.

Mr. F. T. Homan, chief assistant engineer to the Northampton Electric Light & Power Co., Ltd., has been appointed deputy engineering agent, Calcutta, to the Calcutta Electric Supply Corporation, Ltd.

The marriage took place on November 17th of Mr. Trevor F. D. Rose and Miss Irene Phyllis Hirst, younger daughter of Mr. and Mrs Hugo Hirst. In the large company at the reception in Claridge's Restaurant were Lord and Lady Ashfield, Major-General Sir Newton and Lady Moore, Lady Harris, Sir William Noble, Sir John Hewett, Sir Malcolm and Lady McAlpine, Colonel Grant Morden, M.P., Mr. Gordon Selfridge, Mr. and Mrs. A. W. Gamage, Captain Hughes Hughes, Mr. David Gilmour, M.P., Mr. and Mrs. Montague Armstrong, Mr. and Mrs. M. J. Railing, Dr. A. H. Railing, Miss Megan Lloyd George, Mr. and Mrs. Richard Jack, Mr. and Mrs. Llewellyn Atkinson, Mr. C. H. Wordingham, and Mr. J. S. Highfield. Altogether some five hundred guests were present. After the reception Mr. and Mrs. Rose left for a tour on the Continent.

Mr. F. A. Parnwell, assistant general manager of the Great Eastern Railway, has been appointed general manager in place of Sir Henry Thornton, who is going to Canada.

There were thirty-four candidates for the position of manager of the electricity undertaking in Portrush in succession to Mr. Grosse, who had resigned. At the Council meeting last week seven applicants were chosen, and the final selection will take place this week.

While seated in a train, returning from a meeting to his residence at Dundrum, Co. Dublin, Mr. L. Ball, chairman of the Dublin City Electricity Committee, was placed under arrest by Free State troops and conveyed to Wellington (military) barracks. It is not stated whether any charge has been made against him. Mr. McEntee, consulting engineer for many electricity schemes in Ireland, was taken into custody at the same time by Free State troops. So far as is known, no charge has yet been preferred against him.

Mr. W. J. Belsey, who has been manager of the British Thomson-Houston Co., Ltd., Glasgow office, since 1905, has been transferred to the [illegible] office at Rugby as manager of the marine department, and Mr. J. Miller has been appointed to succeed him as manager of the Glasgow office.

Mr. B. H. Jenkinson, senior partner in the firm of Jenkinsons, consulting engineers, Gray's Inn Square, W.C., has been elected for the second year in succession as Mayor of Hornsey. The Town Council at the same time elected him to the position of Alderman of the borough.

Obituary.—Mr. W. H. Smith.—Last week we referred to the death, after a long and painful illness, of Mr. W. H. Smith, who for many years was manager of the Liverpool branch of Simplex Conduits, Ltd. The large number of floral tributes sent, and the presence of many representatives of electrical firms at the church and the cemetery at Walton on November 9th, showed in what high esteem Mr. Smith was held throughout the electrical profession in the Liverpool area.

Mr. J. M. Henderson.—We regret to record the death, which occurred on November 20th at Aberdeen, after a very short illness, of Mr. John Macdonald Henderson, ex-M.P. for Aberdeenshire West (1906 to 1918). Mr. Henderson, who was a chartered accountant and was called to the Bar, was a director of various electrical companies, including Ferranti, Ltd., the South Lancashire Tramways Co., and the Lancashire United Tramways Co. He was 78 years of age.

Mr. J. B. Humphreys.—We regret to record the death, as a result of being knocked down by a motor car, of Mr. J. B. Humphreys, director and manager of Ferguson Superheaters, Ltd., of Kingsway, W.C. 2, with whom he had been associated for many years. At the inquest, the Coroner made some strong comments upon the danger of dazzling headlights, which were the cause of this fatality.

Mr. F. Worldey.—The death is announced, at the age of 72 years, of Mr. Frederick Worldey, who was for many years in business as an electrical engineer in Norman Road and Shepherd Street, St. Leonards, Hastings.

Wills.—The late Mr. W. C. Kelly, a director of the Barbados Electric Supply Co., Ltd., left £14,119.

The late Sir R. V. Vassar-Smith, the well-known banker, left £51,091 gross and £37,808 net personalty.

NEW COMPANIES REGISTERED.

Thames Valley Electric Supply Co. (185,597).—Registered on November 8th with a nominal capital of £100 in £1 shares. To carry on in Henley-on-Thames, Shiplake, Wargrave, Twyford, Sonning, and in other places in the rural districts of Henley and Wokingham, and in the counties of Berkshire, Buckingham, and Oxford and elsewhere the business of an electric supply company. The subscribers (each with one share) are:—W. May, 18, Austin Friars, E.C.2, solicitor; G. W. Spencer Hawes, Marlow Place, Reading, consulting electrical engineer; C. E. Howett, Station Road, Reading, solicitor; J. May, 76, Victoria Street, Westminster, civil engineer; W. Pole Smith, "Readlands," Reading, civil engineer; P. Dawson, St. Stephen's House, Westminster, S.W.1; Col. J. E. Broadbent, "Fynesbury," Reading. Registered without articles of association. No persons had consented to act as directors to November 7th. Solicitors: Slaughter & May, 18, Austin Friars, E.C.

Weldrics (1922), Ltd. (185,661).—Private company. Registered November 10th. Capital, £25,000 in £1 shares. To acquire the business of manufacturers of electrodes, electric welding appliances, &c., carried on at Inverness, as "Weldrics, Ltd.," to acquire the process for the manufacture of the "Corundel" abrasive wheel, the registered trade mark of which is 28,665.I in class 50, and to adopt agreements (1) with Weldrics, Ltd., and R. R. Callingham, the liquidator thereof, and (2) with W. H. Boorne. The first directors are:—A. W. Bullivant, 72, Mark Lane, E.C.; W. H. Boorne (managing director and technical adviser), A.M.I.M.E., M.S.C.I., Bush Lane House, Cannon Street, E.C.; D. C. Bowser, "Overdale," Dunblane, N.B.; T. H. Williamson, 9, York Place, Edinburgh; E. Chalmers, 9, Polwarth Terrace, Edinburgh. Qualification: £500. Secretary: N. B. Young. Registered office: Bush Lane House, Cannon Street, E.C.

Roberts Bros. (Engineers), Ltd. (185,656).—Private company. Registered November 10th. Capital, £1,500 in £1 shares. To acquire the business of electrical engineers carried on by Roberts Bros. & Holloway Ltd. (in liquidation), at Bradford. The subscribers (each one share) are:—A. Roberts, Cragg Cottage, Rawdon, electrical engineer; Mrs. M. A. Roberts, Cragg Cottage, Rawdon. A. Roberts is permanent governing director. Qualification: £1. Registered office: 3, Nutter Place, North Parade, Bradford.

West Kilbride Electric and Lighting Co., Ltd. (12,431).—Registered in Edinburgh November 9th. Capital, £6,000 in £1 shares. To carry on in the parish of West Kilbride or elsewhere the business of electrical engineers, electricians, contractors, &c. Minimum cash subscription, £3,000. The first directors are:—J. Newbigging, Seamill Hydropathic, West Kilbride, hydro manager; R. Barr, "Whinhurst," Kilbride, shipowner; J. H. Greenhill, "Ashfield," Kilbride, master joiner; W. Gray, "Drumailling," Kilbride, solicitor and bank agent; H. H. A. Greer, "Netherby," Kilbride, metal merchant; R. Guy, Alton Cottage, Kilbride, master painter; W. E. Mackenzie, "Redcroft," Kilbride, solicitor; J. G. Penman, 37, Bath Street, Glasgow, electrical engineer; L. D. Penman, "Dunallan," West Kilbride, architect. Secretary: Wm. Gray. Registered office: 75, Main Street, West Kilbride.

L. W. Douthwaite & Co., Ltd. (185,649).—Private company. Registered November 10th. Capital, £7,000 in £1 shares. To adopt an agreement with L. W. Douthwaite, and to carry on the business of electrical [illegible] merchants, manufacturers of, and dealers in electrical accessories, switchboards, meters, bells, batteries, &c. The first directors are:—L. W. Douthwaite, 8, Barkbill Road, Shipley; J. Barnes, 29, Norwood Avenue, Shipley. Qualification: £100. Registered office: 28, St. John Street, Bradford.

Institution of Engineering Inspection (185,645).—(The word "limited" is omitted from the title by licence of the Board of Trade.) Registered on November 10th as a company limited by guarantee. The objects are: To take over the assets and liabilities of the Technical Inspection Association; to promote and encourage the practice of inspection in engineering and allied [illegible] to the management is vested in a Council, the following persons having consented to act thereon: N. P. P. Sandberg, 6, West Eaton Place, S.W., C.E., president (director of Sandberg Sorbitic Steel Co., Ltd.); Lt.-Col. P. R. Embury, Carlton House, Tunbridge Wells, engineer (European representative Bethlehem Steel Co., U.S.A.); F. R. Wade, 87, Campden Hill Court, Kensington, consulting engineer (director, C. A. Vandervell & Co., Ltd., and C. A. V. Small Tools, Ltd.); A. E. Hadley, High Clere, Claygate, Surrey, chartered engineer (director, Victoria Falls and Transvaal Power Co., Ltd.) (past president); H. Gutteridge, 17, Victoria Street, S.W.1, inspecting engineer; D. Leechman, 35, Lee Park, S.E.3, barrister. Secretary: C. L. Wharton. The registered office is at Palace Chambers, Westminster.

Birmingham Radio and Engineering Co., Ltd. (185,631).—Private company. Registered November 10th. Capital, £1,000 in £1 shares. To take over, as from August 15, 1922, the business of electrical engineers carried on at Newhall Chambers, 8, Newhall Street, Birmingham, as "Wright and Co.," and to adopt an agreement with C. B. Richmond. The permanent directors are: R. W. K. Ward, 42, Dresden Road, Crouch End, N., engineer; C. B. Richmond, "Dovedale," Kinetic Road, Orton, engineer. Registered office: 8, Newhall Street, Birmingham.

Holmes & James, Ltd. (185,742).—Private company. Registered November 14th. Capital, £4,000 in £1 shares. To acquire the business carried on at 27, Freeman Street, Birmingham, as "Holmes and James," and to carry on the business of electrical and mechanical, motor and general engineers, manufacturers of electrical accessories, fittings and appliances. As the first directors are: H. J. Holmes, 64, Stoney Stanton Road, Coventry, electrical engineer; H. W. James, 52, Crompton Road, Handsworth, Birmingham, electrical engineer; S. J. J. Vaughton, 29, Mary Road, Stechford, Birmingham, electrical engineer; A. W. Ingram, 38, Hurlbetwith Road, Small Heath, Birmingham, C.A. (all permanent, subject in the case of the first three named to holding £150 shares, and in the case of the last named to holding £150 debentures). Qualification: 150 shares. Solicitors: Freeland and Peyton, 71, Temple Row, Birmingham.

London Electric Stores, Ltd. (185,651).—Private company. Registered November 10th. Capital, £1,000 in £1 shares. To acquire the business carried on by W. A. Hunt, G. V. Ormiston and A. V. Byng, as the "London Electric Stores." The first directors are: W. A. Hunt, 4, Courtfield Gardens, Ealing, W.; G. V. Ormiston, 3, Brookwood Road, Southfields, S.W.; A. V. Byng, 8, Kingsley Street, Lavender Hill, S.W. Qualification: £250. Remuneration as fixed by the company. Registered office: 23a, Oxenden Street, Haymarket, S.W.1.

Lamp Caps, Ltd. (186,691).—Registered as a private company on November 13th, with a nominal capital of £50,000 in £1 shares. The objects are: To carry on the business of manufacturers and sellers of and dealers in caps for electric lamps and other articles, instruments, apparatus used for, or in connection with electric lamps, electrical and general engineers, &c. The first directors are: H. N. Sporborg, 42, Hillmarton Road, Rugby, chief engineer British Thomson-Houston Co., Ltd., and W. T. Munro, 25, Elsee Road, Rugby, chief of production lamps department, British Thomson-Houston Co., Ltd. (nominees of British Thomson-Houston Co., Ltd.); J. Y. Fletcher, Wapshott, Chertsey, near Staines, director General Electric Co., Ltd., and C. Wilson, 80, Castlenau, Barnes, S.W., director General Electric Co., Ltd. (nominees of General Electric Co., Ltd.). The above-named companies have each the right to appoint two directors while respectively holding a third of the issued shares. So long as the said companies are entitled to nominate directors, they may alternately appoint a director in each year, the first being appointed by the General Electric Co. Remuneration (except managing director) as fixed by the company. The registered office is at Magnet House, Kingsway, W.C.2.

Mirror Silvering Patents Development, Ltd. (185,720).—Registered November 14th. Private company. Capital, £1,000 in 975 shares of £1 each and 500 founders' shares of 1s. each. To acquire the business of a mirror silverer, experimental laboratory proprietor, patentee, and owner of British and foreign patents in connection with "The Barnes Process" for silvering searchlight and other mirrors, electrical and general engineer, &c., carried on by A. M. Barnes at 118a, Holdenhurst Road, Bournemouth, as the "Mirror Silvering Patents Co." The permanent directors are: A. M. Barnes, Teinton Wood House, Grove Road, Bournemouth, electrical engineer; T. A. W. Other, 200, Old Christchurch Road, Bournemouth, solicitor. Registered office: 200, Old Christchurch Road, Bournemouth.

Richards Hardware, Ltd. (185,785).—Registered November 16th. Capital, £10,000 in £5 shares. To take over the business of a hardware factor and manufacturers' agent carried on by F. D. C. Richards at 2, Montpellier, Gloucester, as "Frank D. C. Richards." The first directors are: F. D. C. Richards, 2, Montpellier, Gloucester, hardware factor (managing and permanent director); V. H. Parsons, 36, Eastgate Street, Gloucester, ironmonger; J. C. Baker, 48, Foregate Street, Worcester, ironmonger. Minimum cash subscription, £35. No share shall be allotted or transferred to any person or corporation unless they are actively engaged in the ironmongery and electrical trades in Great Britain. Qualification: £300. Remuneration of managing director, £600 per annum. Secretary: L. Cope. Registered office: 2, Montpellier, Gloucester.

Health Machines, Ltd. (185,741).—Registered November 15th. Capital, £2,000 in 1,500 preference shares of £1 each and 10,000 ordinary shares of 1s. each. To carry on the business of electrical engineers, manufacturers of electrical apparatus and materials, manufacturing chemists and druggists, drysalters, &c. The first directors are: R. L. Urquhart, Tavistock Hotel, Covent Garden, W.; T. C. Hodgkinson, 35, Westcroft Square, W.C. Minimum cash subscription, 7 ordinary shares. Qualification: 100 shares. Remuneration (except managing director): £150 each per annum (chairman, £200). Registered office: 35, Westcroft Square, Hammersmith, W.

H. Maguire, Ltd. (185,714).—Private company. Registered November 14th. Capital, £1,000 in £1 shares. To take over the business of an electrical engineer carried on by H. Maguire, at 6, Witham, Hull, as "H. Maguire & Co." The first directors are: H. Maguire, 6, Witham, Hull; A. Gilboy, 346, Holderness Road, Hull, permanent director and chairman (director, Annisons, Ltd.). Registered office: 6, Witham, Hull.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cesco, Ltd.—E. Thomas, of Baltic House, Mount Stuart Square, Cardiff, appointed receiver November 9th, under powers contained in debenture dated March 2nd, 1922.

Hindhead and District Electric Light Co., Ltd.—Issue on November 7th, 1922, of £150 debentures, part of a series already registered.

China and Japan Telephone and Electric Co., Ltd.—Particulars filed of £20,000 debentures authorised by resolutions of November 28th, 1905, and October 24th, 1922, charged on the company's undertaking, property and other assets, present and future, the amount of the present issue being £37,500.

Super Welding Co., Ltd.—Debenture dated November 7th, 1922, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. S. Hughes, 10, Croston Street, Beswick, Manchester.

Carmarthen Electric Supply Co., Ltd.—Mortgage dated March 26th, 1921, to secure £1,000, charged on 8, St. David's Avenue, Carmarthen. Holder: G. Griffiths, Llain, Carmarthen. (Registered November 6th, 1922, pursuant to Order of Court.)

Whitstable Electric Co., Ltd.—Particulars filed of £10,000 debentures authorised October 27th, 1922, and covered by trust deed of even date charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Trustees: W. H. Reeves and A. Collar.

CITY NOTES.

Cape Electric Tramways, Ltd.

In their report for the year ended June 30th, 1922, the directors state that there was a profit of £90,700 and after providing for debenture interest, redemption, income tax, and taking into account the balance brought forward, a net credit balance of £90,700 remains. £15,000 has been paid to reserve, leaving £12,700. A dividend of 4 per cent. free of income tax, on the ordinary shares will absorb £2,457, leaving £13,033 to be carried forward. During the year the tramways carried 31,283,910 passengers, with gross receipts of £414,570, as against 29,773,587 passengers, with gross receipts of £397,124 in 1920-21. While receipts have advanced, expenditure has more than correspondingly increased. This is due to the greater amount that has had to be provided on account of the arrears of maintenance, which should have been undertaken in the past, and were postponed owing to the conditions brought about by the war, the subsequent difficulty in obtaining supplies, and the labour troubles which afterwards developed. The whole of these arrears will be made good within the next two years.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

The directors' report for the year ended August 31st states that the accounts show, after making provision for doubtful debts, &c., a net loss of £94,406. The balance brought forward from last year was £35,498, less dividend on preference shares paid in January and July £12,500, leaving £22,998, to which is added £75,000 transferred from reserve fund, making £97,998. Less loss as above £94,406, leaving to be carried forward £3,592. "The directors regret the loss incurred, which is due to two main causes, of which further depreciation in stock values is the chief one, and secondly, to conditions surrounding the tire section of the business brought about by intense foreign competition. To cover the loss on the year's work, the directors have withdrawn £75,000 from the reserve fund, leaving £140,722 to the credit of that fund and £3,592 to be carried forward. The board regrets that the payment of a dividend on the ordinary shares is impossible, but with a return to more normal conditions it feels confident that the company will once more be put on a dividend-paying basis. The warrants for the half-yearly dividend on the preference shares will be payable on January 1st, 1923. To the unanimous regret of the board, Major Darwin has resigned the chairmanship of the board of directors, as he desired to have leisure for other work not connected with business. The managing director, Mr. C. H. Gray, was unanimously elected to the chairmanship of the board of directors and Major Darwin to the deputy chairmanship." Meeting: November 30th, at 106, Cannon Street, London, E.C.

Western Telegraph Co., Ltd.—The revenue for the year ended June 30th, 1922, was £1,680,049 and the working expenses were £839,045. After providing £32,747 for debenture stock interest, and £260,709 for income tax, corporation profits tax, and final adjustment of excess profits duty, there remains £547,549, plus £128,739 brought forward. £250,000 has been transferred to the general reserve fund. Four dividends of 2½ per cent. each have been paid, amounting to £311,895, making a distribution of 10 per cent., free of income tax, for the year, thus leaving £114,392 to be carried forward. The company's cable steamer *Cormorant* struck some submerged wreckage and foundered off Rio Grande do Sul on January 24th, fortunately without loss of life. The Eastern Telegraph Co.'s C.S. *Sentinel* has been chartered to replace temporarily the lost ship.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Agricultural and General Engineers, 14 ordinary shares of £1 each, fully paid, Nos. 2,485,619 to 2,485,632, and 240,000 new 6 per cent. second preference shares of £1 each, fully paid, Nos. 28,321 to 268,320.

Bellows Magneto Co., 723 ordinary shares of 10s. each, fully paid, Nos. 252,892 to 253,614.

North Wales Power and Traction Co.—The accounts for 1921 show a profit of £14,315. £12,992 is deducted for interest on debentures and £250 for interest on loans, leaving a balance of £1,073. £659 is brought forward, making the total credit balance £1,732.

Siemens Bros. & Co., Ltd.—The directors announce that they are unable to make any interim distribution on the ordinary shares. A year ago an interim dividend of 5 per cent., free of tax, was paid.

British Electric Traction Co., Ltd.—The directors have declared interim dividends of 3 per cent. on the 6 per cent. cumulative participating preference stock and of 2 per cent. on the ordinary stock on account of the year ending March 31st, 1923.

Ever Ready Co. (Great Britain), Ltd.—Interim dividend at the rate of 7 per cent. per annum on both the preference and the ordinary shares.

Chloride Electrical Storage Co., Ltd.—Interim dividend of 5 per cent., free of tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The after-effect of the result of the General Election has been a little disappointing to most of the Stock Exchange markets, which had been looking for a revival in general business upon the return of a sufficiently large Conservative majority to enable Mr. Bonar Law to proceed with his policy. People not only in the Stock Exchange, but evidently throughout the country, had hoped that this would re-energise business, and impart a greater air of activity to the markets. Whereas what actually happened was that the activity of an hour or two became succeeded by quietude, which in its turn has been followed by a certain amount of profit-taking on the part of those who had bought stock in advance of the Election, and who have been turning it out at small profits. Various minor matters have contributed to the lack of new buying orders. In the electrical markets, the passing of the dividend on Siemens ordinary shares and the presentation of a report from the India Rubber Co. showing a loss of £94,000 for the year, have brought about falls, of course, in the shares of both companies.

As the second six months of 1922 draws to its close, it is becoming appreciated by a widening circle that the electricity supply companies have done exceedingly well, and that there is a very fair possibility of dividends showing an almost unanimous increase. In fact, from some of the talk in the market, it might be supposed that the companies are enjoying such a bumper year as would induce directors to distribute dividends which prudence might deem as indiscreet, considering the necessity that there still exists for the companies to establish themselves in impregnable financial positions. It is scarcely to be expected that 1923 will prove such a pleasant one for the companies as is the case with the current year. From this, it is not to be inferred that shareholders are advised to get out of their holdings at the present quotations, which, after all, are not over-valued. It is worth pointing out, however, that over-optimistic dividend anticipations receive no encouragement from those who are in the best position to know what is likely to happen. The market naturally keeps very firm, and the amount of floating supply diminishes week by week.

The Brompton & Kensington Electricity Supply Co. has sent notices to the holders of its preference shares, pointing out that proprietors have the option at any time of giving one month's notice to exchange each preference share for one ordinary share of the company. The Brompton directors intend to issue a notice shortly to the shareholders, inviting them to pass certain resolutions for the purpose of capitalising the reserve fund and part of the depreciation fund. After this, they propose to distribute a bonus of one new ordinary fully-paid share for each two ordinary shares now held by the shareholders. Preference shareholders have been given the opportunity for converting their shares into the ordinary before the necessary meetings take place, in order that they, the preference shareholders, should be able to participate in the bonus to be distributed to the ordinary. The last day for doing this was Thursday in this week, but if any preference shareholders have neglected to send in their certificate and consent, they should do so immediately, when it is possible that their application will be entertained.

St. James, South London, and London preference have each risen ¼. Kensingtons at 7¾ are 5s. up. Bromptons fell a similar amount to 9, the effect of the announcement of new shares evidently having been discounted in advance; the loss, however, was promptly regained. Amongst manufacturing shares, British Insulated are 9d. lower at 43s. 9d. India Rubber shares fell 2s. to 12s. 6d., on the issue of a report showing a deficit on the profit and loss account of £94,400. Last year it may be remembered the loss was £140,000 for eleven months, so present figures can be regarded as better. Siemens dropped to 21s. 3d., a fall of 4s. 6d. on the passing of the dividend, which a year ago was 5 per cent., free of tax. The announcement was not entirely unexpected, though few people had thought that the company would pass the dividend entirely. That the distribution might be cut was almost generally expected; indeed, it has been frequently hinted in these columns. The passing of the dividend altogether is a considerable disappointment. The company's preference fell to 28s. 9d., and the debentures lost a point at 88. Other manufacturing shares are tolerably steady. Edisons are 6d. down at 2s. 6d. Metropolitan-Vickers preference at 2⅞ are 1/16 lower, but the ordinary strengthened to 25s. 9d. No changes occurred in General Electrics. Edmundsons are harder at 36s. 3d. for the ordinary and 4¾ for the preference.

Home Railway stocks are better, with Metropolitans 4½ up at 60, and Districts a couple of points higher at 43½. Underground Electric ordinary rose 3½, and the income bonds to 87½. The tube companies are about to embark upon a very ambitious programme of extension, the reason for which is made obvious by the supposition that the company will expect to receive a Government guarantee for its new issues, in the same way as it has done lately in respect of the various 4½ per cent. debentures offered within the past few months. The Government is anxious for work to be provided for the unemployed, and therefore is giving favourable consideration to schemes of railway construction that will employ large numbers of men. The railway companies see their way to getting capital at a modest rate, and so both sides are suited. The 4½ per cent. Tube debentures stand at "par," the fully-paid being 93 in each case, but the supply of stock is becoming very limited.

Marconi debentures have risen to 3¼ premium. The shares show no change at 2 5/16. Canadian Marconi firmed up to 10s. Cable stocks are still heavy as a whole. Cuba Submarines, on the other hand, are 2s. 6d. higher at 7½. The Eastern group shows practically no recovery from the dull prices which prevailed this time last week.

British Electric Traction improved a trifle to 62½ on the declaration of an interim dividend of 2 per cent. actual. This is the first interim since the company became reconstructed. For last year, the full dividend was 4½ per cent., and the optimists hope for 6 per cent. in respect of the current twelve months. The feature in this section is the remarkable advance in British Columbia Electric stocks, the deferred gaining 5 and the preferred 7½ points. It is said that the company has received permission to retain, for another three years, the right to charge six cents for fares that used to be five cents, but so far as is known in the market, no official confirmation of this has come in. Readers of the Review who have taken practical interest in the stocks may well feel gratified in the way in which the prices have risen this year. Brazilian issues are all better, also, for which the reason is a sharp rise in the value of the milreis. Mexicans are fairly firm. Calcutta Tramways ordinary at 4½ show a small decline.

The rubber share market is steady, but idle. Iron and steel shares weakened a little on the passing of the final dividend by the Dorman Long Co. Armaments attract no particular interest.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Nov. 21. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	9½	—	£6 9 9
Charing Cross Ordinary... ...	8	9	7⅞	—	5 16 2
do. do. do. 4½ Pref. ...	4½	4½	4	—	5 12 6
Chelsea	6	6	6¼	—	4 12 4
City of London	14	14	2⅛	—	6 16 7
do. do. 6 per cent. Pref....	6	6	28/-	—	5 4 4
County of London	8	8	1⅛	—	5 11 ●
do. do. 6 per cent. Pref....	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7½	+ ¼	6 9 0
London Electric	3¾	4	3⅝	—	3 17 6
do. do. 6 per cent. Pref....	6	6	6¼	+ ⅛	5 17 1
Metropolitan	7	7	6⅞	—	5 7 8
do. 4½ per cent. Pref....	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9¼	+ ¼	6 9 9
South London	7	7	4¼	+ ¼	6 7 10
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	7⅞	—	6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	102	—	5 17 6
do. Def.	1⅝	84/6	28⅛	—	6 9 6
Chile Telephone	6	6	6¼	—	4 16 0
Cuba Sub. Ord.	7	7	7⅛	+ ⅛	8 17 10
Eastern Extension	10	10	19⅛	—	5 4 0
Eastern Tel. Ord.	10	10	190	—	5 5 3
Globe Tel. and T. Ord.	10	10	19⅛	—	5 4 0
do. do. Pref.	6	6	11⅜	—	5 5 0
Great Northern Tel.	24	22	28	—	7 17 2
Indo-European	10	10	35½	—	7 1 0
Marconi	26	16	2⅛	—	6 9 6
Oriental Telephone Ord.	12	12	2⅛	—	*5 4 0
United R. Plate Tel.	8	8	7⅜	—	*5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 3
Home Rails.					
Central London Ord. Assented ...	4	4	87	—	5 19 5
Metropolitan	1¼	2½	60	+4½	3 15 0
do District	Nil	1	43½	+2	2 6 3
Underground Electric Ordinary ...	Nil	Nil	3⅛	+ ⅛	Nil
do. do. "A" ...	Nil	Nil	7/-	—	Nil
do. do. Income ...	3	4	87½	+1	*4 11 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref. ...	6½	12½	88	—	7 11 9
do. do. 2nd Pref.... ...	Nil	5½	3⅞	—	7 2 0
do. do. 5 per cent. Deb. ...	5	5	85½	+1¼	5 17 0
Brazil Tractions...	Nil	Nil	50½	+1½	7 16 6
British Columbia Elec. Rly. Pcs. ...	5	5	80	+2½	6 5 0
do. do. Preferred ...	5	98/-	75½	+7½	*6 4 6
do. do. Deferred ...	8	124/-	89½	+5	*7 12 6
do. do. Deb.	4½	4½	76	—	5 11 10
Mexico Trams. 5 per cent. Bonds ...	Nil	Nil	76	—	6 11 7
do. do. 5 per cent. Bonds ...	Nil	Nil	47	+ ½	Nil
Mexican Light Common	Nil	Nil	21½	+1	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds	Nil	5	65½	—	7 14 6
Manufacturing Companies.					
Babcock & Wilcox	15	16	8½	—	4 18 6
British Aluminium Ord.	10	5	16/9	—	5 19 5
British Insulated Ord.	15	15	2⅛	—9d.	6 17 0
Callenders	15	15	2⅛	—	6 17 0
,, 6% Pref.	6¼	6¼	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	2/6	—6d.	Nil
do. do. 5 per cent. Deb. ...	5	5	64	—	7 16 4
Electric Construction	10	10	1⅛xd	+6d.	7 12 4
English Electric	8	8	15/0	—	6 7 0
do. do. Pref.	6	6	18/3	—	6 8 0
Gen. Elec. Pref.	6¼	6¼	21/9	—	5 19 6
do. Ord.	10	5	17/6	—	5 14 3
Henley	15	15	2⅞	+ ⅛	6 11 3
do. 4½ Pref.	4½	4½	4¾	—	5 9 10
India-Rubber	10	—	12/6	—2/-	—
Met. Vickers Pref	8	8	2⅞	— ⅛	5 14 9
Siemens Ord.	10	10	1⅛	—4/6	—
Telegraph Con.	20	20	26½	—	*4 13 6

* Dividends paid free of Income Tax.

SOME USEFUL ADJUNCTS IN METER AND INSTRUMENT WORK.

By G. E. MOORE.

Introductory: Concerning Practical "Tips."

In these days of specialisation, of automatic machinery, of mass production, the saying, "Every job its tool," might well be a truism. I do not wish to dwell upon the general aspect of this, but rather to draw attention to the personal factor when this is characterised by

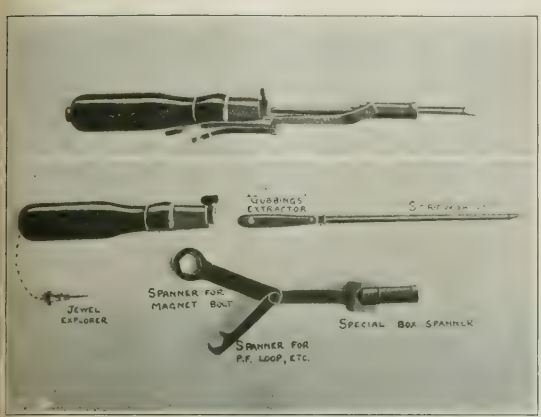


Fig. 1.—A Combination Tool.

"gumption." As one settles down in a particular sphere of activity, and the first suspicions and doubts give place to a deeper and more tolerant understanding, one begins to indulge in more or less practical criticism of the methods and means in vogue. This criticism may or may not represent an advance, and it is possible that any practical development will not meet with general favour; the point is that the personal factor is operating, and, operating, will inevitably at some time or other be the agent of real progress.

The personal factor, with its discernment and its modifying effects, forms quite a study. Trial and error, the instructive incidents of experience, a practical trait coupled with the precious knack of improvisation (of which I have dealt elsewhere in these pages) are all involved. Now, quite a lot of work-a-day knowledge is the outcome, and it seems to me a pity that such knowledge should ever remain parochial, so to speak; but here in Britain, owing not to a habit of secrecy so much as reticence, it does not appear to be "the thing" to pass on the useful little "tips" of practical life—at any rate in a broadcast way. I think that the mechanical side of engineering is luckier than ours in this respect, while the youthful amateurs and the formidable new army of wireless recruits are the best off of all! And one may add that, speaking generally, there is a marked reluctance in the British technical Press to reproduce the useful (and sometimes diverting) ideas published abroad.

In the U.S.A. there is, I think, a considerably more open and encouraging attitude towards the dissemination of practical hints, and although there is an element of slightly irritating publicity about some of it, I cannot conceive of aught but good resulting from such policy. The Electrical Review has on occasion invited practical articles, frankly hinting that writers need not hesitate because they doubt their own skill *as writers;* but this inducement has hardly been responded to as fully as it might have been.

Of course, owing to the fact that the personal factor discriminates, a practical hint is never acceptable to everybody. But it does not always fall upon stony ground of an unfruitful nature. With due provision, and a little hope that the principle has not set up too critical a flux, I propose leaving this matter in favour of a few little "gadgets" and the like which I have found useful. Their nature is indicated by the title, and they may be broadly, as well as specifically, useful. I have not had the temerity to label them "novel" because, although they are my own, I do not want someone to write up next week saying that *he* thought of so and so—oh, quite twenty years ago!

A Combination Tool.—This curious-looking appliance (fig. 1), the components of which provide all the separate tools required for routine adjustments, &c., of Metropolitan-Vickers a.c. meters, took a few months to evolve. I think it would be interesting to explain its genesis. As in many types of meters, the jewel-fitting which receives the bottom pivot of the disk movement consists of a brass screw fitted with a jewel passing through a short bracket and locked thereunder by a nut. The removal or adjustment of such jewel-fitting is almost always troublesome, mainly because one cannot ensure the screw and nut not affecting each other, and because replacement of the fitting is irksome. Such routine operations as these are usually carried out by means of a screwdriver and a box-spanner. It occurred to the writer that, by passing the screwdriver shaft through an axial hole in the box-spanner, it would be possible to have both tools in place at once.

After several forms had been made and scrapped (the first one was a puny affair two inches long), that shown in the first illustration was arrived at. A short length of silver steel was bored for the screwdriver shaft; at one end a larger hole was sunk, and the rod, whilst red-

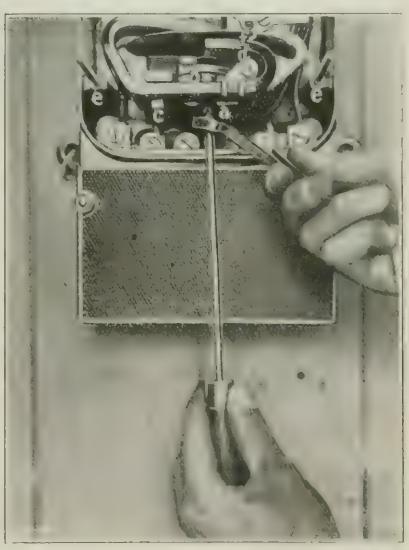


Fig. 2. Screwdriver-spanner Device in Use.

hot, was then forced at this end over a correctly-sized steel nut; a swivel handle was prepared, and the tool tempered.

In fig. 2 this screwdriver-spanner device is seen in use. At *b* is the bracket through which the jewel-stem is screwed, and the box-spanner *a* is there seen embracing the locking-nut. With this arrangement it is possible to slacken the locking-nut, adjust the jewel (and therefore disk movement) up or down, and then re-lock

without jeopardising the new adjustment: to remove the whole intact without dropping it; and to replace same easily by pressing the nut into the spanner, raising to the bracket and screwing home the threaded stem. The top pivotal arrangement (not shown) similar as regards the lock-nut, but not so susceptible to adjustment, can also be dealt with.

The next modification was the attachment of two other spanners to the swivel handle—these had always tended to be mislaid. Having proceeded thus far with the composite arrangement, it was really inevitable that the screwdriver should be altered, as shown, to include a needle for exploring the surface of jewels, and also a gubbings "extractor," "gubbings" being a local term for the filings, &c., which sometimes appear on the poles of motor elements and braking magnets).*

The uses of the combination tool may be summarised as follows, fig. 2 being kept in view:—

(1) Facility in adjustment of jewel-fitting *b* (and upper pivotal device) by special box-spanner.

(2) Nut *c* on each stem supporting meter cover gripped by sliding the special box-spanner down stem.

(3) Fixing-bolt *e* of magnet held by larger spanner.

(4) Locking-nut on clamping screw *d* (which varies magnet position), and retaining nuts of compensating turns on pressure poles, taken by smaller spanner.

(5) Removal of filings, &c., from all poles by means of knife-like form of "'gubbings' extractor."

(6) Use of screwdriver for jewel-stem, screw-head *d*, friction-compensator screw *f*, balance adjusters (in polyphase meters), dial screws, &c.; and

(7) Jewels examined by "jewel explorer."

Occasionally weightier tools are required, but for the average job and the particular make of meter it serves its purpose. Individually, the components are useful elsewhere. The combination tool shows what can be done when a large number of similar instruments or the like are in use; taken by itself, the screwdriver-spanner component may be found to have much more than a special application as heretofore described; while the screwdriver with the modified shaft and fitted with a jewel explorer forms another serviceable combination.

Handy "Link-Blocks."—Tests involving the use of instruments at some distance from the source of supply necessitate long leads, and at times (notably during generator trials with the machine on load and the leads connected to the current transformer secondaries) it is required to make a meter or instrument change without, of course, breaking the (secondary) circuit. This has been done either by a shorting wire at the terminals or by cross-connecting or twisting together bared portions of the leads. Such arrangement being rather crude, the writer fitted a link-block carrier as shown in fig. 3A.

* Elec. Rev., April 14th, 1922, p. 531.

The two leads run through a fibre block, the wire being bare inside the latter (refer to dotted lines) and gripped there by two screws; the projecting stems are fitted with nuts and a brass link, a wire ring at the top of each stem making it impossible for the nuts to drop off. The block can be suitably marked—that in the illustration, for instance, signifying that the leads in question are *blue* phase, one dot *incoming*, two dots *outgoing*.

This arrangement takes up little room, was cheap and readily made, is effective, and robust enough for the somewhat rough usage. In this particular case the potential reaches only a few volts, and there is hardly need for covering insulation beyond, occasionally, a few turns of tape. But, if required, a suitably-insulated pattern can be adopted. A further useful modification lies in link-blocks similar as regards the short-circuiting fitting, but provided with terminals for ready insertion into any temporary circuit where they may be of service.

Safety Holders for Needles.—I bring in the term "safety" because needles and the like used for the examination of jewels are apt not only to lose their points if unprotected, but, if carried about the person, liable to be a source of anguish—nay, worse, should they be housed in a waistcoat-pocket near the duodenum! A pocket scribe [illegible] a useful makeshift, but the writer

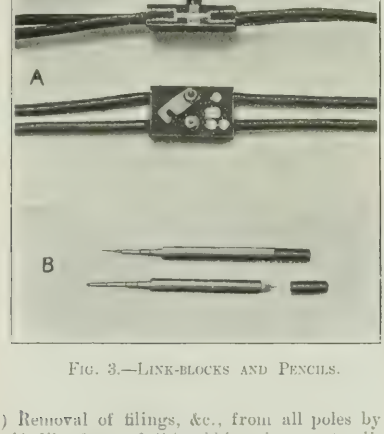


Fig. 3.—Link-blocks and Pencils.

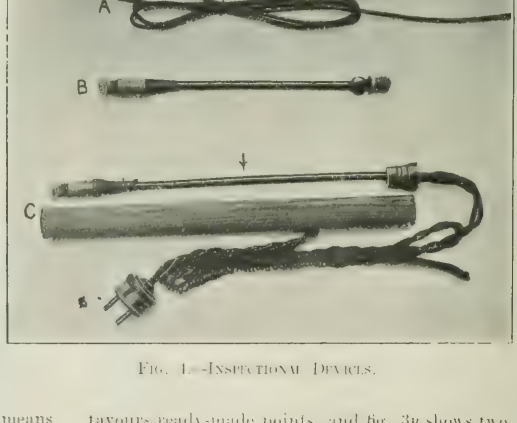


Fig. 4.—Inspectional Devices.

favours ready-made points, and fig. 3B shows two "disappearing pencils" adapted for use in this respect.

In the upper one the pencil itself has been replaced by a gramophone needle, a spare one being kept in the covered recess at the other end of the holder; rotation of the holder causes the needle to vanish inside it. The lower example in the figure shows the pencil retained and a needle mounted at the recessed end—a rather useful combination. The safety needle-holder has incidentally been useful in other ways—*e.g.*, pricking positions on charts, thermo-couple curves, &c. (The pencil-holders shown cost sixpence each, and are quite serviceable, but much more elaborate and costly ones, equally suitable for modifying, may be bought. No doubt these will appeal to the enthusiastic tyro and to the wealthy members of the fraternity!)

Miniature Inspection Lamps.—No matter how strong or diffused the light, or how deft one's arrangement of mirrors, one often cannot see into or illuminate just where one desires. Fig. 4 illustrates some forms of inspectional devices which are flexible and carry tiny lamps. Type A was mainly designed for a variety of instruments, and consists of a long length of sleeving carrying flexible wires running to a small pea-lamp. Type B is much more robust, can be packed away in one's tool-bag, and is intended to be screwed into a pocket-lamp case; to the screw for the latter operation is attached a short length of Bowden-wire tubing,

through which run the flexible wires to the miniature lamp fitting at the other end. Type C is a test-bench modification of the latter, the Bowden tubing (shown by arrow) being somewhat longer and attached to a two-yard length of twin flex, terminating in a miniature two-pin plug; when not in use the lamp is stowed away in a thermometer case (shown) and retained by a stopper.

Types B and C were primarily intended for the internal examination of meters; for the measurement of tooth-depthing and the showing-up of a filing on a pole (a filing here has been known to have a ratchet effect upon the disk), such inspectional lamps are very useful. With ordinary care they are found robust enough, the limit of breakage being decided not by the glass bulb, but by the filament. Due regard must be paid to the voltage (the usual 3-4 V); maximum illumination is not always desirable, and a $\frac{1}{2}$ to 1 V drop in the leads or a resistance is a happy arrangement.

Removing Dust, &c.—The removal of dust and the like is often a matter of grave concern. Two improvised ejectors have proved useful. The first one involves the use of an ordinary bicycle pump. In addition to the probing quality of the flexible connector, there is the advantage of a concentrated blast of air of considerable force. And it is *dry*. The efficacy of the bicycle pump in this respect was first shown on kinematographic machinery, one interesting example being in the removal of odd particles of dirt from the gate of a projector; whilst a film, especially an uncleaned old one, is being screened, particles collect in the "mask" and are thrown on the screen in magnified form, but in an open type of projector a fierce puff from a bicycle pump generally dislodges the substance without interfering with the "picture" in any way.

The second of my two expedients was discovered in a laboratory where some electrical exhibits were on view; a sudden demand arose for a steady current of air which [illegible] was borrowed and provided a blast of air of moderate force—hot or cold at will. An additional advantage with this apparatus is that it can be held steady with one hand and the current of air directed with accuracy



Fig. 5.—Electric Hair Dryer.

a difficult operation when (as in the case of the bicycle pump or similar source of air) both hands are in use. The electric hair dryer has been found particularly useful with statical instruments, &c., under laboratory conditions, for here, while general drying-out is often difficult to obtain or retain, there are instances where a temporary local effect suffices; this is given by the hair dryer, with the heater turned on.

Such apparatus would be more useful still if a stronger air current were available, with, possibly, a variety of nozzles—one at least similar to the flexible connector of a bicycle pump.

THE DEVELOPMENT OF ELECTRICAL ENGINEERING IN THE FAR EAST

By C. A. MIDDLETON SMITH, M.Sc., &c. (Taikoo Professor of Engineering and Director of the Engineering Laboratories and Workshops in the University of Hongkong).

(*Concluded from p.* 698.)

The Great Struggle.—It is, of course, impossible for the reader who has never been east of Suez to realise the amazing variety of peoples and the remarkable conditions of life in the Far East. This British port of Hongkong is the distributing centre for goods which go to nearly all Far Eastern ports, including those in the chain of islands to the south—Borneo, Java, Sumatra, &c. These tropical areas are being developed by the white man and the ubiquitous Chinese. It would be difficult to calculate the millions of tons of oil that have been exported from those islands, but the activities of the Asiatic Petroleum Co. are greatly in evidence all over China. In the development of the vast oil fields of the islands to the South of Hongkong much machinery has been used. They are aware of the value of the hydro-electric schemes that have stimulated industry. Factories for utilising native products are springing up. The mineral and agricultural wealth of those wonderful islands is being developed for the benefit of all humanity. In that development the industrious and persevering Chinese is playing a most important part.

Adjacent is the Malay Peninsula, with its tin and its tropical vegetation. Just now it is depressed, because of the rubber slump, but there is still British enterprise and the persevering Chinese. During the last few years a most successful coal mine has been opened, and there is a great project for a water-power scheme for a general supply of electrical energy. If we suggest that the Federated Malay States is, just now, less flourishing than four or five years ago, we must also state quite emphatically that the engineer has absolutely transformed it, and that parts of it have been made most productive. Electric power, the railways, and the splendid port facilities at Singapore, are but the beginnings of what must come in the near future; already great areas of the jungle have been made fertile, and much capital has been profitably invested in British machinery.

Its near neighbour, Siam, is also changing. Last week one of our Hongkong engineering Chinese graduates, at work in Siam, called to see his old teachers. He told us, with justifiable pride, how he had been helpful in replacing man-power by machinery. In that country the Chinese are the men of commerce, and at last it has dawned upon the minds of these men that machinery multiplies profits.

Coming northwards we have signs of progress in French Indo-China. And then we come to that vast country called China. It stretches from the tropics to the far-away north, where in winter the snow lies deep; it contains about 400 millions of a race second to none in industry. It is a people becoming galvanised into industrial activity by European and Japanese engineers; it is a people essentially peaceful and good tempered, and it is a country that has been made poor by parasitic officials, but one that will be made wealthy by modern inventions and the practical common sense of its merchants and artisans.

Currency Difficulties.—China is cursed, not only by its parasitic officials, but by a complicated silver currency. It might be supposed that a silver dollar in China was of the same value whether in Canton, Hankow, Shanghai, Tientsin, or Hongkong. Unfortunately

that is not so. Hongkong dollars may be at a 5 or 10 per cent. premium or discount in Shanghai. The Shanghai dollars vary in value with the dollar in Tientsin, and all of these dollars vary daily as against gold. Before the war, for a few years, the Hongkong dollar fluctuated from about 1s. 10d. to 2s. 1d. The war sent it down to below 1s. 8d., and then began the amazing rise which, early in 1920, reached the figure of 6s. 2d. Now it is about 2s. 6d. The currency unit for the Maritime Customs is the tael, a weight of silver of specific fineness. The value of the tael varies in almost every town. Decidedly one must have some experience of Chinese currency, or have agents who understand it, to do business in China. Speaking roughly, it is reckoned that the Customs tael is usually about 40 per cent. in excess of value of the Hongkong dollar.

The Customs returns for the last ten years have shown a steady increase in the import of machinery. The Statistical Secretary, in a recent report, says:—"The demand for all kinds of machinery, machine tools, and engineering goods is steadily growing, and inquiries are more and more received from remote places in the interior." Concerning electrical equipment, this report is most optimistic, as the following quotation will show:—"'Electrical Materials' is another interesting and suggestive heading. The demand for electric lighting in most cities altogether exceeded the supply, and existing plants were heavily overloaded, with the result that influential merchants and shopkeepers in the various cities purchased small electric lighting sets for the lighting of their own shops and perhaps two or three adjacent premises. These small sets were supplied almost entirely from America. There is a tendency in the more important establishments to install larger units, and while a few years ago 200- and 400-kW sets were considered large, it is now quite common to install units of 1,000 kW and upwards, and it is reported that a large number of orders had been placed for privately-owned power stations for the purpose of supplying power to cotton and flour mills. This increase in the amount of machinery installed has, of course, stimulated the demand for electrical accessories, fittings, and lamps. Japan has captured the lion's share of the business in accessories, especially in the cheaper kinds; America has the largest share of the better-class fittings and glassware; while in lamps the market is practically monopolised by the large factories in Shanghai and by Dutch and Japanese manufacturers. The importation of electrical materials into China amounted to 2.3 million taels in 1913, five millions in 1919, and 6.3 millions in 1920."

Readers of this journal are acquainted with the remarkable growth of the Shanghai municipal electrical undertaking. There are only three or four stations in Great Britain with a bigger capacity. Since 1919 the Hongkong Electric Co., Ltd., has placed orders for three sets of 5,000 kW each. Shanghai is typical of what will happen in other places. It is the inevitable industrial transformation of China that will lead to an increasing demand for electrical machinery. The financial aspect of engineering contracts in China demands consideration, but the profits are there. In these changes it is believed that the engineering graduates of Hongkong University will play an important part. Their ability cannot be questioned, as their work has been referred to and praised by examiners in the University of London. Most encouraging has been the recent offers by British firms to take these Chinese graduates into their English works, at a living wage. They should receive just the right experience that will make them useful representatives in the Far East.

A Cycle of Cathay.—The years have, indeed, brought great changes to the Far East. There were very few European engineers out here in 1872. Now there are thousands of well-trained European and native engineers at work. The most rapid change has been in Japan, but China is now most anxious to acquire a knowledge of machinery. Particularly does electrical engineering attract the young Chinese. If we try to picture the Far East of fifty years ago we find it impossible. Very few Chinese spoke English, very few Europeans spoke Chinese; it is improbable that a half-a-dozen Chinese, out of a nation numbering 400 millions, had ever heard of the idea of either mechanical or electrical power. Fifty years ago Hongkong was just emerging from the struggles of its precarious infancy. Not long ago we celebrated the jubilee of our most ancient engineering works—the Hongkong and Whampoa Dock Co. We are only 80 years old as a British Colony, but in that short span we have grown from a pirate's haunt to the biggest port in the world. In 50 years our population has increased ten times, our revenue in a much greater ratio.

Fifty years ago there was not in the whole of South China, outside of Hongkong, a vehicle with a wheel; and in Shanghai, so far as we can picture the place, the Chinese used wheels only for their weird-looking wheelbarrows, although some of the Europeans had imported carriages.

Fifty years ago, but for the life in the tiny outposts of Singapore, Hongkong, and Shanghai, and the stirrings in Japan, caused by the glimmerings from the foreigners' torch of science, the hundreds of millions of humans in the Far East were living life as it had been lived since the dawn of history; the routine of at least 45 centuries went on as the unchanging cycles of Cathay succeeded each other. And then the torch of science grew stronger and stronger and was brought nearer and nearer. Gradually, by reason of its brilliance and its invigorating rays, it has affected, however remotely, almost all of the inhabitants of Japan, China, Siam, and other countries in the Far East.

First Impressions.—A cycle of Cathay is 60 years—this national cycle was instituted B.C. 2637. If you glance over the records of the past you will find evidence of Chinese ingenuity and industry, but always you will find the tendency to isolation. That tendency has gone, so far as the individual is concerned. The native of the Far East is by no means content with his country as it is; he has definite desires to see the countries of the West, and especially to see the latest inventions and conveniences to be found in those countries. He wants to copy them. The peoples of the Far East have at last awakened to the knowledge that applied science will be of enormous benefit to them.

At first, on arrival, the Western engineer is greatly disappointed with the Far East. It seems incredible that in all of South China, outside of Hongkong, there is scarcely a road. Yet inland there is machinery that has been carried for miles on bamboo poles by coolies, or taken along the waterways by junks towed by fussy little steam launches or motor-boats. For the first years out here the engineer will be impatient. He is so anxious to accelerate progress. It is only when he has had experience and looks back over a period of, say, ten years that he realises that, for all his impatience and the still great contrast between East and West, there have been changes.

The New Japan.—The most amazing change, for rapidity unequalled in the history of the world, has been the change-over of Japan from an entirely agricultural to an industrial country. In that transformation the British engineer has played the most prominent part. The great pioneers were Ayrton, Perry, Ewing, Dyer, Milne, and the other British who taught the youth of Japan applied science. To-day Japan has enormous shipbuilding yards, thousands of factories, electric railways, and countless hydro-electric installations. Many millions of pounds' worth of British machinery has gone to Japan to help in the work of the new civilisation. A month ago it was announced that the English Electric Co., Ltd., had secured an order for electric railway plant for Japan exceeding £500,000 in value. Turbines and surveying and electrical instruments, and almost every product of British engineering factories are exported to Japan. The timid talk of Japanese industrial competition; the bold engineer adventurers are out in Japan

booking orders. For they know that trade is the life-blood of the modern world, and trade in engineering products is impossible with a country that is not developing its natural resources.

At the end of 1920 the total electrical power developed by hydro-electric companies in Japan was 1,254,000 kW. The total power licensed for development by these concerns was 2,756,000 kW. Many millions have been invested in hydro-electric works. The Yokohama electric railway is but one of several electric railways in the country, but it has made the district between Tokio and its port "one long industrial village."

The European war caused considerable industrial development in Formosa. The Japanese have certainly pushed ahead with engineering projects in that large island, which was practically undeveloped when under Chinese rule. The Formosan Government has the supply of electricity under its own control. In 1917 there were four hydro-electric schemes in working order averaging from 3,000 to 4,000 h.p. each. In 1920 a semi official limited company commenced work on the Lake Candidius scheme, which will give a maximum of 100,000 kW. Labour in Formosa is plentiful, and on constructional work is paid at the rate of about 2s. 6d. a day. Another company has 7,500 kW, for which a contract has been let. The locality is so favourable that the cost of erection of the installation is about £50 per kW.

The development of the huge tracts of agricultural lands in Manchuria, where the Japanese control the railways, has been phenomenal. In these vast agricultural districts the mechanical and the civil engineer do the pioneer work, but the demand for electrical machinery inevitably follows.

The Future.—There are the young men "out from home" who come to the Far East to join a business firm, hoping to make a fortune in about seven years, and then retire in affluence. They are disappointed; but, if industrious, they usually retire in due course quite well off. Sometimes, by lucky speculations, they do make wealth quickly. There are the representatives of engineering firms; sometimes they know little about the technical details of the goods they wish to sell and usually they know nothing of China and the Chinese. They also become disappointed, finding that customers are not to be had for the asking. The old days of huge profits and much idleness while waiting for mails have gone. The cable and the fast steamship have accelerated competition. The lure of the East still holds, and there will yet be fortunes for the men of commerce—victories with rich rewards for the energetic and industrious. The Far East must always be attractive to the Westerner if only because of the characteristics of the place and people that will survive all changes. For the engineer the Far East has this great charm. He can see that he is doing good work, and the natives with whom he works are decidedly likeable. If the engineer is an Anglo-Saxon, he will see ample evidence of the results of the efforts of his own country.

Each cycle of Cathay, each jubilee that we celebrate, pushes our thoughts alternately forward and backward. Looking ahead to the next 50 years we see that the Far East will be an entirely new world. Everywhere there will be electrical apparatus. It is not unreasonable to suppose that vast areas of Southern and Eastern Asia, which are now desert, jungle, or waste, will be made productive. It is not realised that electric fans, freezing machines, and similar fittings have made the tropics "liveable" for the energetic white man. He is "cleaning up" the dark places of the earth. Electricity is helping him in every way. It is not improbable that hydro-electric schemes will supply energy for the stimulation of crops. The people of the Far East will learn to revere the names of Faraday and Kelvin as for thousands of years they have paid homage to the names of Confucius and Mencius. May the transformation take place quickly and may British engineers and British machinery play a very prominent part in it.

A MODEL WATER-POWER INSTALLATION.

One of the most interesting little country house installations we have heard of for a long time is that at "Blarich," Rogart, Sutherland, the property of Mr. James Menzies.

Through this property, at a distance of 150 yards from the house, runs a mountain burn. Like nearly all Highland burns, the flow in this varies greatly; at times it is a raging torrent, at other times only a tiny stream, and it is a matter for careful consideration to decide on the size of plant best fitted to utilise the power available, especially where, as in this case, no impounding could be done. Investigation and inquiry indicated that the minimum flow in this burn was about 40 cubic feet per minute, and a plant to utilise this was installed. A mile of the burn was surveyed, and the section which could be most cheaply and conveniently developed was chosen. This section was 600 yards in length, and in this distance a gross fall of 67 ft. was obtained. A strong rock-built weir, 4 ft. high and 15 ft. broad at the base, was constructed across the burn, and into this was built a heavy timber sluice, the object of which is to enable the *debris* which accumulates above the weir to be easily cleaned out. A fish notch 12 in. wide and 3 in. deep was left in the weir. When the fish are moving, it is an interesting sight to see them shooting up through this notch into the river above.



Fig. 1.—The Burn.

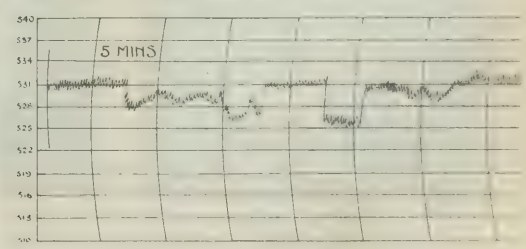


Fig. 2.—Governor Test.

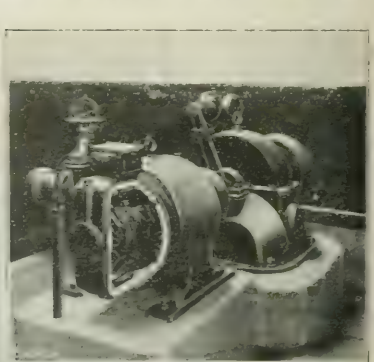
From the weir and intake chamber, a 10 in. stoneware pipe is taken along a contour line above the burn to a point 200 yards down stream, where it terminates in a concrete surge tower. From the latter an 8 in. steel pipe is taken on neat steel supports built in rock piers











Telephone Works in Hungary.—According to the papers, the Ujpest Company of Hungary intends to re-commence manufacture of telephone apparatus which was discontinued in 1911. The former installations comprised 40,000 telephones annually.—*Reader's Digest Service.*

THE IMPROVEMENT OF POWER FACTOR.

By the late Dr. GISBERT KAPP*, Past President.

(Abstract of paper read before the Institution of Electrical Engineers.)

Whether consumers' individual motors have a good power factor or not does not directly concern the supplier of electricity; all the latter asks is that consumers shall take from his terminals a current nearly in phase with the voltage; this condition the consumers can always fulfil, but that all consumers on a system should voluntarily incur the expense involved cannot be expected. The supplier must, therefore, make it worth their while, and thus the purely technical question of p.f. improvement becomes tied up with the question of suitable tariffs.

The introduction of power-factor improving devices necessarily involves capital expenditure, but it reduces the capital cost of the electrical part of the generating and transmitting plant. Where the supplier is also the consumer, the relation between extra expense on the consuming plant and saving of expense on the supply plant is direct and obvious. In the case of a supply company and its many consumers this relation may not be so obvious. Nevertheless, the relation exists. If the customer cannot participate to a reasonable extent in the benefit he confers by installing plant of good power factor, he will naturally refrain from doing so.

The economical limit of power-factor improvement does not depend on the power factor of the unimproved plant, but only on the ratio of the cost per kW of the original plant at power factor to the cost per wattless kVA injected by the phase advancer.

If c = capital cost of generating and transmitting plant per kW and c_a = cost of phase-improving plant per wattless kVA, then writing $a = c/c_a$ it is economical (from the capital outlay point of view) to go on improving the p.f. until $\sin \phi = a$, where ϕ = the angle of lag. The saving thereby effected = $100\ [1 - \cos(\phi_0 - \phi)]$ per cent., where $\cos \phi_0$ = original p.f. before improvement.

Since a is generally very small (say, within 0.1 and 0.3) p.f. improvement may economically be carried fairly near to unity p.f., but should not be carried beyond it so as to make ϕ negative. This refers to the installation as a whole, but does not mean that any individual motor may not be worked with a leading power factor if thereby the overall p.f. can be brought up to the economic limit.

Let κ be the cost of the original plant without any improvement, and s be the saving in capital outlay through using phase advancers. Then the following table shows the saving in capital outlay effected by power factor improvement for a few values of a and $\cos \phi_0$:—

$\cos \phi_0$ ...	0·6			0·7			0·8		
a	0·1	0·2	0·3	0·1	0·2	0·3	0·1	0·2	0·3
s/κ per cent....	32	24	18	22	16	11	14	9	5

The cost of p.f. improving plant per kVA varies within wide limits; it may be as low as 10s. with a phase advancer applied to the slip-rings of a very large induction motor, or it may go up to £4 or £5 with static condensers. The essential condition is that we must not depart too widely from the rule $\sin \phi = a$, *i.e.*, when the total cost (excluding consuming devices) of the electrical plant per kW becomes a minimum.

With regard to the apparatus used for p.f. improvement:

Rotary Condenser: The largest machine yet built has a capacity of 30,000 kVA when used to advance the phase of the current, and 20,000 kVA when used to retard the phase.

I am not aware of any instance where a consumer drawing his supply from a thermic works has put a rotary condenser on his own premises for p.f. improvement; and the reason is not far to seek. The consumer has to pay not only for the energy he consumes in his motors, but also for that which he wastes in his rotary condenser, and that is a considerable amount. A rotary condenser of some hundreds of kVA cannot be worked with a smaller loss than a generator of equal output. The loss in kW may be between 6 and 7 per cent. of the output in kVA. Therefore, the installation of rotary condensers by consumers is financially unsound. That rotary condensers are successfully used by supply companies is not due to financial reasons, but to the absolute necessity of giving their distant consumers a constant-voltage supply, for which purpose, in the present state of the art, the rotary machine is the only available apparatus.

Static Condenser.—The static condenser requires no attention, and has, in this respect, a great advantage over any rotary machine, and its own waste of energy is exceedingly small. The cost varies inversely with the frequency and the square of the voltage per element.

The following data as to cost have been supplied by the makers for a condenser equipment of 100 kVA output, including tank and switchgear, all at 50 frequency:—

Voltage at supply terminals	100	120	140
Transformer	Not used	Used	Not used
Condenser voltage	600	600	1,100
Cost	£336 13 6d.	£468 8 1d.	£487 5 11d.

Synchronous Leading Motor.—[illegible] the double purpose of [illegible] same time, injecting leading kVA into the supply terminals, but its cost must always be greater than that of an equivalent induction motor, and the difference in cost tends to be greater the smaller the leading power-factor required for full normal load. Its efficiency is a little lower owing to the greater loss in excitation. The various makes differ in detail, but the main principle is the same.

Rotary Converter as Phase Advancer.—[illegible] of machine for injecting leading kVA into the supply line is rather limited on account of the rapid increase of the copper losses in the armature with an increase of the wattless component given to the line, and p.f. improvement can only be obtained at a sacrifice of output. Economically it is better not to use a converter for giving to the line leading kVA but to be content with taking from the line true kW and thus raising the general p.f. of the system by increasing the watt load. Moreover, a converter excited to unity power-factor will scarcely influence the line voltage at all, whilst a converter injecting leading kVA may have some disturbing influence.

Slip-ring Phase Advancer.—Neglecting losses, which are very small, a phase advancer having an output of 6.3 kVA will benefit the line to the same extent as a static or rotary condenser giving it 250 kVA. At the same time the overload capacity of the motor is increased. There are two types of slip-ring phase advancer in use, the rotary and the oscillatory. The former is an a.c. commutating machine which must be driven from some external source of power, the latter is a d.c. machine which requires no external driving, but needs d.c. excitation from an external source.

Rotary Phase Advancer.—The Scherbius rotary phase advancer has no stator, but the iron core of the armature is radially extended beyond the armature conductors, so that the rotor iron outside the winding performs the office of an external stator. Since the magnetic reluctance of the air-gap is thus avoided the advantage of a strong field with only a moderate excitation is secured, but there is the disadvantage that the commutation necessarily takes place, not in the neutral space, but in the strongest part of the field, making the commutation more difficult than in an ordinary d.c. machine. The fact that not a direct but an alternating current must be commutated is of little importance, because the frequency of this current is so low that the condition as regards commutation is practically the same as with d.c.

If the rotor is at rest the machine acts simply as a choking coil. If the armature is rotated by external power with slip frequency the machine acts simply as a dead resistance. By increasing the impressed speed, so that the winding rotates with a speed greater than that of the field, the e.m.f. generated changes sign, that is to say, it leads relatively to the current by a quarter period. Saturation avoids excessive phase advancing at heavy load and yet obtains a satisfactory power factor at lighter loads; the overload capacity is sensibly increased.

Oscillatory Phase Advancer.—The author's phase advancer, more generally known under the name "vibrator," has already been described. Its action is simply that of a condenser of very large capacity, and as this capacity has a fixed value for every type, even for light loads, a good power factor can be obtained with an induction motor by adding a vibrator.

The phase-advancing effect of the vibrator depends on the square of the flux, and is inversely proportional to the mass. This points to the use of two-pole armatures of small diameter and comparatively great length. The proportion found in practice to be suitable is about 1 to 2. Since the air-gap can be made very small the power required to produce the strong field is not very large: it varies between ½ and 1 kW, which means from 0.25 to 0.1 per cent. of the power of the motor. The connection of the vibrator with the slip-rings may be either in star or in delta, depending on which comes nearest to the given full-load rotor current, but as a general rule delta connection is preferable because of the smaller current. As the vibrator is essentially a low-voltage machine it is advisable to make it the star point of the rotor circuit. Where the rating is fixed with regard to short-time overloads the increase in rating may be considerable (20 to 30 per cent.) so that the cost of a motor with phase advancer will not appreciably exceed that of a larger motor without phase advancer.

The power lost in the phase advancer is very small, and is

* Dr. Kapp died on August 10th, 1922; the paper was read by Prof. Miles Walker, M.I.E.E.

[illegible] by the saving in stator copper loss.

Methods and Results.—It is hard to ascertain the general trend in the supply industry towards discriminative tariffs, the author made enquiries of the larger power companies with the following results: On the whole the importance of framing the tariff so as to induce consumers to take their supply [illegible] power factor is recognised, but the question is [illegible] to the unsettled industrial condition] still in a state of flux.

The examples of tariffs cited (in the original paper) show that the tendency in the supply industry is rather in the direction of a fixed charge for the maximum demand, augmented by a flat rate per kWh, than only a flat rate adjusted according to power factor. The latter is unscientific and can, in some circumstances, be unfair to either the consumer or the company, but anomalies cannot occur under a maximum-demand tariff. The consumer may leave his condensers in circuit permanently without depriving the company of a certain percentage of the revenue to which it is entitled, because the fixed charge is not influenced, or is only slightly influenced, by energy factor. For the same reason the consumer cannot be penalised for doing a little more phase advancing than is necessary. The basic idea of the two-part tariff is that the fixed charge for maximum demand should recompense the company for capital outlay incurred on account of each consumer, whilst the flat rate per kWh recompenses it for running costs. If the voltage at consumers' terminals is kept constant the maximum kVA demand can be found from a maximum-current indicator scaled in kVA. Under these conditions the metering becomes very simple. All that is wanted is a coulomb meter combined with a time element which brings the pointer back at regular intervals of 10 or 20 minutes, leaving the indicator in its farthest position, and an ordinary cosine energy meter. Neither energy factor nor power factor enters in the making-up of the total charge, and the customer can by inspection of the two meters find out for himself what energy he has used and how much he has to pay for it. This is an advantage, especially with small consumers, who cannot be expected to understand the mathematics of power and energy factors.

The condition of constant terminal voltage may not, however, be strictly maintained. The error thus introduced by excessive voltage drop may be appreciable and, as it is always against the consumer, most supply companies replace the simple (coulombs)/(time) indicator by a (units)/(time) indicator, and translate the reading into maximum kVA demand with reference to the energy factor by dividing the number of kWh by $\cos\phi$. Under this more accurate system of metering three instruments are required: (1) A maximum-demand kW indicator which is a cosine meter with a time element; (2) an ordinary cosine energy meter; and (3) a sine meter to record $f\text{EI}\sin\phi dt$. From the two last-named instruments is found $\tan\phi$, and from this $\cos\phi$.

If p = maximum kW demand, P = maximum kVA demand, m = charge per maximum kVA demand, d = number of units consumed, d = flat rate, then $P = p/\cos\phi$; and the total charge = $mP + dv$.

Under this tariff there is no necessity to place the consumer under any restriction as to a minimum power factor. The latter may be as bad as suits the customer's method of working his machinery, because its effect will make itself felt in the energy factor and thus appropriately increase the fixed charge, thereby recompensing the supply company for its greater expenditure on electrical plant.

Discussion in London

Mr. [illegible] Appleyard, in opening the rather disappointing discussion, referred to the late Dr. Kapp's early work, and mentioned that, although physically he failed rapidly at the last, mentally he was as alert and keen as ever, as the paper under discussion proved; even after his death they were still learning from him.

Dr. S. Parker Smith pointed out that power-factor correction was [illegible] question, but was becoming a necessity on certain systems. He drew attention to two papers [illegible] read in 1899, in one of which Mr. Mordey [illegible] Dr. Kapp had done, and to a set [illegible] electrical [illegible] both [illegible] the [illegible] of [illegible] power.

Mr. [illegible] with reference to the maximum-demand tariff and the use of a coulomb meter combined with a time [illegible] voltage [illegible] were maintained strictly constant, and it was questionable whether Dr. Kapp's suggested method of overcoming the error thus introduced [illegible] it introduced complications. [illegible] pressure variation and, secondly, the [illegible] should [illegible] be the average and not the [illegible] at the time the [illegible] made [illegible].

Mr. W. E. [illegible] the use of static condensers [illegible] pressure at [illegible] 100 V [illegible] the difficulty of [illegible].

Mr. E. T. Woodhouse [illegible] that he had [illegible] install a static condenser to improve the power-factor of an installation. It had given no trouble whatever. All agreements for the supply of power should, he thought, be on the kVA basis.

Mr. W. B. Woodhouse explained that 18 years ago he adopted the kVA basis of charging for power. Two questions were: Who was to provide the idle power, and who should do the power-factor correction—the consumer or the electricity supply authority? In his opinion it should be made prohibitive in price for a consumer to have a low power-factor. He knew of a case in which the provision of condensers had reduced the power bill by £8,000 per annum, and in another case a synchronous motor had resulted in a saving of £2,000 a year being made; both installations had given satisfaction for a number of years.

Mr. W. E. M. Lipman described and illustrated by means of lantern slides a new type of power-factor meter that had been developed on the Continent; it was known as the Lipman pattern.

Mr. W. M. Selvey agreed with Mr. Woodhouse that it should be made prohibitive in price for a user of electricity to have a bad power-factor; his experience was that if they told users frankly that they were abusing their privileges, without going into detail or even mentioning power factor at all, they would find them sympathetic and reasonably willing to help the electricity supply authority. After referring to methods of metering and measurement of power-factor with accuracy, he expressed the opinion that they should separate the technical question from that of policy.

Mr. C. L. Ayres advocated the improvement of power factor by the re-grouping of existing motors, so as to utilise them to their best advantage; in the U.S.A. that was always the first way of tackling the problem, but, of course, that was not always possible.

Prof. Miles Walker, in briefly replying to the various questions raised, expressed the opinion that power-factor correction would eventually be carried out by means of the phase advancer, but they would take thirty years to wake up to the fact that that was the best solution.

Discussion at Newcastle-on-Tyne.

At a meeting of the North-Eastern Centre of the Institution (Mr. F. G. C. Baldwin in the chair) Prof. Miles Walker read the late Dr. Kapp's paper.

Mr. J. M. Heslop, in opening the discussion, said that as a supply system became more extended the importance of power-factor became a matter of most serious moment. The types of machines for improving the factor had good points, the value of which it was difficult to estimate, which, with plant of the present-day dimensions, became rather embarrassing. The consumer could not be absolved from all complicity in the troubles arising from a bad power factor; a man who took an excess of magnetising current should pay for so doing, and Dr. Kapp's methods enabled them to do this. He emphasised the fact that a bad power factor involved a wasteful consumption of coal, and also there must be some unproductive capital concerned, which might otherwise be spent on connections, &c.; as a matter of fact, a man with a good power factor was bearing more than his share of the expenses. The supply authorities should impose a stiff penalty for a bad power factor, and give some reward for a good one.

Mr. Thomas Carter thought particularly useful the section of the paper dealing with synchronous induction motors, because of the details of designs collected therein, and because of the clear way in which it showed that that type of machine, to have a respectable overload capacity, must work at a leading power-factor; or, if that was undesirable, an abnormally large machine, correspondingly expensive, must be chosen. All through the counsel was to effect power-factor improvement with discretion, and not to imagine that the more the power factor could be increased the better. When correction had to be applied to an existing installation no nice balancing of relative costs was usually possible, and only a rough approximation could be made to the most economical amount of improvement. The curve of relative rates of change of $\tan\phi$ and $\cos\phi$ was approximately horizontal between $\cos\phi=0.6$ and $\cos\phi=0.95$, both lagging, and practically [illegible] between $\cos\phi=0.70$ and $\cos\phi=0.90$, and the correction required for a given amount of improvement was reasonably constant within that range of values. Outside of it, however, including a change from lagging to leading power factor, the kVA required for a given correction became excessive. There was much to be said for the principle that a consumer should not be penalised because he was a small motor man, whose installation would tend to work at a lower power-factor than that of the large motor man. The vital question was whether each man was doing his electrical driving in the best possible way. If anyone's power-factor was needlessly low for his type of installation he ought certainly to pay for that bad design, but so long as he did the best for his own job the suppliers ought to be satisfied, without wanting to [illegible] kWh [illegible] which he had no control. After all, power-factor difficulties arose because suppliers used a.c., and that they did for their own convenience, and not for that of their customers. The paper suggested that low power factor was detrimental to both supplier and consumer, but the speaker suggested that the bulk of the burden was on the supplier, and it was of his own choosing. The speaker was inclined to fix, not unity power

factor in every case as the ideal, but some figure suitable to the installation, perhaps as high as 0.95 in the best cases, and as low as 0.75 in the very worst, depending on the average size of motor that ought to be employed for the work, and its usual best commercial power factor.

Mr. P. F. Allen pointed out that, arising out of what the last speaker had said, it seemed to be a matter that the supply authorities should deal with. It cost so much to supply the energy, and so much to supply the wattless current, and it was for the suppliers to say what the cost was and charge for it accordingly.

Mr. P. B. Maclean referred to the cost of installing a rotary condenser for the improvement of a bad power factor, and said it raised the question at once whether or not the improvement was worth the cost. The cost was put down by the author at £2,100, but the speaker thought that it could be done more cheaply now, and labour charges could be cut altogether in some cases. In a colliery the electrician only looked into the power-house once or twice per day, and that was the only attention the machine got.

Mr. G. L. Porter thought that tariffs might be looked into; a.c. gave a cheaper supply than did d.c., and of that cheapness the consumer got the benefit; therefore it was as much for the consumer to pay his share of the cost entailed by a bad power factor as for the supply authority.

Mr. R. D. Spurr said the paper should be brought plainly before the consumer; it should be re-written in such a way that its real meaning would come home to him. All users of motors tried to keep on the "safe side" by using a motor larger than was needed. Manufacturers seldom gave advice as to the exact size of motor that was requisite for the work to be done.

Prof. M. Walker, in replying to the discussion, thought one reason why so little had been done to improve power factor in the past was that the power supplier had not made it worth while for the consumer to improve it. A phase-advancer was suggested in 1896 by Le Blanc, but no one made it worth while for the consumer to use it, and it had only been fitted where there was an especial reason for it. It was for the power suppliers to make it worth the consumer's while to improve the power factor and then it would be done.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Expanding Pulley.

Among the exhibits at the recent Textile Exhibition, Manchester, was an expanding-pulley produced by The Expanding Pulley & Electric Co., Thornhill Lees, Dewsbury. This consists of segments fitted between two circular plates with radial slots, adjustment being made by a strap which opens or closes the segments as required by sliding them in the slots. By this means a variation of 20 per cent. can be made in the speed—employing one pulley to drive a similar one. The actual expansion is effected by a thrust plate (provided with a ball thrust) which operates internal cones; these slide along the boss or barrel and operate on a tapered surface on the underside of the segments. Each set of segments is turned when at its least diameter, so that, as expansion takes place, the edges cannot cut the belt, as the radius of each segment is less than that of the pulley as a whole. Centrifugal action is overcome by means of specially designed springs, housed in a malleable cast-iron flange ring and enclosed by an aluminium guard. The gear can be arranged for automatic operation. An application of the pulleys is seen in the accompanying illustration (fig. 1).

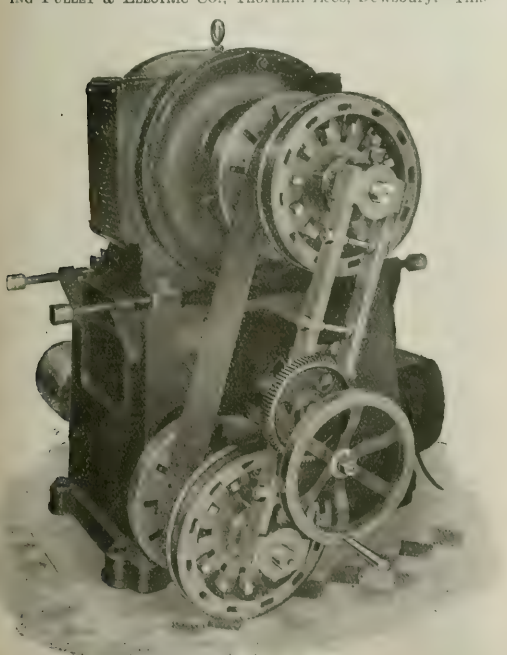


Fig. 1.—An Expanding Pulley Gear.

The "Reako" Heater-Toaster.

The "Reako" electric fire, which can be used in two positions, has been put on the market by the Russell Electrical Appliances Co., Ltd., Alliance Mills, Belfast Road, Stoke Newington, N.16. Fig. 2 shows the appliance in the position for general heating. The end plates are of substantial construction, and can be supplied plated in almost any finish desired. The spiral element wire is secured in grooves in the refractor bar. This bar is built up in sections on steel rods, and is of a registered design. Over the element are four bars to support the utensil or to serve as a rest when bread is to be toasted. A hinged guard effectively protects the element when the appliance is required as a fire, but can be thrown back when cooking operations are in hand. The provision of heat-insulating feet enables the device to be placed on a highly polished table without fear of scratching or scorching. The loading is approximately 600 watts.

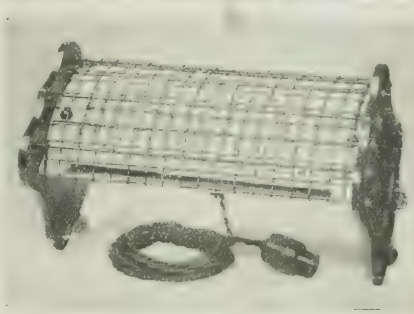


Fig. 2.—The "Reako" Heater-Toaster.

An Electrically-driven Air Compressor.

Fig. 3 shows a compact electrically-driven air compressor recently put on the market by Messrs. Marshall & Plumtree, Ltd., 20, High Holborn, W.C.1, a feature of which is that the compound-wound motor is coupled through gearing with the compressor, the whole being assembled in a totally-enclosed dust-proof housing, the top cover of which is in sections and can easily be removed for inspection purposes. These machines are made in two sizes, to give outputs of 6 cu. ft. of air per minute at 150/200 lb. pressure, and 12 cu. ft. per minute at 50/75 lb. pressure, and for running on direct-current circuits of 110 V or 220/240 V. The outfit is suitable for stationary work or it can be easily rendered portable by mounting it on a trolley. No water cooling is required; the cooling is effected



Fig. 3. An Electrically-driven Air Compressor.

by air circulation, which is drawn from the outside atmosphere by means of a fan on the armature shaft and circulated round the compressor cylinder walls and then expelled at the orifice below the two hose valves. The high-pressure air is cooled by means of a ribbed expansion chamber on the delivery side. All lubrication is effected by grease to the ball-bearings and other working parts, and the plants will run continuously without any attention for long periods. An important point is that only pure air free from oil vapour is delivered from the machine.

The " Pryco " Flashing Adapter.

A device of great utility to those who use intermittent or " flashing " electric signs has been put on the market by Pryco, Ltd., 14, Shouldham Street, Edgware Road, W.C.2. The invention is an extremely simple one, consisting merely of a thermostatic contact device contained in a lampholder which differs only from the standard type by the length of its barrel. The thermostat itself is contained in a little glass tube not more than 1 in. in length. A small heating element of high-resistance wire is twisted round a bi-metal contact which opens upon being heated, thus breaking the circuit, and closes again when cool. A sample tested by us with an ordinary m.f. 60 W lamp functioned satisfactorily, giving alternating periods of light and darkness of nine seconds' duration. The adaptor is made in a number of sizes to take currents of from 0.125 to 7 A. It can be adapted to work a four-way sign showing advertising matter in three flashes, the fourth illuminating the whole sign.

The " Ripolite " Reflector.

The " Ripolite " reflector recently marketed by the Electrical Products Co. (London), 20, Goswell Road, E.C.1, is a corrugated metal fitting, the interior of which is silvered, the outside being enamelled. At the top of the reflector is a dome, into which a vertical-filament electric lamp can be fitted. Comparative tests with a number of other commonly-used reflectors carried out at Faraday House, show that the " Ripolite " reflector possesses many points of superiority. The vertical candle power obtained with the use of a 100-V, 60-W m.f. lamp was 171 as compared with 115 in the next best. The lower mean hemispherical candle power was 72.5 as compared with the next highest of 60.2. The infrangibility of the reflector is another advantageous feature.

A Gas Engine Power Set.

Messrs. Holes, Ltd., Netley Abbey, Southampton, are putting on the market a complete power unit of 100-kW capacity, comprising a six-cylinder vertical gas engine running at 440 r.p.m., developing 150 h.p., connected on a one-piece bedplate to a 100-kW dynamo of open multipole type, compound wound, having a full load efficiency of 91.75 per cent. Gas is supplied by a producer of ample capacity to give a continuous supply of gas at full load, the fuel consumption being .9 lb. of anthracite per h.p.-hour. The unit consists of all fittings, including a hand compressor for initial charging of air starting receivers, and cooling tanks of 2,000-gal. capacity.

EAST SCOTLAND ELECTRICITY DISTRICT.

Edinburgh Corporation's Scheme.

In February, 1922, the Electricity Commissioners provisionally delimited the above-named area* in connection with which they are to hold a local inquiry at Edinburgh on December 12th, and at which they will also consider a draft scheme for the reorganisation of the supply of electricity within the district that has been submitted by the Corporation of the City and Royal Burgh of Edinburgh.

In an explanatory memorandum it is pointed out by the Corporation, *inter alia*, that it is in point of fact the only undertaker which supplies electricity on a large scale within the district, and it is prepared and in a position to generate and supply electricity for the whole of the district.

The Corporation is erecting a large generating station at Portobello, which is or can be made capable of fulfilling the functions of a capital station from which supplies of electricity can be afforded for the whole of the district. The site has sufficient space for a station having an ultimate capacity of 100,000 kW, and the adjacent ground can be utilised for coal sidings or by-product recovery plant. The station is to be erected in sections. The first, which is believed to be sufficient for present needs, is expected to be in operation within a few months. In it three 10,000-kW turbo-alternator sets are being installed with the requisite boiler plant, &c. No other station is or will be necessary.

The whole of the financial responsibility for the erection of the station has been undertaken by the Corporation, and the necessary borrowing powers have been authorised partly by the Secretary for Scotland and partly by the Electricity Commissioners.

With the exception of the Corporation's existing area of supply, the electrical requirements of the district have not been developed to any great extent. The generating stations in the district other than those of the Corporation consist of: (1) a station of the Musselburgh & District Electric Light and Traction Co., Ltd., at Musselburgh, with a capacity of 600 kW; (2) a station of the Lothians Electric Power Co., at Bonnyrigg, with a capacity of 150 kW; (3) a station of the Electric Supply Corporation, Ltd., at Dalkeith, with a capacity of 110 kW; (4) a station of the North Berwick and District Electric Light & Power Co., at North Berwick, with a capacity of 30 kW; and (5) a station of the Linlithgow County Council, at Uphall, with a capacity of 150 kW.

The Corporation has an agreement with the Musselburgh and District Electric Light & Traction Co. under which a bulk supply of electricity will be given to the company from the Portobello station, and the existing station of the company at Musselburgh will be closed down as a generating station.

There are two power companies within the district. The Lothians Electric Power Co., incorporated 1904, as authorised to supply energy (*a*) to authorised undertakers in bulk; and (*b*) to persons requiring a supply for power. Its authorised area of supply consists of parts of the Counties of Mid-Lothian, East Lothian, Peebles and Lanark and is a very extensive one, but, with the exception of the above-mentioned small plant, is has not made any provision for meeting the requirements of its authorised area of supply.

The Scottish Central Electric Power Co. was incorporated in 1903, and its authorised area of supply consists of the whole of the Counties of Linlithgow and Clackmannan and portions of the Counties of Dumbarton and Stirling. It is understood that it gives supplies of electricity in the western part of the County of Linlithgow, but its operations have not extended to the portion of that County which is included in the district as provisionally determined by the Commissioners.

The draft scheme of the Corporation is submitted on the following basis, *viz.*:—That the new station at Portobello will be the capital station for the district; that the Corporation will retain its ownership and control and will continue to distribute electricity within its existing area of supply; that the Corporation will be prepared to give supplies of electricity in bulk to existing authorised distributors within the district and that, as regards the parts of the district where there are no existing authorised distributors or which are not yet developed, arrangements will as far as practicable be made for distribution being effected by authorised distributors and the Corporation will be prepared to assist in making such arrangements; that a Joint Electricity Authority will be set up for the district on the footing that such a Joint Authority will delegate to the Corporation its powers and duties as to the generation and supply of electricity other than with respect to the distribution of electricity in the district outside the Corporation's existing area of supply. It is proposed that such delegation shall be made under the provisions of the clause in the Electricity (Supply) Act, 1922, the marginal note whereof is " Mode of exercise of powers by Authorities." ceding the date of the election.

The Corporation also proposes (in view of the provisions of Section 14 of the Electricity (Supply) Act, 1919, and of Section 68 of the Lothians Electric Power Act, 1904), that there shall be excluded from the area of supply of the Lothians Electric Power Co. such portions of that area within the district as are not being supplied by the company.

The chairman of the Joint Authority shall be appointed by the Authority from its members. There shall be thirteen members, ten of whom shall be appointed by the constituent bodies mentioned in the following proportions:—

(i) City and Royal Burgh of Edinburgh, 8; (ii) the County Council of Mid Lothian, 1; (iii) the County Council of East Lothian, 1.

The remaining three members shall be elected by the authorised undertakers within the district other than the Corporation. The basis of voting power for the election of the elected members shall be the number of kWh sold within the area by each authorised undertaker during the year preceding the date of the election. No member shall represent more than one constituent body.

The main outlines of the technical scheme are specified as follows:—

The system of supply will be three-phase a.c. at a frequency of 50 cycles per second. The primary transmission pressure will vary according to the distance of the region supplied from the generating station. In the neighbourhood of the capital station at Portobello it will be 6,600 volts. An increased primary pressure may be used for long-distance transmission up to 33,000 volts. The distribution for traction will be by conversion to d.c. For industrial purposes energy in bulk may be supplied untransformed, if required, and for lighting in outside areas 1.p. a.c. will be used. The cables will be three-core, paper-insulated, lead-covered and armoured, and will generally be laid direct in the ground. In special cases, unarmoured cables may be drawn into ducts. A balanced system of feeder protection will be adopted. In outlying parts of the district overhead transmission may be used.

It is proposed that the older stations of the Corporation at Dewar Place and McDonald Road will continue to be used so long as it is economical to work them, either continuously or on peak load only. Other generating stations in the district belonging to various authorised distributors may be discarded.

* Elec. Rev., March 3rd, 1922; p. 305

It is not proposed to erect any further generating station than that now under construction at Portobello. Neither is it proposed to ask the Ministry of Transport to construct any works under Section 18 of the Act of 1919. The railway companies in the district have not yet taken into consideration the question of the electrification of their railways. The Portobello station would, however, be competent to supply all such electricity as might be wanted for this purpose.

THE QUALIFICATIONS OF A SALESMAN.

Similar conferences upon salesmanship to those organised by the E.D.A. in London are being held at Newcastle-on-Tyne, and at the second of these, which was under the chairmanship of Mr. H. Marryat, M.I.E.E., Mr. Angus Watson, J.P., was the principal speaker.

Mr. Watson said that his experience was that no matter how good a product was, and no matter how perfect the factory organisation, without an efficient selling organisation the business would not reach the desired success. The most important part of a selling organisation was the choice of the right men. There were no definite tests which could be applied—each individual's work had to speak for itself. If possible, salesmen should be selected from the staff—they would then have an inside knowledge of the business. It was a mistake to think that technical knowledge was essential, although it was very helpful. The ground should be plotted out for salesmen, and whatever business came from a man's district, whether direct or by other ways, should be credited to him. The speaker thought that salesmen should be remunerated by salary and commission. If the salary was too big they would not feel inclined to work so hard; a commission gave them an interest in the amount of sales. It was important to have both inside and outside sales managers to watch and compare the work of salesmen. These managers would get each man's assistance, and collect information of use to all. Daily reports, although sometimes regarded with suspicion, were useful to enable the head office to follow up visits to prospective consumers with letters.

Mr. Watson said that he was a great believer in periodical sales conferences, and his firm held one every year to discuss selling problems.

The common belief that a salesman attained success because of special innate qualities was only true to a certain degree. Nearly all the qualities of salesmanship could be cultivated, and they might be summarised as follows: Enthusiasm, perseverance, unfailing good temper, tact, systematic working, thoroughness, and an intimate knowledge of competitors' goods. A "born" salesman was frequently uncertain in temperament and irregular in his work.

It was of the utmost importance to keep samples in good condition; a new buyer selling them for the first time was predisposed either in favour of or against goods by their appearance. Generally, it was a mistake to leave samples with a customer; this hardly ever resulted in business. The same applied to samples sent by post. Buyers frequently used these devices as means of getting rid of a salesman. The ultimate success of a salesman depended upon the amount of new business he brought in. Every salesman should see that he did nothing to lower his health standard. He should keep himself in condition by steady, regular habits, healthy vigorous recreation, and a mind free from unnecessary trouble. Too much emphasis could not be laid upon the importance of systematic working. Buyers should know when to expect the salesman, so that they would hold up orders until he called. Salesmen should not worry about the collection of accounts, but encourage buyers to remit payment direct to the head office.

It was always advisable to know what competitors were doing, as it was only by this means the salesmen could talk intelligently and forcibly about their own goods. The wise salesman would, however, not talk competitive goods down; indeed, he should avoid such discussion altogether, but if forced to do so, agree that they had merits of their own. Sometimes buyers were exasperating, but the salesman should never lose his temper. On the other hand, it was not wise to become too friendly with customers, as too much time was wasted in this way. Politics, religion, and intimate personal matters should be avoided.

Customers should not be told anything not strictly true, nor should they be left with false impressions. The wisest plan was to let the customer do the talking, his conversation being skilfully guided into the right channels. The salesman should not argue with a customer; it wasted time, irritated him, and never secured sales.

The salesman's personal appearance was very important. He should be neatly, but not elaborately dressed. He should above all, be natural. Enthusiasm was one of the driving forces of salesmanship, for, unless a salesman was enthusiastic about his goods, he could never make his customer so.

In the ensuing discussion Mr. R. Robson agreed that the salesmen should be selected from the staff whenever possible, but he thought that in the contracting branch of the electrical industry technical knowledge was essential in a salesman. Regarding payment by commission, he thought that commission should never be reduced however much a man made. There was one difficulty in their business which did not seem to apply to Mr. Watson's. If they got a customer there was just one order, and not another for many months afterwards. In conclusion, he considered that insufficient attention was given by retailers to advertising.

Mr. Spence said that the salesman in the electricity business had to possess a fair technical knowledge in order to be able to sell goods to technical men. Annual conferences were not sufficient; his own firm held meetings weekly and monthly. He thought that the salesman *was* born to the business; some people could not be trained beyond a certain point.

Mr. Watson said that he wished to make his statement clearer. He meant to say that a man need not be a technical man when engaged as a salesman. If he had the gift of salesmanship he could be technically trained afterwards.

Mr. Pinkney said that Mr. Watson had touched upon a subject which was exercising the minds of men in the electrical industry—whether it was better to take a technical man and give him the sales knowledge, or to get a salesman and train him technically. He, personally, had been of the opinion that the qualities necessary in a salesman could not all be cultivated. His view was that it was easier to give a born salesman a certain amount of knowledge than to train an engineer in salesmanship. It was of importance that a salesman should adapt himself to the customer's point of view. He agreed with Mr. Watson that goods, so far as possible, should be sold on their own merits, and comparisons with competitors' goods should be avoided. The principles enunciated by Mr. Watson applied to all branches of the electrical industry, whether alternators or sixpenny units were being sold.

Mr. T. Carter thought that a good salesman should be a psychologist, able to tell in a moment if he was going wrong with a customer. That being so, he did not consider it possible to put into a man what was not already there. Mr. Watson's principles were applicable to the electrical industry, but there was a difference in that Mr. Watson's firms supplied goods to suppliers of other people, while contractors were selling to people directly. He did not think that technical knowledge was very important, although a salesman should have sufficient knowledge to be able to answer questions. Mr. Carter emphasised the need for the interchange of views regarding different areas.

Mr. Cross considered that technical knowledge was essential as contractors' salesmen had to be in a position to advise non-technical customers. Samples should be taken from stock, and not specially prepared. There was a lot to be learned from the criticisms of users.

Mr. Ellis considered that a successful salesman possessed certain inherent qualities and others acquired by experience. Therefore the salesman was best "caught young," and should preferably be taken from the staff. It was not, however, a matter that could be dogmatised upon. A man ought to be paid at a high standard apart from his commission. He thought that one effect of a high commission and a low salary might be the salesman's concentration on new business and old buyers might suffer. Above all the salesman should provide willing "service."

Mr. Ward gave it as his opinion that technical knowledge was a *sine quâ non* for electrical salesmen. A man selling electric radiators, for instance, should be able to say which was required for a certain room. Only a technical man could get customers out of their troubles.

Mr. Winchester thought that electrical salesmen should operate in pairs—one to sell the current and the other to sell appliances. There should be greater co-operation between supply authorities and contractors.

Mr. Marryat said that there was a great deal of difference between selling an installation and selling switches. In the first case, it was generally business with an inexperienced customer. In his own business he had found it best to have a salesman who could do his own estimating.

Mr. Watson, in reply, said that he considered it a delusion to think that different kinds of businesses required different salesmen. The art was the same whatever the article might be. Frequent conferences between salesmen were advisable if they could be arranged.

B.E.A.M.A. Scholarships.—The Council of the British Electrical and Allied Manufacturers' Association (Incorp.), on the recommendation of its Education Committee, has recently granted the following scholarships for the 1922-23 session, each tenable for one year and carrying a maintenance allowance of £100 and the payment of college fees:—

In Electrical Engineering (Steam Turbo-generators):—L. H. L. Badham, tenable at the City & Guilds (Eng.) College, South Kensington; W. F. Evans, tenable at Manchester College of Technology; R. C. Matthews, tenable at the City and Guilds (Eng.) College, South Kensington; R. Wright, tenable at the City & Guilds (Eng.) College, South Kensington.

In Mechanical Engineering (Steam Turbines):—W. S. Bowers, tenable at Finsbury Technical College; A. E. Bailey-Smith, tenable at the University, Birmingham; J. W. Davison, tenable at Manchester College of Technology; I. H. Hedley, tenable at Armstrong College, University of Durham; H. C. Lack, tenable at Manchester College of Technology; F. D. Roberts, tenable at Manchester College of Technology; M. L. Yates, tenable at Manchester College of Technology.

NEW PATENTS APPLIED FOR, 1922.

NOT YET PUBLISHED.

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

30,154. "Automatic cutout devices for electric circuits." L. Drault et C. Raulot-Lapointe. November 3rd. France, December 22nd, 1921.)

30,155. "Self-regulating dynamos." H. Crochat Etablissements. November 3rd. (Belgium, November 26th, 1921.)

30,156. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Worcester. November 3rd.

30,172. "Thermionic valves for wireless telegraphy, &c." C. H. Roddie. November 4th.

30,210. "Telephone receivers." R. L. Murray and Telephone Manufacturing Co., Ltd. November 4th.

30,212. "Apparatus for starting electric motors." A. Schulze. November 4th.

30,247. "Electric gravity contact signal lamp." R. A. Galloway. November 6th.

30,260. "Resistance for wireless and electric sets." A. Davison, H. St. J. Ward, and C. F. Westerby. November 6th.

30,262. "Electric bonding junction-boxes for metallic-sheathed wires, &c." S. J. Bryce and Callender's Cable and Construction Co., Ltd. November 6th.

30,292. "Means for simultaneously transmitting and receiving a number of wireless messages." F. W. V. Fitzgerald. November 6th.

30,297. "Ignition apparatus for internal-combustion engines." A. C. Lock. November 6th.

30,302. "Polarised electromagnets and their application to railway block instruments, &c." J. W. Punter and Tyer & Co., Ltd. November 6th.

30,309. "Electrical illuminated signs." S. Sherman. November 6th.

30,335. "Gauges for indicating condition of electric accumulators, &c." Chloride Electrical Storage Co., Ltd., and H. Dean. November 6th.

30,352. "Electric light fittings." T. Phillips. November 7th.

30,368. "Sparking plugs." R. Bosch Akt. Ges. November 7th. (Germany, August 28th.)

30,372. "Electric switches." W. Preston. November 7th.

30,399. "Stereoscopic X-ray apparatus." I. R. McDonald. November 7th.

30,411. "Cleaning and lubricating device for electrical machinery, &c." P. A. Lothbury and C. B. Pinkerton. November 7th.

30,425. "Illuminating advertising signs." R. H. Parkinson. November 7th.

30,429. "Combined starting, lighting, ignition, and cooling device for internal-combustion engines." H. E. Rae. November 7th.

30,437. "Holders for electric lamp bulbs." L. Berkovi. November 7th.

30,447. "Electrical instrument for detection of smoke in the atmosphere." A. M. Dickinson and H. Dickinson. November 7th.

30,452. "Devices for transmitting signals on railways, &c." H. E. Guerrier. November 7th.

30,456. "Illuminating devices." British Thomson-Houston Co., Ltd., W. Millner, and H. C. Wheat. November 7th.

30,466. "Telephone systems." Siemens & Halske Akt. Ges. November 7th. (Germany, January 2nd.)

30,467. "Wireless telegraphy." J. B. Bower. November 7th.

30,468. "Means for generating electric oscillations." Ges. für Drahtlose Telegraphie. November 7th. (Germany, February 14th.)

30,469. "Valve amplifiers for electric oscillations." Ges. für Drahtlose Telegraphie. November 7th. (Germany, November 19th, 1921.)

30,470. "Employment of thermionic valves in radio communication, &c." Sterling Telephone & Electric Co., Ltd. November 7th.

30,471. "Means for indicating interruptions in ignition circuits." H. Ness and L. F. Nortier. November 7th.

30,495. "Telephone apparatus." I. Schmid. November 7th.

30,501. "Electro-magnetic device for use with petrol, &c., engines." R. C. Graseby. November 8th.

30,514. "Earthing running rails, &c." J. McCreath. November 8th.

30,516. "Connections between co-axial armatures of rotating machines." Ateliers de Constructions Electriques de Charleroi. November 8th. (Belgium, November 8th, 1921.)

30,521. "Electric motor starters." Brook, Hirst & Co., Ltd., and J. A. Hirst. November 8th.

30,522. "Automatic, &c., telephone systems." G. H. Bryant and Relay Automatic Telephone Co., Ltd. November 8th.

30,558. "Wireless apparatus." G. G. Aimer. November 8th.

30,559. "Wireless inductance coils." G. C. Aimer. November 8th.

30,571. "Means for operating points and/or cable switches of tramways, &c." G. Bromilow. November 8th.

30,575. "Electric motor-control apparatus." British Thomson-Houston Co., Ltd., E. P. Tuppen, and G. O. Watson. November 8th.

30,576. "Insulating composition." British Thomson-Houston Co., Ltd. (General Electric Co.). November 8th.

30,582. "Rotary electrodes for metal welding." S. H. Gordon and Rose Street Foundry and Engineering Co., Ltd. November 8th.

30,583. "Adapting electric bell installations for use as fire alarms." G. L. Jones. November 8th.

30,597. "Insulating and waterproofing materials." T. Pittman. November 8th.

30,598. "Soft-iron tele-compass." Soc. des Etablissements Gaumont. November 8th. (France, December 28th, 1921.)

30,606. "Electric switches." J. H. Hewitt and Wilkins & Wright, Ltd. November 9th.

30,636. "Automatic, &c., telephone systems." W. Aitken. November 9th.

30,640. "Safety device for preventing opening of enclosing parts of electric switchgear." P. S. Brook and J. A. Hirst. November 9th.

30,647. "Annunciator." W. Farquharson. November 9th.

30,648. "Pliers for electric welding." E. T. Baker and T. Piggot & Co., Ltd. November 9th.

30,667. "Variable electric condensers." G. F. Barrington. November 9th.

30,669. "Electric burglar alarms." A. V. Cannon and M. J. Railing. November 9th.

30,681. "Tele-compass." Soc. des Etablissements Gaumont. November 9th. (France, March 24th.)

30,712. "Connecting or multi-conductor cables." A. M. Taylor. November 10th.

30,723. "Electric switches for starting electro-motors, &c." H. W. Cox. November 10th.

30,728. "Inductance coil." H. P. Ward. November 10th.

30,732. "Electric fuses." E. D. Rodway and Switchgear & Cowans, Ltd. November 10th.

30,733. "Contactor starting switches." E. N. Bray and E. N. Bray, Ltd. November 10th.

30,742. "Wireless receiving systems, &c." Radio Communication Co., Ltd., and J. Scott-Taggart. November 10th.

30,743. "Electric circuits for thermionic valves." N. Lea and Radio Communication Co., Ltd. November 10th.

30,744. "Wireless receiving systems, &c." Radio Communication Co., Ltd., and J. Scott-Taggart. November 10th.

30,745. "Gas-filled electric lamps." British Thomson-Houston Co., Ltd., and P. D. Ford. November 10th.

30,746. "Resistance [illegible]." J. E. Nicholas. November 10th.

30,759. "Means for supporting filaments, &c., in thermionic tubes." H. G. Hughes, J. G. Pender, and A. L. [illegible]. November 10th.

30,781. "Controlling means for drop windows." British Electrical Federation, Ltd. November 10th.

30,793. "Electric pocket lamps." [illegible]. November 10th.

30,790. "Lightning arresters." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.). November 10th.

30,792. "Device for wireless telegraphy, &c." T. J. Simms. November 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

12,138. "High-frequency telephone systems." Ges. für Drahtlose Telegraphie. May 20th, 1920. (163,691.)

13,084. "Dynamo-electric machinery applicable for electric welding." Brush Electrical Engineering Co., Ltd., B. A. M. Boyce, and P. Huggins. May 7th, 1921. (Cognate application No. 16,356/21.) (187,644.)

13,977. "Thermionic devices." H. J. Round. May 18th, 1921. (187,646.)

14,625. "Control of dynamo-electric machines." A. H. Midgley. May 23rd, 1921. (187,649.)

14,404. "Electro-magnetic wave-signalling apparatus." J. O. Mauborgne and G. Hill. May 24th, 1920. (163,709.)

16,875. "Electric oscillation valves." Dr. E. F. Huth Ges. June 18th, 1920. (165,096.)

17,313. "Emergency lamps for use on motor vehicles, or for other purposes." H. S. Johnson. June 24th, 1921. (187,662.)

17,495. "Fly-wheel dynamo-electric machines for internal-combustion engines." R. L. Aspden. June 27th, 1921. (187,665.)

17,798. "Construction of electrical heating elements." W. Weekes. March 29th, 1922. (187,667.)

19,616. "Coin mechanism for prepayment telephone call apparatus." G. H. Huntsworth and T. G. Anderson. July 21st, 1921. (187,689.)

19,712. "Electric alarms." A. W. Ames, W. E. Lloyd, and A. L. Lloyd. July 22nd, 1921. (187,696.)

19,840. "Electric signal apparatus." H. Wade (E. P. Severance). July 23rd, 1921. (187,707.)

19,853. "Adjusting device for electric meters, measuring apparatus, and other similar apparatus." New Antwerp Telephone and Electrical Works. July 24th, 1920. (166,898.)

19,917. "Duplex and the like telegraphic systems." H. W. Sullivan. July 25th, 1921. (187,713.)

19,930. "Electrical circuit breaker for vulcanising apparatus." A. Ludi. July 25th, 1921. (Convention date not granted.) (166,904.)

20,069. "Dry batteries." Ever Ready Co. (Great Britain), Ltd. ("Hoka" Elektrotechnischefabrik Ges.). July 26th, 1921. (187,722.)

20,672. "Telephone systems." Western Electric Co., Ltd., and G. Deakin. August 3rd, 1921. (187,736.)

20,687. "Electric condenser and clamp therefor." W. Dubilier. February 7th, 1921. (175,236.)

20,793. "Mercury motor meters." A. E. White (Sangamo Electric Co.) August 4th, 1921. (187,737.)

20,841. "Directional wireless apparatus." J. Robinson. August 5th, 1921. (187,738.)

20,925. "Electric heating." H. Harrison. August 6th, 1921. (187,739.)

21,252. "Telephone exchange systems." Western Electric Co., Ltd (Western Electric Co., Inc.). August 10th, 1921. (187,747.)

21,725. "Electric radiators." C. W. Marriott. August 16th, 1921. (187,755.)

22,523. "Interlocking mechanism, particularly mechanism for electric and like controllers." British Thomson-Houston Co., Ltd., and R. P. Halliwell. August 24th, 1921. (187,767.)

22,875. "Control means for electric motors." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 29th, 1921. (187,775.)

23,021. "Electric motor starters." British Thomson-Houston Co., Ltd. (General Electric Co.). August 30th, 1921. (187,784.)

23,319. "Electrically-lighted sewing machine." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (187,785.)

23,731. "Electrical plug connectors for use with flexible conductors." British Thomson-Houston Co., Ltd. (General Electric Co.). September 6th, 1921. (187,789.)

25,060. "Electrical connection and lighting boxes for mines and industrial purposes." E. B. Williams. September 21st, 1921. (187,801.)

25,797. "Operating mechanisms for electrical switches." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1921. (187,811.)

26,330. "Magnetic blow-out devices for use with electric-circuit controlling apparatus." G. Ellison and J. Anderson. October 5th, 1921. (Cognate application 5,093/22.) (187,821.)

26,567. "Electric current interrupting devices." Chamberlain & Hookham, Ltd., and S. James. October 7th, 1921. (187,823.)

27,561. "Telephone systems." Siemens & Halske Akt. Ges. October 18th, 1920. (170,308.)

27,763. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). October 19th, 1921. (187,837.)

32,365. "Calling apparatus for high-frequency telegraphy." Ges. für Drahtlose Telegraphie. December 4th, 1920. (172,321.)

32,725. "Fastening transformers in their oil tanks." S. Z. de Ferranti and Ferranti, Ltd. December 6th, 1921. (187,879.)

33,077. "Ignition devices for internal-combustion engines." E. H. Tartrais. December 22nd, 1920. (173,221.)

34,286. "Galvanic batteries." Fuller's United Electric Works, Ltd., and A. P. Welch. December 20th, 1921. (187,892.)

34,405. "Electric insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). December 21st, 1921. (187,893.)

34,645. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 21st, 1921. (174,332.)

1922.

486. "Electric starters for internal-combustion engines." Scintilla (firm of). January 15th, 1921. (Addition to 161,588.) (174,065.)

782. "Spark-gap devices for internal-combustion engines having electric ignition." G. F. C. Joly. May 28th, 1921. (180,977.)

1,481. "Electric organ actions." T. H. S. Jones and H. S. Jones. January 17th, 1922. (187,899.)

1,774. "Oil switches." Sachsenwerk Licht und Kraft Akt. Ges. April 21st 1921. (Addition to 172,982.) (178,803.)

5,096. "Thermionic tubes and the like." J. H. Swinton Whittaker. July 20th, 1921. (Divided application on 177,816.) (187,907.)

5,541. "Insulating tubes or guides for high-tension electric conductors." Meirowsky & Co. Akt. Ges. March 19th, 1921. (177,499.)

6,008. "Double pole for the supporting of telegraph, telephone, and electric power wires." J. E. Rutter. March 1st, 1922. (187,909.)

10,348. "Prepayment meters for gas, water, electricity, and other similar commodities." Landis & Gyr Akt. Ges. April 12th, 1921. (178,439.)

14,009. "Cooling of electric transformers and similar apparatus." W. H. Simms (Bureau d'Organisation Economique). May 18th, 1922. (Convention date not granted.) (187,921.)

16,733. "Trucks for tramway or railway vehicles." S. Thomas and Peckham Truck and Engineering Co., Ltd. August 15th, 1921. (Divided application on 185,009.) (187,927.)

18,873. "Automatic electric switching device." E. Magerle. July 21st, 1921. (183,444.)

21,707. "Electric-current limiting device." Aktiebolaget Birka Regulator. September 30th, 1920. (Divided application on 169,686.) (184,484.)

22,007. "Control systems for dynamo-electric machines." N. E. North and Metropolitan-Vickers Electrical Co., Ltd. January 27th, 1922. (Divided application on 183,692.) (187,928.)

25,566. "Electric switches." W. A. Coates, G. E. Gittins, D. R. Davies, and Metropolitan-Vickers Electrical Co., Ltd. July 13th, 1921. (Divided application on 186,733.) (187,585.)

THE

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ELECTRICAL REVIEW.

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THE GOVERNMENT SCHEMES TO RELIEVE UNEMPLOYMENT.

THE proposals which have been put forward by the new Government for the execution of public works of great importance and magnitude, with a view to the immediate relief of unemployment, have been received with interest by the whole industrial world, and by no section more attentively than by the electrical industries. There is enormous scope for development in various undertakings which are intimately associated with electrical engineering, "the handmaid of all other industries," and any extension of industrial activity is bound to react immediately and favourably upon the output of electrical workshops.

Most prominent amongst these projects is the electrification of railways, of which so much has been heard and so little has been done during the four years which have elapsed since the Armistice. It was dealt with in the Electricity (Supply) Acts of 1919 and 1922, and is an important feature of the policy of the Ministry of Transport. Progress has been hindered by the operations of the Ministry in connection with the reorganisation of the railway systems and the uncertainty which has prevailed regarding the future, but the grouping of the railways has now been established on a definite basis, and the only remaining obstacle is the all-important question of finance. To some extent that difficulty was relieved by the enactment of the Trade Facilities Act, which has enabled the London Underground Railways to embark on new developments of considerable magnitude, and the South-Eastern & Chatham Company to put in hand a scheme for the electrification of its suburban system which will cost over five millions sterling. But a vast amount of work remains to be done.

As Sir Philip Dawson remarked in our issue of November 17th, the electrification schemes which have been carried out in this country up to the present have not only proved of great benefit to the travelling public, but also have been most satisfactory to the shareholders; even at present prices, the electrification of the South-Eastern, Brighton, and Great Eastern systems would result in a substantial return on the capital outlay, besides assisting in the supply of cheaper electricity for all purposes. These schemes are already drawn up, and had they been carried into effect would have provided an immense amount of employment for various branches of the engineering industry; and the plans for several other projects are well advanced, particularly the electrification of the North-Eastern main line from York to Newcastle.

What was imperatively needed was an initial impulse to set this great work in motion, and we heartily welcome the action of the Cabinet Committee on Unemployment in conferring with the managers of the railways with a view to making an early start. Elsewhere we give a list of schemes which are in contemplation. We were glad to learn that the representatives of the railway companies expressed their desire to assist in every way possible, and to push on with development schemes with a view to providing employment at an early date.

It has been estimated that the aggregate cost of the projects in contemplation will amount to sixty millions.

If any difficulty is experienced in raising the capital—surely an improbable event—the Government will guarantee the interest. Power is already given by the Trade Facilities Act for this purpose up to a total of £26,000,000, and if necessary further powers will be obtained; but the method does not involve any actual outlay by the Government, except under very remote circumstances. The matter is rightly being treated as one of urgency.

We trust that the speedy inauguration of these great undertakings will have effect, not only in directly employing a large number of men, but also in stimulating the revival of trade and industry in other directions. The reports that we receive regarding the situation almost invariably indicate that a slow but steady improvement is taking place; important orders have been received from the Dominions, and confidence in the future, which is so necessary to industrial progress, is growing. Out of the mists and shadows of the present we look forward to a future when the sun of prosperity shall shine again upon these islands, and every man shall be assured of steady and remunerative employment.

Trade with Russia.

Under the title of "The Truth About Trade with Russia," a reproduction of a letter from a German correspondent, apparently at Petrograd or Moscow, appears in the *Elektro-Export Anzeiger* of October 15th.

After referring to the high cost of commodities in general, reckoned in paper roubles, the correspondent states that there are no longer to be found any dealers in the iron and the tool trade branches, and the procuring of merchandise from abroad seems not to have been resumed. None of the firms which existed before the war and had a large turnover with German manufacturers are still in business, but some of the owners are occupying themselves with all kinds of commission transactions and are waiting in the hope that other countries will some time come to their assistance in order to be able to carry on again.

The words "free trade" are declared by the correspondent to represent merely a Russian term, as all exports are a monopoly of the Government, although, according to a recent decree, individuals can obtain goods from abroad on securing special permission to do so. But the chief buying remains in the hands of the Commissariat for Foreign Trade. Every step taken, apparently, by those who seek to get an import permit, has to be paid for in the sense of the bribing of the officials. The writer lays emphasis upon this question of bribery, but his letter was no doubt dispatched before the recent decision of some of the Soviet chiefs to take steps to prevent this abuse of official positions.

The correspondent further states that very few foreign firms accept the risk of sending goods to Russia on consignment, as it is feared that the merchandise would be stolen before reaching its destination, and as there are no merchants engaged in regular business, who would undertake the responsibility for payment? Some German manufacturers are said still to imagine that it is only necessary to have a representative in Russia in order to be able to do business as in former times, but the grant of a commission on transactions would by no means suffice to maintain a representative in present expensive times and when bribery is rampant.

It is obvious that the German correspondent is under a misunderstanding in regard to the matter of free trade in Russia. This facility has not existed for a long time past in relation to the export trade, but freedom of trading was thrown open in the inland market some time ago. According to Russian news which reached Paris last week, it is now proposed to abolish even this privilege owing to the prices of commodities having been forced up by about 100 per cent. recently in consequence of profiteering.

From New Zealand to Canada.

Canada is very much before the mind of electrical men at present, and rightly so. Our recent leading article on the possibilities of the market and new measures that were being adopted to increase the sales of British electrical goods, excited so much interest and brought so many inquiries for further information, that it is amply proved that British manufacturers are far from giving the market up as a hopeless one. This is especially encouraging just now by reason of changes which are reported to be imminent in connection with the appointment of some of His Majesty's Trade Commissioners. Mr. G. T. Milne, who has been acting as Chief Commissioner in Canada for some years, is retiring, his period of office having come to an end. That being so, we may, while referring with satisfaction to the service that he has rendered, also refer with pleasure to the recent announcement that he is to be followed by Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, who is now in this country laying before such electrical and other traders as are taking the trouble to inquire of him, particulars of the position in New Zealand as it was when he left it a month or two ago. The notes that we published last week from the pen of Mr. Dalton showed that he has no mean ability in grasping and handling an electrical situation. To many of our readers, as to ourselves, this was not unknown many years ago, for Mr. Dalton came into close touch with the electrical fraternity here before he left for New Zealand six years ago. His previously-obtained electrical experience and acquaintance with Governmental policy and procedure, also his knowledge of business-men's ambitions and characteristics, are now reinforced by six years' experience in New Zealand when electrical schemes have been in the forefront of affairs. He will shortly proceed to a vast field of electrical opportunities—Canada—which was written of so hopefully by a number of contributors to our Jubilee issue. We are not suggesting that the chief Trade Commissioner in Canada can hope for a bed of roses, but if we could feel that Mr. Dalton would be able to achieve there one tithe of the success that has marked his lengthened stay in New Zealand, we should say that the British electrical industry's share of Canadian electrical development would be large. The appointment naturally arises: Who is to follow him in New Zealand so that the good work already begun may be continued?

Falling Prices and Swedish Railway Electrification.

It was originally estimated that the expenditure on the proposed conversion to electric traction of the Stockholm-Gothenburg railway would amount to 105,000,000 kronen. As a result of the fall in prices, the estimate was reduced to 50,000,000 kr. last spring, while now the computation has been further lowered to 35,000,000 kr. One of the State Railway officials emphasises the necessity for providing the native firms with work, and states that 20 per cent. of the orders would devolve upon the electrical works and the balance on the copper and steel works and the mechanical engineering works.

German Failure in Foreign Markets.

According to a German newspaper, the competitive capacity of German industry in the world's markets is further decreasing. Thus the Government of Brazil is said to have allocated to a United States firm the order for the delivery of plant for the introduction of electrical working on the Central Railway of Brazil. It is stated that the German offers put in did not receive favourable consideration owing to the prices being higher than those of American firms, and also because it appeared to the Government that the maintenance of the periods of delivery was not sufficiently guaranteed in consequence of the economic conditions in Germany.

There is little doubt that Germany in her efforts to resume trading operations with various markets will

avail herself of the services of men of other nationalities. Evidence to that effect is constantly arising, and it is not surprising to those of us who knew with what measure of success such arrangements operated in this country and in some of our Colonies before the war when the German had less need to hide his face on account of his bloody record, than he has to-day. A revival of such activities was the openly avowed, almost boasted, intention of some, and it was well known what we might expect from them when they felt that British recollections of some things were becoming dulled by the persistence of other problems. But Germany's difficulties in foreign markets are by no means confined to the continued antipathy of other peoples. Financial and economic problems are her supreme trials, and in this connection it is noteworthy that British assistance is to be enlisted to enable German concerns to exploit concessions in Russia. German Press reports have it that an agreement has been reached between Krupps and a British syndicate (Mr. Urquhart is said to have acted as an intermediary) for the exploitation of concessions which have been obtained by the former in various parts of the world, including Russia. It is even said that "the British group" is to advance 75 per cent. of the requisite capital. In the absence of fuller details we are unable to express ourselves very definitely in regard to the reported understanding, but while we want to see industrial and other development taking place which shall secure stabilisation in Russia, and while we want to see an improvement in Central European conditions in the interests of the whole world, we are not enamoured of a proposition that British capital should enable German concerns to secure Russian contracts for execution in Germany. We are at the present moment more anxious that British capital should be available for enabling our own schemes here and in the Colonies to be proceeded with, making employment for our own kith and kin who, in too many cases, perforce stand begging at our very doors.

The Trade Problem of India.

During the past year or two there has been a good deal of fear regarding the future of British trade with India. That country suffered severely from the failure of international demand for her produce and from the over-importation of manufactures, both of which occurred after the Armistice was signed. British merchants were subjected to unwarranted criticism because they naturally refused to shoulder the whole burden of repudiated contracts when delivery could not be taken and payment could not be obtained on speculative orders. Forgetful of the debt which India owes to British capital and energy in developing her economic resources, political and racial feeling there, accompanied by attempts at boycott, at one time threatened the cordial and long-standing relationships that existed with United Kingdom firms. Further, India has shown an inclination to follow the example of so many of our overseas markets and raise a tariff wall against imports in the hope of fostering more manufacture within her own boundaries. It is true that the import duties so far imposed are in few instances heavy, and that the Fiscal Commission, whose report has recently been published, recommends that "discrimination" be exercised in any protective tariff that may be framed. But there is at the same time revealed a strong minority in favour of heavy protectionist duties. In all these circumstances, while one may fervently hope for a full realisation of the measure of optimism displayed in H.M. Trade Commissioner's report, which we summarise in another column, one cannot help feeling that the situation is still fraught with some danger. Our engineering trades, however, have probably less to fear than our textile exporters. If India decides on a policy of protected industrialisation, she will require large quantities of machinery, factory equipment, and semi-manufactured material for many years to come. By way of normal development, Mr. Ainscough anticipates a great expansion in the demand for plant of all kinds. A number of sound industrial propositions are, he says, merely awaiting a favourable money market before they are floated. He looks forward, too, to British success in obtaining the bulk of the orders placed in connection with the expenditure of £100,000,000 which is to be made during the next five years on the Indian railways. In this connection our engineers might do well to note the Trade Commissioner's remarks about American preparedness.

International Telephony.

The French Minister of Posts, Telegraphs, and Telephones (M. Paul Laffont) proposes, according to the Paris correspondent of *The Times*, to invite the technical administrators of the telephone systems of the Western European countries and of the Mediterranean seaboard to attend a conference at Paris in the near future, with a view to the establishment on a commercial basis of a practical system of long-distance telephony by means of international trunk lines.

The delegates to this international technical conference shall include, it is proposed, representatives of the telephone systems of 13 countries—namely, England, Belgium, Holland, France, Switzerland, Italy, Spain, Portugal, Morocco, Algeria, Tunis, Tripoli, and Egypt—and M. Laffont urges that France, by her geographical position, would naturally become the keystone of the vast telephone system that would be formed by the combination of the systems in the above-mentioned countries. If France does not become the intermediary, Germany, it is feared, will try to take her place.

In outlining his plan, the Minister calls attention to Mr. Frank Gill's recent presidential address before the Institution of Electrical Engineers, which we commented upon at the time, in which the long-distance telephone service that is available in the U.S.A. was instanced as a striking example of what is possible as a regular and practical system. Mr. Gill's bold plan, it will be remembered, is that Europe should, in effect, be treated as one country for telephonic purposes.

His additional suggestion—that a conference of representatives of all the European telephone authorities should be called immediately—seems to have been acted upon, and if the Conference can get to work without undue delay, it should find no great difficulty in formulating a scheme for the attainment of the desired result, which could be submitted to the International Conference on Electrical Communication, which, it is expected, will take place in Paris in the spring of 1923, when an attempt will be made to come to agreement on the various subjects that were discussed at the preliminary conference held at Washington in October and November, 1920.

Mr. Gill's daring plan seems to have been approved of, at any rate in France: America has found the telephone service indispensable to the efficient transaction of commercial affairs, and there would appear to be no serious reason why Europe should not share that convenience also. As Mr. Gill stated in his address, the language question presents no difficulty, and the better the facilities for intercommunication the better for the peace of the world.

International Arbitration in Commercial Disputes.

With further reference to this subject, upon which we have on several occasions commented editorially, we learn that the Executive Committee of the International Chamber of Commerce, which assembled in Paris last week, decided that merchants and manufacturers in all countries should have the facility of utilising the services of the Court of Arbitration which has been established in connection with the Chamber. The Executive Committee of the Court is ready to examine any disputes which may be submitted as from the present time. The solemn inauguration of the Court, comprising 100 members representing the affiliated countries, will take place in Paris on January 19th, 1923.

CAUSES OF TRANSFORMER FAILURES.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

The faults that most frequently occur in practice may be classified broadly as follows, although to a large extent the different kinds often react upon one another:

A. Breakdowns in the magnetic circuit, *i.e.*, in the cores, yokes, and adjacent clamping structure.

B. Breakdowns in the electrical conducting circuit, *i.e.*, in the coils and minor insulation and terminal gear.

C. Breakdowns in the dielectric circuit, *i.e.*, in the oil and major insulation.

D. Other structural breakdowns.

These breakdowns may be due (*a*) to faulty manufacture, which comprises poor design, faulty material, and bad workmanship; and (*b*) to faulty and abnormal operation, which includes careless drying out and installation, lack of adequate supervision, and abnormal transient or sustained operating conditions. How far these various factors are responsible for transformer breakdowns can be judged from the following review.

(A)—Breakdowns in the Magnetic Circuit.

1. Failure of core bolt insulation, paper or other insulation between laminations and insulation between yokes and yoke clamping plates. These failures produce large circulating eddy currents which generate considerable quantities of heat, so damaging the core and possibly the coil insulation.

2. Vibration of the core structure due to slack core clamping bolts. This tends to weaken all the core insulation, which produces the failures mentioned under 1.

3. In manufacture, the edges of the core and yoke laminations may have become burred due to the continued use of worn dies. Laminations become short circuited therefore, and eddy currents with consequent abnormal heating are produced.

4. Similar to 3 is the presence of iron filings or small steel turnings between the laminations; the results, too, are frequently the same.

5. Abnormal gaps, between the cores and yokes of transformers with butt yokes, may be left due to poor machining. In service this produces local heating and possible burning in the vicinity of the gaps.

6. Shallowly designed yokes, particularly of the "butt" type, result in the magnetic flux entering and leaving the cores at an angle other than normal to the joint. This produces local eddy currents and heating at the joints. A deep yoke eliminates this by drawing the flux more vertically upwards or downwards, so tending to bring the leaving or entering angle back to the normal.

7. High core loss and excessive heating of the core is produced when the e.m.f. waves, for a given effective voltage, are flat topped. The formula connecting voltage and flux is—

$$E_{eff} = 4 \cdot f \cdot B_{max} \cdot A \cdot n \cdot T \cdot 10^{-8}$$

where f is the form factor of the e.m.f. wave.

For a sine wave of e.m.f., $f = 1.11$.

For a peaked e.m.f. wave $f > 1.11$, and therefore B_{max} is lower for the same effective voltage, and the iron loss is less than if the e.m.f. wave were sine shaped.

For a flat topped e.m.f. wave $f < 1.11$, and therefore B_{max} is higher for the same effective voltage, and the iron loss is greater than if the e.m.f. wave were sine shaped. The magnetising current is also considerably heavier.

8. Apart from the increased difficulties of core assembly, the use of thin laminations often produces high iron losses and heavy magnetising currents. This is on account of the low iron factor involved, which gives a smaller cross-sectional area of core than has been allowed for, and a correspondingly higher value of B_{max}. This cause only applies to those cases where the shops have inadvertently used thinner laminations than they have been instructed to use by the designer.

9. High saturation of the magnetic circuit often results in heavy magnetising current rushes occurring when switching a transformer into circuit on no load. While this current rush generally dies down rapidly, large electromagnetic forces are generated while the heavy current lasts, and the windings are thereby strained. The phenomenon becomes more severe the nearer the transformer is located to the generating source. Repeated switching-in may ultimately cause disrupture of the windings.

10. If transformers providing a mid-wire or neutral for use as a d.c. neutral have not their windings carefully balanced, the d.c. ampere turns in the windings on opposite sides of the transformer neutral do not neutralise one another. The a.c. flux, therefore, instead of being symmetrically disposed on either side of the normal *zero* axis, becomes equally disposed on either side of an axis corresponding in value to the resultant d.c. flux in the core. That is, the a.c. flux becomes superposed upon the resultant d.c. flux, and the total a.c. flux waves are unsymmetrical about the *zero* axis. Therefore, the core becomes highly saturated during one half period and correspondingly less magnetised in the next half period, and it heats up to an extent depending upon the value of the d.c. resultant flux.

11. Transformers for use with rotary converters are often designed for a high internal reactance for the purpose of d.c. pressure regulation. The high reactance is obtained by the use of magnetic shunts placed in the leakage field between the primary and secondary windings, and if these shunts are designed to possess a high degree of magnetic saturation, a large amount of heat will be generated, which will eventually destroy the coil insulation, and possibly cause the oil to sludge. Under certain operating conditions, the high saturation in the magnetic shunts may produce commutation troubles in the rotary converter, due to the higher harmonics introduced.

12. High saturation in the magnetic circuit produces higher harmonics of voltage or current of appreciable magnitudes which may have very serious effects. Generally the third harmonic only is of importance, though under very abnormal conditions harmonics above the third may create trouble. Third harmonics of magnitudes likely to be objectionable are confined to three-phase shell-type transformers, and to three-phase banks of single-phase core and shell type transformers; they are usually negligible in three-phase core type transformers. Their sphere of potency can still further be confined to the star/star, star/interconnected star or interconnected star/star connections; in the last two connections the star side only need be considered. With isolated neutrals, the line to neutral voltage will contain a large third harmonic component equal in maximum amplitude to 60 per cent. or more of that of the fundamental. This represents an increased dielectric stress on the coil insulation which *may* shorten the life of the transformer. If the secondary neutral only of a star/star connected transformer or bank supplying a high or moderately high voltage cable is earthed, the third harmonic component of the magnetic flux becomes amplified, which further increases the third harmonic voltage component until the transformer core becomes thoroughly saturated. The saturation, therefore, reaches a much higher value even than originally designed for, and the iron loss increases considerably.* Under such conditions the transformer will reach a dangerous temperature, which will cause deterioration of the coil and core insulation, and if allowed to continue will produce

* See "Triple Harmonics in Transformers," by G. Faccioli, *Journal* American I.E.E., May, 1922.

sludging of the oil. This abnormal heating occurs without load on the transformer, and in practice the iron loss has been known to increase to three times the normal.

13. If the voltage applied to a transformer must be increased appreciably on account of the exigencies of the system load, the frequency must also be increased in order to avoid high magnetic saturation of the core. An *increase* of voltage must not be accompanied by a *decrease* of frequency, as, if it is, high core saturation will occur with resultant increased iron loss and abnormal core heating. The interdependence of voltage, frequency and flux will easily be seen from the following formula :—

$$B_{max.} = E_{eff.} \times 10^{8} / 4 . f . A . T . n$$

where $B_{max.}$ = max. induction density in the core.
$E_{eff.}$ = effective applied voltage,
f = form factor.
A = cross-sectional area of core.
T = number of turns.
n = frequency.

14. In the older manufactures, ageing of the core plates may be found to have taken place. This is due to a deterioration of the material of the laminations, and the result is manifested by a considerable increase in iron loss and rise in temperature of the transformer. This may eventually lead to a partial or complete destruction of the coil insulation and to sludging of the oil.

(B)—Breakdowns in the Electric Circuit.

1. A short circuit between adjacent turns of a coil—usually of the h.p. winding—may be caused by the presence of sharp edges on the copper conductors. If the transformer vibrates when on load, or if the windings are subjected to repeated electromagnetic shocks, these sharp edges will cut through the insulation and allow adjacent turns to make metallic contact.

2. A short circuit between turns may result from the dislodging of one or more turns of a coil caused by a heavy external short circuit across the windings. Breakdown may not occur immediately the turns are displaced, but should the transformer vibrate while on load due to looseness of core bolts, or should it receive repeated heavy electromagnetic shocks, abrasion of the insulation between adjacent dislodged turns will most likely take place, so producing a breakdown.

3. Occasionally the cotton covering of square wire conductors may not be wound on the copper as tightly as it should be, in which case it has a tendency to bulge over each face of the conductor. The true square configuration of the conductor is, therefore, masked, and in fact it may even appear to be more round than square. Consequently the coil winder has some difficulty in making certain that the conductor has not become twisted in the winding process, and cases have occurred where short circuits between turns have arisen as a result of this twisting. At some place in the coil, adjacent conductors are edge to edge or face to edge, and in time the insulation between such turns becomes chafed and breakdown ensues. The trouble is, of course, accentuated if the edges of the conductor happen to be sharp instead of rounded.

4. Transformers for use on heavy powered systems are now usually fitted with adjustable coil supports for the purpose of taking up any shrinkage of the insulation which may occur under service conditions. Unless this hand adjustment of the coil supports is performed very carefully by an experienced workman, so as not to place too great a mechanical pressure on the windings, some of the conductors may become dislodged, and a short circuit between turns may occur as outlined under 2 above.

5. Short circuits between turns are almost bound to occur sooner or later should moisture penetrate the fabric insulation of the coils. Breakdown from this cause is rendered more imminent still if the coils have been insufficiently impregnated, *i.e.*, if the varnish has not thoroughly penetrated to the innermost layers of the coils.

6. Drying out a transformer on site may be undertaken by an engineer not fully conversant with the operation, and the process may be unduly shortened. If normal electrical pressure or a testing pressure is switched on while the insulation resistance of the windings is still low, the insulation between adjacent turns is very liable to fail at some point or other on account of the presence of moisture vapour.

7. Cases have occurred where thin ribbon wires have been wound on edge, direct on to an insulating cylinder, to form spiral type coils. Such a coil is mechanically weak, and the turns are liable to lean over from the plane normal to the cylinder surface so that the coil becomes very susceptible to damage in the event of an external short circuit occurring on the system.

8. In very high voltage transformers the conductor insulation may deteriorate on account of the corona which may take place from sharp or slightly rounded edges. This phenomenon becomes more acute should there be any occluded air in the coils, and a short circuit between turns may eventually take place.

9. If a transformer is subjected to more or less rapidly fluctuating loads, the expansion and contraction of the copper-conductors alternately compresses and releases the pressure on the insulation between turns. As the dielectric strength of most fabric insulations decreases with increasing mechanical pressure, the windings become more susceptible to failure should they be subjected to electrical or magnetic shocks.

10. If individual coils, particularly of the h.p. "cross-over" type, are designed to have too great a radial depth in comparison with their height, so-called "hot spots" will arise in the interior of the coils. These will produce brittleness of the conductor insulation, and a short circuit between turns may eventually take place. This danger becomes considerably enhanced if the design of the oil circulation system is inadequate, *i.e.*, if the oil ducts are too narrow.

11. For the purpose of increasing the dielectric strength between adjacent conductors, the latter are often taped with one or more overlapping layers of insulating tape. If this has been carelessly carried out, only one effective thickness of tape per layer instead of two may be the result; that is, the overlapping has been converted into a butt joint of the taping. Pressure tests on a sample coil would, of course, locate this, but otherwise the windings would probably fail sooner or later when subjected to the shock of electrical pressure rises.

12. Heavy eddy currents may be produced in coil conductors—usually the l.p. coils—where there are several wires in parallel to form each conductor. These wires are usually rectangular, and they should so be wound that the shorter side of each is presented to the flow of the leakage flux between primary and secondary windings. That is, the shorter side should be normal to the path of the leakage flux and the longer side parallel with it. If this procedure is reversed, excessive eddy currents flow in the conductors, and "hot spots" may be produced in the windings.

The various layers of sub-divided conductors should be transposed during the winding process so that each parallel portion in its path from terminal to terminal occupies each different position for an equal length. This has the effect of equalising the load taken by each individual wire. If this be not done, the different layers will not share the load equally, and some will overheat, thus tending to accentuate the "hot spot" phenomenon previously referred to.

13. Badly soldered joints between coils may overheat on load, and local carbonisation of the oil may occur. The heat generated at the joint will probably be transmitted to a certain contiguous length of conductor of each coil, and this may partially carbonise the insulation round the conductors and eventually result in a short circuit between turns.

14. In very high voltage transformers, dielectric losses in the insulation may lead to excessive heating and ultimate failure of the latter.

(To be concluded.)

ELECTRO-FARMING.—II.

The Load-Factor of the Poultry Farm.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

Where progress is slow, lack of knowledge will be found. This is very true of electro-farming in this country at the present time. Although its advantages have been amply demonstrated abroad and confirmed at home, there is no definite move being made to secure them for this nation. The reason is largely and frankly ignorance of the possibilities and conditions.

Probably the chief cause of farm electricity supply not being developed in this country is the widespread impression that the agricultural load factor is too poor. Fortunately this impression is quite wrong. It is the purpose of this article to examine in reasonable detail the conditions which govern the poultry farm's demand for power and to show the true value of the resulting load factor. It will be found to be surprisingly good—

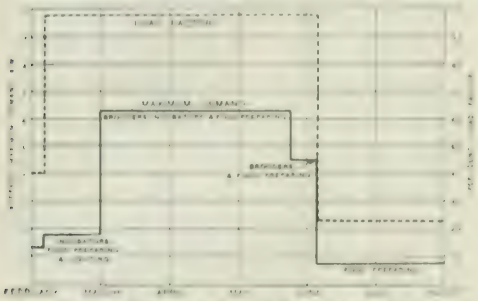


Fig. 1. Mean Demand and Load Factor during Egg-laying Season of Small Poultry Farm.

much better in fact, than any works load factor in industrial areas.

It is fairly obvious that the class of farming carried on should influence the demand for power and modify its load factor. This is found actually to be the case. The dairy farm as usually carried on in England is the poorest with its modest load factor of 13 per cent. At the other end of the scale the poultry farm gives at least 50 per cent. In themselves these are desirable loads, but considered in conjunction with the other demands for which power stations usually cater, they have additional attractive features.

It is not pretended that machinery or methods developed for other drives will necessarily give the best results by the mere addition of an electric motor. Although even under these circumstances a considerable improvement will be found, it is possible in farming, as in other industries, to obtain better results where slight adjustments in the usual processes are made to take full advantage of the electric drive.

If a private generating plant is installed, the farmer can usually be induced to make the necessary modifications in his working arrangements if it is made clear to him that by so doing he can meet his requirements with a smaller and cheaper plant. That represents a direct saving to him, and the farmer is essentially an economic being and is probably the only one considered in that light. If progress is slow in building up a farm load on public mains, it is because few engineers have taken the trouble to put the advantages before him as a question of money value. It is utterly futile to start out with the idea that his load is unremunerative to the station and charge him in consequence a price per unit which makes electricity unattractive, and apparently unremunerative to him. It is a national calamity when this short-sighted policy is pursued based on a woeful misconception of the case.

The twenty-four hour load enables the maximum number of units to be supplied per annum from a generating plant of given size. Because its earning capacity is thus increased, the standing charges per unit are reduced, and owing to steady loading and the consequent better use of the generators, more economical running is obtained. The cost per unit is therefore much reduced. Such an elementary statement may appear to be a mere platitude, but it contains a basic principal unfortunately too often ignored when desirable loads a little out of the ordinary are considered. Were it really applied, a more extended development of heat storage water-heaters would have taken place.

Properly organised on electrical lines, the modern farm can provide a load which in combination with the much prized industrial load of the towns will approach reasonably near to the desirable twenty-four hour condition.

In spite of the enormous imports of poultry and eggs into this country, poultry farms on a large scale are numerous and, in general, prosperous. There is no doubt that given cheap current, their number would rapidly increase, for the reduced expenses would enable a part of the twenty millions annually expended on imported poultry products to be spent on home produce. From the central station standpoint, the load provided by a fully electrically-equipped large-scale poultry farm is as close to the ideal as can be obtained in tranquil times when the fever heat of munition-making has subsided. For five or six months of the year a continuous and constant load for twenty-four hours per day and seven days per week can be obtained. A poultry farm upon which the author is advising will require, when electrically equipped, a plant capable of giving 45 kW continuously during five months of the year under these desirable conditions. The remainder of the year will provide a load factor of from 25 per cent. to 30 per cent.

There is no reason why even this very good condition should not be still further increased and incubation made all the year-round business in order to supply the demand for table poultry. The introduction of new means will almost certainly lead to new methods.

It will probably be a surprise to many that the somewhat despised "hen farmer" can be such a desirable connection from the supply standpoint. In the case instanced above, the weekly units amounts to 7,500, or,

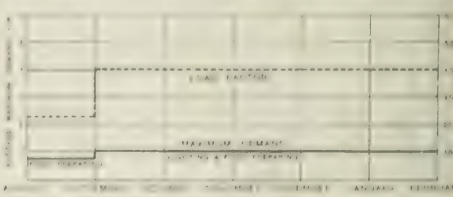


Fig. 2. Mean Demand and Load Factor during Laying Season.

for the five busy months, 166,000. Even if the remainder of the year brings up the total annual consumption to 200,000 units (a figure much below what the consumption will be), the result is an average annual load factor of 51 per cent. Looked at in another way, this poultry farm will consume as many units annually as an engineering works with 450 h.p. of motors, or a cloth factory with a maximum demand of over 200 kW.

Valuable as such a load would be to any supply station, it is insignificant when compared to the consumptions of the large American poultry businesses whose speciality is the sale of day-old chicks. These concerns run five months in the year and then shut down till the next season. The largest hatchery is entirely

equipped with automatic control instrument and has a capacity of about 600,000 cubic feet per twenty-four hours. The weekly consumption of coal-gas by Gasbags on the plant is 30,000 cubic feet. The maximum demand so far recorded is 1,200 cubic feet per hour, established in January last.

It is interesting to note that the Lindsey scheme is but one amongst others that will participate in future developments. The Commission have considered gasbags as the cheapest form of storage, but the Lindsey scheme is the first scheme of any magnitude to be put into operation. The Commission have also considered the question of storage by means of compressed air, but the cost of this system is very high. Another system which has been considered is that of storage by means of electrically-driven pumps, but this system is also very costly. The Commission have also considered the question of storage by means of accumulators, but this system is also very costly.

The Commission have also considered the question of storage by means of compressed air, but this system is also very costly. The Commission have also considered the question

After a lapse of, say, seven years, commencing from about the time the licensee began to raise capital, the public are looking for some return on the investment. At or about the same time the licensee is perhaps looking for more money on the pretence of, or (which is more likely) for the purpose of, building necessary steam-power stations and, perhaps, transmission lines. It is obvious that this country must not have any of these very bad examples of "commercial" hydro-electric power transmission engineering if the industry is to expand. It would be due to such failures or "fishy" commercial engineering that financiers and the public alike would be apt to say: dispense with power transmission, put up the steam plant first, and then talk about water power and transmission lines and the power market, &c., when more reliable information regarding the available water power, reliability of service, and favourable power rates, &c., is at hand. This represents one of the conditions this country will have to guard against, and, in the writer's opinion, every assistance should be given to the Electricity Commissioners.

In general, developments of the type offering in this country are likely to require a relatively large capital investment, and the return on these investments will depend in no small measure on how the plants obtain the *greatest number of kW-hours per cubic ft. of water*, and on how the plants are burdened by the terms of and expense of capital for the development. For this country, hydro-electric plants will, in general, be supplemented by steam plants, in which case all the load that cannot be supplied by the hydro-electric plants must be obtained by burning fuel.

Putting aside for the moment the question of the most economical development, future progress in the way of storage (excess and ordinary) is certain to attach considerable importance to the saving of fuel and operating expenses, &c., during that part of the year when the stream flow is high and when, perhaps, it would otherwise go to waste; obviously, the existence of *secondary power* will permit the closing down of an equivalent amount of steam power. Depending on the character of the development, but more particularly on the amount of storage available, secondary power may, in one way, be determined by such a condition as the economic balance between the yearly fixed and operating costs of the additional hydraulic and electrical plant, equipment, &c., and the operating expenses necessary with a steam plant of equivalent capacity. The "base-water" or *primary power* usually means the amount available for 8,760 hours in the year. When storage is used, the estimated available power is most often taken over every hour of every day for 100 to 150 days of the year, the period of time varying with the amount of storage and the probable use of the power, the load factor, the diversity factor, &c. The extent to which storage can be used to augment, equalise, or regulate steam flow depends on a great variety of conditions varying widely in character. In this country the amount of energy that can be delivered in the form of secondary power is likely to be much greater than the amount that can be delivered as primary power. For many of the larger future developments in this country, the secondary power can be fully utilised only by combination with some other power, such as steam-electric or other hydro-electric plants. In most cases, the *excess* storage of water can be accepted as representing primary power—difficulty may often be found in the determination of the exact dividing line for these two distinct classes of water power. In all cases, the chief question will be the determination of the amount of plant and apparatus that should be installed for a given development using storage, and how much it will cost to develop this class of power in comparison with what is usually expressed as the relatively more reliable source—steam-electric power.

It is clear that, failing to obtain a reliable analysis of the rainfall and run-off or the accurate determination of the quantity and distribution of the stream flow available, it will be impossible to prepare final figures for the most essential matters, such as: the most economical development; the maximum and uniform power which can be depended upon at all times in all years; the length of time storage or secondary power will be available; the actual (*not* the estimated) total energy available corresponding to (*a*) base-water supply, and (*b*) storage. Furthermore, as regards *the economical plant capacity* which depends chiefly on the average annual run-off of stream flow, other important matters are involved, such as: whether the plant is to be operated singly or to be linked up with other hydro-electric or steam-electric plants; the system load factors and their characteristics; the anticipated power market (present and future); the total development costs; the estimated profits, &c. All these and other independent and inter-dependent factors must be given proper study.

In the hydro-electric field we have now reached a stage of high efficiency where hydro-electric works and plants can be cheaply installed, cheaply maintained, cheaply housed, and cheaply operated. Due to the present state of *high overall efficiency* of the developed waterways, turbines, generators, transformers, transmission lines, &c., constituting all the main "links" in the developed hydro-electric system (of which the turbine has up to the present received perhaps the most attention, due chiefly to its relatively delayed state of high efficiency), the writer is firmly of the opinion that, now the turbine has reached about the highest efficiency (94 per cent.) that can be expected of it, and that hydro-electric power in great amount has been delivered to the switchboard at 90 per cent. overall efficiency, the near future will see a more general concentrated attention on those matters affecting improvement in the "*overall water efficiency*," commencing with the catchment area itself and following every movement of the rain water up to and including storage and water supply to the developed waterways. As shown below, present-day maximum efficiency of the developed works, plant and apparatus, &c., clearly indicates that little improvement can be expected in this direction. With proper attention given to conservation of water and head effected by the reduction of hydraulic losses to a minimum, and by refinements in the design of the various essential elements of the development as a whole (starting at the watershed itself), the production of power is certain to reach a much higher state of perfection, speaking generally, than exists in the world at the present time.

From a universal viewpoint, very few hydro-electric schemes can claim (*a*) the highest possible practical use of a given quantity of rain-water; (*b*) the best and most economical location of development sites; (*c*) the most economical development as a whole; and (*d*) the very best and most economical system operating conditions. In general (considering the *developed* hydro-electric system) there are to be found several outstanding points in a complete development where efficiency improvement can be effected. The principal points, considered in the order of importance as regards losses, are: (1) conservation of rain-water from the time of rainfall up to and including the point of storage and the entrance through racks at the intake of the developed waterways; also the accurate determination of the economical development with reference to the available water power; (2) turbines complete; (3) transmission lines; (4) feeders; (5) electric distribution service; and (6) the open conduit (unlined) and the pipe line.

One of the greatest mistakes of the present day is in the high value assumed for overall efficiency of the complete hydro-electric development. Usually the lowest overall efficiency given is somewhere around 65 per cent., whereas 45 per cent. would—with the majority of existing developments—have been nearer the mark when accounting for all losses from and including the developed waterways up to and including the point where the energy is to be sold, *i.e.*, the customers' service. Neglecting the losses in advance of and above the entrance to the developed waterways, the overall efficiencies of the *best* and *largest* hydro-electric systems,

as also the overall efficiencies of future similar or larger-sized developments, are given below in estimated form.

Certainly the most important problem of the future will be one of how efficiently water can be utilised rather than one of producing a reliable source of power, which latter we have already overcome. Higher efficiency will come from the study and training of run-off, &c., and from the making of the development as a whole—commencing at the watershed; that is, by conservation and economical utilisation of the seasonal flow to the very best advantage and by getting as much of the total precipitation, in the form of run-off water, to the turbines with the *minimum of loss of water and head*. In other words, to obtain the greatest number of kW-hours out of the smallest quantity of water, or the greatest number of kW-hours from the highest possible ratio value of run-off to total precipitation.

For the best *modern* and best *future* hydro-electric systems (large systems only), the overall losses respectively, should come within the prescribed ranges (*a*) (*b*) and (*a'*) (*b'*) given in the following:—

*Hydro-electric system losses.**	Per cent. values. Best Modern. (*a*)	(*b*)	Best Future. (*a'*)	(*b'*)
No. 1. In the developed waterways, including head works, short conduit and pipe line, &c.	2	4	1.5	2.5
2. Turbines (main units, exciter units, &c.)	7	10	6	10
3. Generators and exciters, &c. ...	2	3	1.5	2.5
4. Step-up transformers	.8	1.5	.7	1.0
5. Transmission lines	6	8	4	6
6. Step-down transformers ...	.8	1.5	.7	1.0
7. Synchronous machines, sub-stations, and distribution centres	4	8	4	6
8. Feeder circuits	5	10	5	9
9. Low-pressure transformers and distribution service	5	9	4	7
Total	33.6%	55%	27.4%	45%

The best overall efficiency of all the developed waterways from the headworks-intake to the turbine shaft (including such rare cases as the late Niagara installation) is:—

Best modern (*a*) 91 per cent. *Future* (*a'*) 92.5 per cent.
(*b*) 86 per cent. (*b'*) 87.5 per cent.
(*mean value*) 88.5% (*mean value*) 90%.

As bulk supply will usually include those items between No. 1 and No. 6 inclusive, the very best overall efficiency will be:—

Best modern (*a*) 81.4 per cent. *Future* (*a'*) 85.6 per cent.
(*b*) 72.0 per cent. (*b'*) 77.0 per cent.
Best mean overall efficiency 76.7% (modern).
Best mean overall efficiency 81.3% (future).

But, to the point of energy for sale to low-pressure customers, the best overall efficiency will be around the following figures:—

Best modern (*a*) 66.4 per cent. *Future* (*a'*) 72.6 per cent.
(*b*) 45.0 per cent. (*b'*) 55.0 per cent.

With a best mean overall efficiency of 55.7% for *the most modern and largest sizes, and a best mean overall efficiency of* 63.8% for *the best and largest future systems.*

Two developments are rarely, if ever, exactly alike, hence the limits (*a*) and (*b*), and (*a'*) and (*b'*), are given for what may be called the highest practical range of efficiencies. At the present time the major portion of the world's hydro-electric systems, taken as a whole, have not attained the efficiencies of (*b*); hence the necessity, when making a determination of available power, of allowing for a proper and safe overall efficiency which, at the present time, is usually rated too high. The above values represent the highest range of efficiencies.

* Poor hydro-electric systems have losses somewhere in the order of:—

Item.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5	No. 6	No. 7.	No. 8.	No. 9
Losses %	11	18	5·5	2·2	15	2·2	12	16	18

It rarely happens that all these losses occur on any one system, hence they are not additive, nevertheless the respective losses given represent poor design, and they are found in practice. On the other hand (*a*) and (*a'*) will be of rare occurrence as they represent the very best efficiencies for each main "link" in the system.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Society of Technical Engineers.

The E.P.E.A. has figured recently to a considerable extent in the technical Press, and such references naturally occasion some curiosity as to the present standing and activities of its sister organisation—the Society of Technical Engineers. The success of the E.P.E.A., in the sphere where it proposed to function, has not been more clearly depicted than in the attempt to clip its wings in the matter of alterations of status of some of its members. The S.T.E. has apparently not yet achieved any recognition by the "powers that be," and has therefore no body to be kicked, but its official non-existence is a very doubtful benefit to members and possible members. It is also, I believe, unknown to a very large number of potential members, and by a few who have heard a little about it, it is described as a "wash-out," and judging by the paucity of Press references, both counts appear to possess a certain semblance of truth. Wherein lie the reasons for the undoubted and distinct success of the E.P.E.A. and the apparent failure of the S.T.E.? The latter body, it will be remembered, was heralded and commenced its career in the midst of publicity and propaganda, an environment which was certainly not the good fortune of the E.P.E.A., and yet with this undoubted advantage over the E.P.E.A., although the publicity rapidly became a vanishing quantity, it appears to have made little or no headway, is now apparently moribund, and if rumour is correct, likely to dwindle away into a vague regret. The E.P.E.A. gives every promise of fully justifying its "raison d'être," but the S.T.E. with a larger field for membership, more favourable conditions for propaganda, and with only slightly less time to develop its policy, has not up to the present indicated that it will ever compare favourably with the E.P.E.A. as a protective organisation. There is surely scope for a live association of technical engineers, and if the S.T.E. does not fulfil requirements, the reason should be ascertained and rectified or alternatively the E.P.E.A. might consider opening its membership to the technical staffs of electrical manufacturing concerns.

One of Them.

November 27th, 1922.

Estimating for Internal Wiring Contracts.

In your issue of the 24th inst., Mr. Kirk adversely criticises "The Scottish Mode for the Measurement of Electrical Works, 1918." We would mention that we have scheduled, estimated, and made out our accounts practically in accordance with this Mode in all the installations we have carried out during the last 30 years that is, before the system was introduced in the Scottish Mode, and we have never found any difficulty with it in practice.

Lowdon Bros. & Co.

Dundee, *November 27th*, 1922.

The problem of an equitable code for the estimating of internal wiring contracts is much more involved than appears on its surface, and the President of the Electrical Contractors' Association of Scotland has drawn my attention to the letter in your issue of November 24th, by Mr. Alan Kirk, who states a case which might, under certain circumstances, be inequitable.

The code was designed to be applied for work of any voltage, to be issued by an engineer conversant with the principles involved, and to ensure that the contractors estimating would all be tendering for the same amount of work, and the same class of materials.

The classified circuit wiring termed "wiring to points; lighting, plug, switch, &c.," also includes the proportion of leads between the distributing fuseboard and the distribution box, from which the lighting point in question is served, and if the number of lights at any one point is increased it will be necessary for the contractor to rearrange the lighting circuits so that the number of lights thereon shall not exceed the limit mentioned in the specification; the addition of one light could conceivably necessitate running an additional pair of leads between the distributing fuseboard and a local distribution box, involving considerably more expense to the contractor than running an entirely new [illegible] from the distribution box. A case in point would be in a 25-volt installation where the number of standard lamps on any one circuit was four, and this circuit had been filled before the additional light suggested by Mr. Kirk had been ordered.

The writer's citation of the addition of one light to a three-light point is obviously an intention to quote an extreme case. In most installations the proportion of three-light points, compared with one light, is extremely small, and the addition, therefore, should be a comparison of four lights to one light, and it must be quite clear that a con-

tractor is entitled to twice as much for wiring a four-light point as for one light.

May I remind Mr. Alan Kirk that it costs 1s. to send 5 lb. weight by parcels post, but only 8d. if his package is a fraction of an ounce under that weight.

Basil A. Pilkington.

Edinburgh, *November 27th*, 1922.

Salesmanship.

There is a great deal in your columns in the ELECTRICAL REVIEW this week on the matter of Salesmanship, with which I find myself in agreement. May I suggest that salesmanship is just a psychological question: A man must have the gifts and intuition of a seller and must receive the support and encouragement of the management. If after a few months he has it borne in on him that he ought to have done a lot more business, and that the question is why the deuce he has not done so, he loses somewhat in efficiency. There is another attitude of mind very often noticed in "The Management"—that is, that any good contracts were bound to come to that particular company on account of the transcendent virtues of the management and the extraordinary excellence of its manufacture; that also takes off a little from the salesman's efficiency. Another temptation that "The Management" frequently succumbs to is that of butting in at the last moment and signing the contract with some slight modification, and then saying that "we did it, of course, from this office." That also does not add to the efficiency of the salesman. It should be borne in mind that the good salesman is a highly tempered—but withal a very sensitive—instrument of commerce. It is no use blunting your own tools and expecting work of precision. The management, if it is fit to appoint a salesman, should be taught that selling is a gift of certain temperaments—we, of course, take for granted a good sound technical training and experience of affairs. The salesman should not be taken to be the "outsider" mentally, because he is outside physically. Though I, myself, have had very happy experience as a district engineer, I cannot help thinking that in very many cases the management should have quoted to it: "Physician, heal thyself." That is a quotation which would lead to business—repeat business, which is what "Management" cannot always get and will very seldom get if the salesman is dwarfed in importance to an accident of commercial procedure.

D. P.

London, *November 27th*, 1922

The E.D.A. is to be congratulated on securing the services of Mr. Wallace Attwood to give his all-too-short series of lectures on salesmanship. I am sure that all of us left Caxton Hall last Friday imbued with a new kind of enthusiasm, *i.e.*, to give better service.

His clear definition of the fundamental points of salesmanship must surely have shown how obvious are our defects.

This type of lecture is bound to do an immense amount of good to those who make a special point of attending the E.D.A. conferences.

W. L. Wernham.

London, *November 20th*, 1922.

Dielectric Loss in Cables.

Referring to the historical note on the above subject in your issue of November 17th, I am now able, through the courtesy of Mr. James Swinburne, to give you the reference to his mention of the subject in connection with the first Deptford 11,000-V paper-insulated main. It is to be found in his paper on "Alternate Current Condensers" which was read before the Physical Society on December 12th, 1890, and published in the *Philosophical Magazine* for February, 1891.

B. Welbourn.

Prescot, Lancs.,
November 27th, 1922

Steam Condensing Plant.

In reply to Mr. Velut's letter, we would first like to say that we do not wish to bring into this correspondence any personal observations such as those made by Mr. Velut, and we will therefore assume that his experience is all that he affirms.

The matter under discussion is the efficiency of the Delas ejector, and we will confine ourselves to this question.

We note the statement that the reduction in steam consumption from [illegible] to 25 per cent. is based on the results of tests taken by an eminent and independent engineer in this country. Why does not Mr. Velut publish these tests? To do so would inspire confidence. We simply desire to have the statement confirmed, and so far we have not been referred to any condensing plant in this country in reply to the request contained in our previous letter. In this direction we are surprised to hear Mr. Velut state that no comparative result could be obtained. Surely the most valuable test of apparatus is always its performance under operating conditions, and any saving which is real should be obtained under such circumstances. Presumably the condensers to which the Delas ejectors are fitted are of good modern design, and it is not difficult to make a plant reasonably air tight and clean for testing purposes.

We would ask Mr. Velut to reply and state definitely whether he will undertake to supply us as customers with a Delas air ejector which he will guarantee to operate with from 20 per cent. to 25 per cent. less steam than any other ejector. We already have information regarding Delas ejectors tested in France and in the United States, but as we can find no improvement upon the performance of other ejectors, we are anxious to have tests of the Delas ejector as manufactured in this country with regard to which the statement has been made.

Mr. Velut admits that a water jacket was not first disclosed by Delas, and therefore no further remarks on this point are necessary.

H. Fothergill & Co.

London, *November 25th*, 1922.

Literature on "Other Uses."

I have long been hesitating over the question of installing electrical apparatus for other purposes than lighting and have followed the E.D.A. discussions with more than passing interest.

My indecision was brought to a head on Friday morning by the arrival of the sweep, followed later in the day by high words in feminine voices proceeding from the kitchen. In the afternoon I hurried to the showroom of ———Ltd. (across the road) eager to be persuaded. I opened the proceedings by inquiring if they had any literature on the subject of heating and cooking. They had not.

And that closed the proceedings. The door fell softly behind me and I walked slowly away a disappointed and disheartened man.

E. C. R.

London, *November 27th*, 1922.

[If our correspondent had applied to a firm specialising in electric heating and cooking, or to the Temple of Publicity itself—the Electrical Development Association—he would have received all the literature he wanted, and more also.—EDS. ELEC. REV.]

Shift Engineers' Salaries.

I wonder if you could allow me a small space in your columns in which to say how glad I am to see shift engineers are speaking out.

Many others, like myself, have carried on, hoping that something would be done through the recognised channels, but promises are not always kept, and such "little" things cause amusement when mentioned now. The fact of being at the "base" is honour enough perhaps! but if the base of a ladder slips the man at the top has the longest drop.

Perhaps if this is realised in time something may yet be done.

One of Four.

November 27th, 1922.

I am in full accord with the letter written by "Industrial" in the current issue of your valuable paper, although only a charge engineer myself, and would like to say that I obtained considerable increases under the 20 per cent., plus £90, award and also under the salaries schedule. These increases were entirely due to the activities of the E.P.E.A., and unless I am the only charge engineer in the kingdom it is only reasonable to expect that all other charge engineers benefited to a similar extent; at any rate, I am personally acquainted with a great number who did. Apart from this I trust that we do not intend to remain charge engineers all our lives, even if berths off shift-work seem as remote as Heaven, and probably some time before we reach that haven of bliss we shall obtain positions higher than Grade 8, and then we may not feel quite so sorry for ourselves as we are at present.

As an hon. official of the E.P.E.A. for a number of years, I should like to point out to the grumblers of Grade 8 that if they would attend their section meetings regularly, they would see, probably much to their astonishment, that the E.P.E.A. has done something for them and will continue to do so. With regard to the plaint of "Midland Counties, that no amendments have been put forward to improve the grading of charge engineers, I recommend him to question the chairman of his next section meeting and he may hear of something to his advantage, and I should like to point out that these meetings are the proper places to air one's grievances.

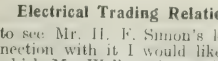
Members should read the *Journal*, and if they must grouse on paper let it be in the paper that is run for their benefit, and not take up valuable space in the columns of the ELECTRICAL REVIEW, which could be used to far greater advantage by matters of more importance and general interest.

P. G. H.

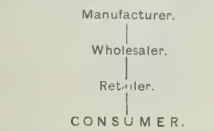
November 27th, 1922.

Electrical Trading Relations.

I was glad to see Mr. H. F. Simon's letter in your last issue. In connection with it I would like to refer to one of the diagrams which Mr. Wallace Attwood showed at his first E.D.A. lecture on "Salesmanship." This diagram was presented thus:—



My letter in your jubilee number suggested that the flow of business in the electrical trade should proceed from the manufacturer through the wholesaler and the retailer to the buyer, so that Mr. Wallace Attwood's diagram, instead of presenting the units in parallel, should present them in series, thus:—



There is a vast difference between these two methods, and the electrical trade will proceed on more successful lines when series, and not parallel, working of its chief sections is achieved.

W. E. Warrilow,
Lionel Robinson & Co.

London, *November 28th*, 1922.

I agree with the views expressed by Mr. W. E. Warrilow and Mr. H. F. Simon regarding the necessity for the fullest co-operation between supply authorities, manufacturers, wholesalers, and retailers. It is apparent that salesmanship has been somewhat neglected by the electrical industry in the past, and I am pleased to find the interest aroused by the E.D.A. conferences and the articles in the ELECTRICAL REVIEW.

Co-operation between the various interests involved is very necessary, and at the present time is increasingly apparent through various joint meetings and informal chats which are taking place. The E.D.A. is devoting a great deal of time to this matter with, I consider, some degree of success.

I do not think that Mr. Simon is correct when he states that the manufacturers are best qualified to sell "cooking, water-heating, and other specialised appliances." The manufacturer, on the one hand, sells only goods of his own manufacture, which may be the best in certain circumstances, but not in all. The retailer, on the other hand, is in touch with all makers of apparatus, and can sell the most suitable make for the particular conditions, thus giving better service to the user.

I am aware that some contractors do not try to sell electricity as they might, but firmly believe that if manufacturers and supply authorities would assist by wise publicity, and leave the actual selling to the contractors, the whole of the sales to users would be made by the contractors (retailers) at less expense than if the manufacturers dealt direct with the users.

I do not believe that methods of inter-trading can be discussed in E.D.A. open meetings with any good result, as much mud-slinging would probably take place, and some of the mud would stick and cause bad feeling. These matters require most deliberate thought, and can best be handled by small joint committees which could, I think, formulate a policy which would be acceptable to all parties.

I trust the Sales Conferences and discussions which are taking place will open the eyes of all in the industry to the importance of selling "the idea of electricity," and thus increase the demand for apparatus of all kinds.

W. Cross, M.I.E.E.

Newcastle-on-Tyne, *November 27th*, 1922.

I fear that your readers will infer from Mr. Simon's remarks in your last issue that gas for heating is always cheaper than electricity. Mr. Simon in his letter says: "First, and most important, the necessity of supplying electric power at a figure competitive with gas." Possibly your contributor had domestic heating in mind, for his statement certainly does not hold good as far as industrial production is concerned.

Numbers of British and foreign manufacturers are hardening in Wild-Barfield electric furnaces articles ranging from sewing needles to the gear wheels of motor cars at a cost of 3d. per ton. This is always our cost of production for hardening steel articles with power at 1d. per kW. In one of the largest industrial centres in this country these furnaces are effecting a saving over gas of 40 per cent. We have not yet one instance where town gas is cheaper than electricity so far as furnaces are concerned.

Automatic and Electric Furnaces, Ltd.,
E. P. BARFIELD,
Managing Director.

London, *November 28th*, 1922.

Standard Brush Holders.

Our attention has been drawn to a letter in your [illegible] correspondence" columns on the above subject which, perhaps, calls for some comment from ourselves, although a modest and silent one has already been made in reply to the claim made by the Standard Brush Holder Co., by our page advert. in your issue of October 6th, wherein we illustrated our standard brush holder, and we had intended to leave it to your readers to judge of the added value, if any, the S.B.H. Co.'s pattern may have, seeing that, in principle, it is clearly nothing less than a copy of our own standard, slightly altered in detail, and to our minds not so efficient, as essentially the fixed position on the bar is not universal for radial adjustment, as is the Flather type.

We learn that this new holder is claimed to be the result of a collaboration of the leading motor manufacturers. This must be intended to read "some of them," for we ourselves were not consulted, which is perhaps rather significant.

As you, Sirs, and most of your readers are aware, we have been manufacturing dynamos and motors for the past thirty years, and during that time we have been flattered many times that so many of our details are being copied by our friendly competitors, to which we have raised no objection, nor will we do so, as it is not our policy to be rushing to the Patent Office repeatedly, but rather that if we have anything good all may share in it.

Nevertheless, it seems rather stupid that others should patent such designs, as obviously they are wasting money and giving a very wrong impression.

Flather & Co., Ltd.,
C. MARGERISON.
London Manager.

London, *November 7th*, 1922.

Applications to Box Numbers.

I have been a reader of your paper this last sixteen years, and during that time I have answered dozens of applications under the heading of "Situations Vacant," to box numbers, but have only received about three answers to these applications.

Being a practical engineer I am possibly not an adept at brilliant composition, &c., so that I could relate my experiences and talents in glowing fancy language, and unfold all my private concerns. I have certainly gone so far as to ask my friends who are considered smart in correspondence to give me an impressive epistle.

It is a firm conviction with me that the people or firms who have these advertisements inserted can be divided into two sections, and possibly an assorted third, *viz*: the genuine advertiser; and, secondly, the inquisitive employer who does not actually require a person for the post advertised, but is simply testing how many men there are in the unemployment market, and also the minimum salary such men are asking.

I think it only fair that the firm requiring a man should append its name and address to the advertisement, seeing that the particulars generally required are of a personal or private nature, and not information to be thrown about at random.

I know of a case of a firm advertising for a man to fill a certain position, and amongst the applications received was one from one of its own employés. No doubt you can imagine the consequences.

Now, coming to the point, I suggest that all would-be applicants for situations vacant should refrain from answering the box numbers, and wait until the employer realises that to get the man he requires he must cease advertising under box numbers, and come into the open and inform the applicants who he is by placing the name of the firm at the end of the advertisement; then I am sure he will get the fullest details possible given to him in confidence, and it would give the applicant much more encouragement.

I remember, some little time ago, correspondence appearing in your paper with regard to the giving of the intimation of the post being filled, but even this has not been made use of as it should be, a great number of firms not having the courtesy to put the minds of their applicants at rest by informing them that they are unsuccessful.

It is a common-sense conclusion that if a firm genuinely requires a man it will certainly pay postage to inform the successful candidate, but it is the least it can do to inform the unfortunate ones by inserting a notice that the post has been filled.

Practical Engineer.

[We sympathise with our correspondent in his unfortunate experience. The use of box numbers, however, is not likely to be abandoned by advertisers. Our Advertisement Department endeavours to mitigate its disadvantages by withholding replies (when so instructed) in accordance with the notice printed at the head of "Situations Vacant," and by inserting notices of appointments being filled, free of charge. Useful advice on drawing-up applications for employment was given in our issue of June 16th, 1922, p. 857.—EDS. ELEC. REV.]

PARLIAMENTARY NOTES.

(By our Parliamentary Reporter.)

Trade Facilities Act Guarantees.—On November 27th, Mr. Baldwin, the Chancellor of the Exchequer, informed Mr. Briggs that, among others, the Government had agreed to give guarantees under the Trade Facilities Act to the London Electric Supply Corporation (£650,000), to the Oxford Electric Co., Ltd. (£25,000), to Harland & Wolff, Ltd. (£95,000), to the Kassala Railway Co., Ltd. (£1,500,000), to the Tata Power Co. (£850,000), and to the South-Eastern and Chatham Railway (£5,500,000).

Telephones in Rural Areas.—On November 28th, Mr. Millar asked the Postmaster-General whether he was prepared to institute an inquiry into the question of providing a wide extension of the telephone system in rural areas at reasonable rates to meet the requirements of the agricultural and other rural industries. Mr. N. Chamberlain replied: In view of the very favourable terms on which new exchanges are now opened in rural areas, the very low tariff for rural party lines, and the rapid growth in the number of rural call offices and telephone subscribers, I do not consider that there is any case for an inquiry at present.

Replying to Mr. Foot, Mr. N. Chamberlain said: Since May last about 200 new exchanges in rural areas have been authorised. In the same period 437 call offices have been opened at provincial post offices, chiefly in rural districts, and about 200 more have been authorised and are awaiting completion. The number of rural party line telephones in use has increased by 1,850 since May 1st.

London Telephone Exchanges.—On November 28th, Sir Harry Brittain asked the Postmaster-General whether his attention had been called to the varying degrees of efficiency of the various London telephone exchanges; and whether he was able to state which exchange, in the opinion of the department, was worked with the greatest satisfaction to the subscribers and which exchange was the subject of the greatest number of complaints. Mr. N. Chamberlain said that statistics which gave some indication of the comparative efficiency of the various London telephone exchanges were periodically prepared and utilised by his department, but in view of the many factors involved, including differences in local conditions, he did not think it was possible, consistently with justice to the staff concerned, to publish a list of exchanges in order of merit.

BUSINESS NOTES.

Bankruptcy Proceedings.—William Ford, residing at Swan Street, Alvechurch, and lately trading as the "Redditch Electrical Accessories Company" at Central Chambers, Unicorn Hill, Redditch.—A meeting of the creditors was held on Thursday last week at the office of the Official Receiver in Birmingham. A deficiency of £189 was disclosed, and the failure was attributed by debtor to bad trade. He was formerly, until 1917, an electrical engineer at the General Post Office, Birmingham. Then he commenced business at Alvechurch in partnership with a Mr. J. W. Falkner, who died in November, 1917. In February, 1918, the debtor was joined in partnership by a Mr. Larner, and the business was removed to Redditch. By reason of disagreements, the partnership was not a success, and it was dissolved in 1920, the debtor retaining the assets and taking over the liabilities. There was a further partnership with a Mr. Millward, and although this was not dissolved, this partner obtained a situation and took no active part in the business, which later became very depressed. The Official Receiver is the trustee.

George William Humphry, 24, Broad Quay, Bristol, trading as the Humphry Electrical Co., electrical engineer.—The public examination of this debtor was held on November 17th at the Guildhall, Bristol. The ranking liabilities were returned at £467, and there was a deficiency of £156. Debtor had traded at different places in Bristol since 1917. Two years ago he was appointed a director and engineer of an electrical company, but later he withdrew. He now had a claim of £234 against the company for commission. The examination was adjourned.

W. C. Ellis, electrician, Applegate Street, Leicester.—Application for discharge will be heard on December 20th at the Castle, Leicester.

G. Hill and E. Cowley (G. Hill & Co.), electrical engineers, 22, Chantry Lane, Great Grimsby.—Last day for proofs for dividend, December 9th. Trustee: Mr. J. F. Wintringham, St. Mary's Chambers, Great Grimsby.

Francis Leopold Perrin, electrical engineer, residing at and carrying on business at 57, Wellingborough Road, Northampton, and also carrying on business at 5, College Street, Northampton.—The statement of affairs in this bankruptcy shows gross liabilities of £2,885, of which £2,740 is estimated to rank against the estate. The assets are estimated to produce £611, and the deficiency is shown as £2,129. The debtor attributes his failure to the slump in trade, to bad debts £238, loss on contracts, £300, loss on sale of motor-car, £100, and to competition. The deficiency account includes £385, estimated depreciation of stock-in-trade. The Official Receiver (Mr. J. Osborne Morris) in his observations, states that the debtor, now aged 33, was apprenticed to his father, who was an electrical engineer. His father died 13 years ago, and the business was continued by the debtor's mother, for whom he worked for three years, when he commenced business on his own account in a small way at 15, Kingswell Street, Northampton. He had no free capital, but borrowed £50 from relatives. The business proved a success, and in 1915 he removed it to 5, College Street, Northampton, a lock-up shop. The business continued to prosper, and debtor undertook a number of contracts. By way of extending the business he borrowed £200 from relatives, and that amount is still owing. About two years ago the decline in business generally affected him, and about that time he lost not seen £150 and £200 on contracts, and also sustained losses on book debts. Further, when the slump began, he found that he had considerably over-bought, and consequently the value of his stock was great depreciated by the heavy fall in prices. Difficulty in meeting accounts followed and, later, recourse was had to registered money-lenders, borrowing from one to pay another. One outstanding contract, which is being completed, is expected to bring in £175. The statement of affairs discloses unsecured debts: £448 borrowed from registed money-lenders, £114 borrowed from friends and relatives, £23 personal expenses, and £1,854 for trade goods, trade expenses, and law costs. The fully-secured creditor, a banking company, holds two life policies on security for an overdraft.

F. C. Jinks and S. J. Watson (Vulco Magneto Co.), 11, Long Acre, W.C.—Order made October 31st. Bankrupts' discharge suspended for three months.

W. Camp (W. Camp & Co.), electrical engineer, Carr Lane, Slaithwaite, Huddersfield.—Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford, released November 22nd.

T. Rawsthorne, electrical engineer, 67B, Paradise Street, West Bromwich.—Trustee, Mr. E. E. Deane, Official Receiver, 191, Corporation Street, Birmingham, released November 22nd.

Company Liquidations.—Modern Electrical Supply Co., Ltd., Whitecross Place, London, E.C.—A largely-attended meeting of the creditors of the above was held on November 22nd at the offices of Messrs. Gray, Stainforth & Co., C.A., 31, Lombard Street, London, E.C. Mr. Rodway Stephens, the liquidator of the company, submitted a statement of affairs which disclosed ranking liabilities of £4,054, all of which were due to trade creditors. The assets were estimated to realise £5,214, from which had to be deducted £148 for preferential claims and £5,049 due on debentures. The net assets, therefore, totalled £26, or a deficiency, so far as the creditors were concerned, of £4,028. The assets were as follows:—Cash in hand, £5; cash at bank, £158; book debts, £2,460, estimated to produce £2,000; stock-in-trade, £3,717, valued at £3,000; furniture and fittings, £50.

The liquidator stated that the company was registered on August 15th, 1921, with a nominal capital of £1,500 to carry on the business of electrical engineers and dealers in electrical goods. Of the capital, £430 was issued as fully paid to Mr. G. S. Stone and Mr. G. A. Davenport, while Mr. A. T. Whittle took up shares to the value of £500 for cash. Subsequently it was found that the capital of the company was insufficient, and in November, 1921, it was increased by the issue of 200 preference shares of £10 each. All those shares were taken up by Mr. A. T. Whittle, and paid for in cash. Later, further capital was required, and Mr. Whittle advanced £5,000 on the security of debentures. The debentures were issued on March 9th last, at which date Mr. Whittle had lent £4,000, and he subsequently lent a further £1,000. The accounts for the year to July 31st last showed a loss of £3,180. That loss was attributed principally to the low rate of gross profit which was earned. During recent months the company had been pressed by creditors, and unsuccessful attempts were made to enter into an agreement with them. The debenture-holder had appointed a receiver. The latter was of the opinion that the stock would only realise £2,500. That meant that the assets would be insufficient to fully meet the claim of the debenture-holder, and there would be nothing whatever for the unsecured creditors. The failure of the company was attributed to the fall in the value of the stock, the very small margin of profit obtainable, owing to the fact that consumers could obtain identical terms from manufacturers, with the result that the company had to deal with small firms and run the risk of bad debts. The company had also suffered by the heavy purchase of wireless sets, which, owing to the delays in the broadcasting scheme, there was very little demand for. The stock included wireless sets and accessories to the value of £1,000. The turnover of the business during the year to July 31st, 1922, was only £15,000.

The representative of Messrs. Watsham & Co. asked the liquidator if he had in any way investigated the position between the company and the Kent Coast Electrical Co. at Broadstairs.

The liquidator said he understood that the Kent Coast Co

was a private venture of Mr. A. T. Whittle's, and dealt in electrical goods. He believed that Mr. Whittle obtained his supplies from the Modern Electrical Co.

Messrs. Watsham's representative complained that on November 4th the Modern Co. telephoned and demanded that goods should be sent at once.

Two or three other creditors also stated that goods were obtained from them at recent dates, and one creditor said he supplied goods at a date when the company had issued a notice calling the shareholders together for the purpose of passing the resolution for liquidation.

The chairman stated that up to the date of the liquidation negotiations were in progress by which it was hoped a compromise would be effected with the creditors. The meeting for voluntary liquidation was called as a provisional measure. He went on to state that the balance-sheet last July showed assets of £6,800, against debentures of £5,000, and trade creditors' claims of £1,900. At that date the company appeared to be about £100 on the wrong side.

Mr. P. Houstoun, of Messrs. Corfield & Cripwell, pointed out that since July 31st the indebtedness to the trade had increased from £1,900 to over £4,000. As late as October 20th the position of the company was known to the directors, and yet on November 1st it received £88 worth of goods from one of his clients, and £200 worth of goods from another firm which he represented. Such a proceeding, he declared, called for a great deal of explanation.

Mr. A. T. Whittle was asked by a creditor whether he was aware that the company was insolvent on September 13th last, and he replied that he did not wish to answer the question. He was not proposing to make any offer to the creditors, and pointed out that he had lost heavily through the failure of the company.

A creditor pointed out that after October 26th, when the resolution for voluntary liquidation was issued, the wholesale houses in the trade were being pressed to deliver goods.

The representative of the Maxim Lamp Works said that on October 16th he received an order for goods to the value of £600, and he wanted an explanation as to why the company received goods from him after that date.

A suggestion was made that the representative of Messrs. Corfield & Cripwell should be appointed as liquidator of the company, but Mr. Houstoun said he could not agree to that course, as he thought it was a case for compulsory liquidation. It did not appear that the creditors would receive anything, but it was a case where trading of such a description should be exposed. In such cases, if they allowed a respectable burial to take place under voluntary liquidation, they would be asking for trouble, and within a few months they would be met with 20 or 30 similar cases.

The solicitor to the liquidator said he did not think that the creditors could pass any definite resolution other than one referring to the voluntary liquidation, and it was then decided that the meeting should be adjourned for ten days.

An informal meeting of the creditors was subsequently held under the presidency of Mr. Houstoun, when the representative of the Maxim Lamp Works declared that the circumstances of the case seemed to be so unsavoury that he thought the fullest investigation was necessary. He proposed a resolution expressing the opinion that it was desirable that the company should be wound up compulsorily, and that the general body of creditors should be recommended to subscribe towards the costs of the petition to an extent not exceeding 2½ per cent. of the amount of their respective claims.

The representative of Messrs. Callender's Cable & Construction Co. seconded the motion, which was carried unanimously, and an informal committee of three of the creditors was also appointed.

The principal creditors are:—

	£		£
Associated Electric Trading Co., Ltd.	81	General Electric Co., Ltd.	332
Automatic Telephone Mfg. Co., Ltd.	66	Geipel, W., & Co.	75
British Thomson-Houston Co., Ltd.	144	Henley's Telegraph Works, Ltd.	84
Belling & Co.	71	Langham Electrical Supplies Co.	85
Bapsty, S.	72	Maxim Lamp Works	94
Catchpole & Morris	164	Mullard Radio Valve	87
Cable Accessories Co.	212	Rose Bros. Electrical Co.	50
Dawson, W., & Co.	169	Russ, J.	86
Dwyer, P. L.	115	Smith, J. & W. B.	139
Ever-Ready Co.	77	Higgs Bros.	50
Falk, Stadelmann & Co.	92	Wootten, H. A., & Co.	60
		Watsham & Co.	175
		Wireless Instrument Mfg. Co.	50

"Watt" Electrical Co., Ltd., 161, Westminster Bridge Road, London, S.E.1.—A meeting of the creditors was held on November 23rd, at the Institute of Chartered Accountants, Moorgate Street, E.C. The chair was occupied by Mr. H. Gardner, of Palmerston House, E.C., who had been appointed to act as the liquidator in the voluntary liquidation of the company. The statement of affairs presented showed liabilities of £929, while the assets were estimated to realise £517. After allowing £118 for preferential claims, the net assets were £399, or a deficiency of £530. The assets consisted of cash at bank, £16 10s. 6d.; stock in trade, £431, expected to produce, £250; fixtures and fittings, £25; good book debts, £136; and bad and doubtful debts, £228, estimated to realise, £90. The liquidator reported that the company was registered on January 20th last for the purpose of taking over a business which had previously been carried on by Messrs. E. H. Whatton and L. N. Abrey under the style of the Watt Electrical Co., at Railway Approach, London Bridge, S.E. The company purchased stock valued at £258, which was satisfied by a cash payment of £100, and the discharge of existing liabilities amounting to £98. Shares to the value of £100 were issued for cash. No remuneration had been drawn by the directors. At a later date further shares were issued to the extent of £100. During the summer the company entered into negotiations for the acquisition of the rights of a new electrical advertising device. The directors were, perhaps, excessively optimistic, and increased the capital of the company to £5,000. No further capital, however, was issued, and larger premises were acquired at Westminster Bridge Road. In the middle of October, the financial position became acute, and liquidation was decided upon. The books of the company had been kept in a somewhat elementary fashion. The present position of the company was due to the acquisition of a larger stock than was justified by the immediate prospects of business, carrying out contracts at unremunerative prices, and the failure of the negotiations with regard to the advertising sign. Since its incorporation the turnover of the company had only been £1,610. During the discussion which took place, certain creditors expressed dissatisfaction at the position, but eventually it was decided to confirm the voluntary liquidation of the company, with Mr. Gardner as liquidator. The following are creditors:—

	£		£
Abrey, L. N.	111	Lee, Albert, & Co.	29
A. & A. Electrical Co., Ltd.	10	London Electric Supply Corp.	17
Beardmore, F. W.	116	Magic Appliances, Ltd.	14
British Central Electrical Co.	24	McCaw, Ltd.	21
Steer, A.	10	Metropolitan-Vickers, Ltd.	90
Brown Bros., Ltd.	35	Newberry & Thomas	11
Brown & Hart	12	Sloan Electrical Co., Ltd.	29
Electrical Conduits, Ltd.	11	Stella Lamp Co., Ltd.	52
General Cable Manufacturing Co.	14	Visible Typewriter Co.	29
General Electric Co., Ltd.	42	Theatres Advertising Co.	10
Hugan & Wardrop	13	Waller, G.	25

The Bell Battery Co., Ltd., Laburnum Grove, Ilford.—Pursuant to Section 188 of the Companies (Consolidation) Act, a meeting of the creditors in this matter was held on November 21st at the offices of Mr. F. Wilcock, C.A., of 1, Great Winchester Street, E.C., when a statement of affairs was presented, showing total liabilities amounting to £6,249 and assets (gross) £315, from which had to be deducted £39 12s. 4d. for preferential claims and £800 for debentures, which left no assets available to meet the claims of unsecured creditors. The assets consisted of cash in hand, 9s. 9d.; stock-in-trade, £608, estimated to produce £100; trade fittings, &c., estimated at £40; and book debts, £175. So far as the shareholders were concerned, there was stated to be a total deficiency of £15,873. The capital of the company issued and allotted included 60,000 ordinary shares of 2s. each and 3,100 preference shares of £1 each. Mr. Wilcock reported that the company was formed in October, 1919, and took over an existing business of cell manufacturers, &c. The goodwill of the business was said to be of no value. The business had been advertised for sale as a going concern for a week, but nothing had yet resulted. The business was still being carried on by Mr. Wilcock. After discussion it was decided to leave the matter in the hands of Mr. F. Wilcock as liquidator. The following are creditors:—

	£		£
Dussek Bitumen Co.	10	Fuller's United Electric Works, Ltd.	36
W. T. Bruce & Co.	21	Poulton Bros.	67
Hillbar Press	80	Clarke, —	10
Electrical Engineering and Equipment Co., Ltd.	678	Bankers	3,020
Fletcher, —	28	Elliott, —	100
Le Carbone	31	Seligman, —	697
Grey & Martin, Ltd.	25	Edenborough, —	300
Hugh Stevenson, Ltd.	27	Cornelis, —	100
Hardware Trade Journal	16	Managing director	320

Cesco, Ltd., electrical engineers, Cardiff.—The creditors interested herein were called together recently at 8, Westgate Street, Cardiff, when Mr. A. H. Smith, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs, which showed total liabilities of £5,162, made up as follows: trade creditors, £1,816; amount due to vendors on the transfer of the business, £1,600; banker's claim, £1,725; and Cardiff Corporation for rates, £21. The assets were estimated to realise £4,110, or a deficiency of £1,051. The assets consisted of stock, £2,329; fixtures and fittings, £190; book debts, £1,587; and cash in hand, £3 19s. 6d. It was reported that the company was registered in October, 1921, the stock being purchased for £2,500. It was arranged that the company should purchase the stock for a cash payment of £500 and discharge the balance by quarterly payments of £250. Since the company was formed the stock had depreciated in value owing to the fall in the market. The bank held a first debenture over the assets as security for its claim, and had appointed a receiver. The debenture was for the face value of £2,000. After a short discussion, a resolution was passed confirming the voluntary liquidation of the company, with Mr. Smith as liquidator, while a committee of three of the principal creditors was appointed.

British & Allied Electrical Agency, Ltd.—Winding up voluntarily. Liquidator: Mr. St. J. Bennett, 16, Devonshire Square, E.C. Meeting of creditors, December 11th. Particulars of claims to be sent to the liquidator by December 30th.

Dalziel's Constant Voltage Patents, Ltd.—Winding up voluntarily. Liquidator: Mr. S. T. Hall, 24, The Strand, Derby. Meeting of creditors, December 2nd. All creditors will be paid in full in due course.

Weldrics, Ltd.—Particulars of claims to be sent to the liquidator, Mr. R. R. Callingham, 34, Nicholas Lane, E.C., by December 23rd.

Tyne Electric Steel Foundries, Ltd.—Particulars of claims to be sent to the liquidator, Mr. J. G. Swan, 31, Mosley Street, Newcastle-on-Tyne, by December 21st.

National Electric Supply Co., Ltd. Meeting of members is called for December 27th at 11, Winckley Street, Preston, to hear an account of the winding-up from the liquidator, Mr. W. H. Ainsworth.

Dissolutions of Partnership. Lucas & Bach, electrical engineers, 5, Bull Ring, Birmingham.—Mr. A. W. Lucas and Mr. H. F. Bach have dissolved partnership. Mr. Bach will attend to debts and continue the business on his own account.

Car Lighting & Ignition Supply, electrical engineers, 51, Leamoor Road, Westbourne, Bournemouth.—Mr. A. W. Iles and Mr. T. Cartledge have dissolved partnership. Debts will be attended to by Mr. Iles.

Trade Announcements.—The firm of L. W. Douthwaite and Co. has been converted into a private limited company. Mr. Douthwaite joined the late firm of Chas. A. Muller in 1901, and for eight years was the manager. In 1916 the business was taken over by him as sole proprietor. The present conversion into a company is for private reasons. Mr. Barnes, who has been associated with the firm for the last 14 years, becomes, with Mr. Douthwaite, one of the first two directors. There will be no change in the conduct of the business.

Consolidated Pneumatic Tool Co., Ltd.—Owing to expiry of the lease, the company has removed the pneumatic and electric repair shops and show-rooms from 73-75 and 79-80, Petty France Street, Westminster, to 23a, Bramber Road, West Kensington, W.14.

Mr. Thomas T. D. Geesin, of 4, Clevedon Road, Penge, announces that his telephone number is now "Sydenham 2704."

Catalogues and Lists.—Messrs. Hick, Hargreaves & Co., Ltd., Soho Iron Works, Bolton.—An illustrated description of a closed-feed system for the complete de-aeration of boiler-feed water.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publications No. 333, describing special head 'phones for ladies' use; No. 336, dealing with the "Stadium Magnavox" loud speaker; and No. 337, advertising a rotary filament resistance.

Messrs. A. P. Lundberg & Sons, 447-489, Liverpool Road, N.7.—List S.40, illustrating and describing numerous types of tumbler switches, plugs and sockets, &c. Fully priced.

Electrical Utilities, Ltd., 1-3, Shelgate Road, Battersea Rise, S.W.11.—Leaflet M.T. 1, illustrating and describing the "Utility" multiple toaster.

Dugdill's Patents, Hazel Grove, Stockport.—A mailing card illustrating numerous types of lighting brackets, standards, &c.

Radiophones, Ltd., 1a, Granville Place, Marble Arch, W.1.—A priced catalogue of complete radio-telephony receiving sets and components.

Messrs. Meldrums, Ltd., Timperley, near Manchester.—An illustrated pamphlet describing the "Meldrum" oil burner and its applications.

Batteries, Ltd., Redditch.—List No. 1, describing several types of nickel-iron accumulators for various purposes.

Messrs. Crossley Bros., Ltd., Openshaw, Manchester.—Publication No. 2,229—a reprinted article from *The Engineer*, describing a "Premier" wood-fuel, suction-gas plant at a Rhodesian mine.

Leeds Electrical Construction Co., Ltd., Charmouth Street, Leeds.—An illustrated brochure describing "Losles" automatic temperature control gear.

Brittain's Electric Motor Co., 110, Cannon Street, E.C.4.—A series of pamphlets giving particulars and prices of 1-, 2-, and 3-phase slip-ring and squirrel-cage motors for all voltages and frequencies.

For Sale.—Nuneaton Electricity Department has for disposal one battery of 250 Chloride cells, two switchboard panels, complete, charging booster, &c. (See our advertisement pages to-day.)

Trading Relations with Latvia.—Latvia is one of the small Republics created by the war, and although it has a population of only 2,000,000, nevertheless it affords an opening for a variety of goods needed to supply a substantial community, among which goods are machinery, locomotives and railway material, automobiles, iron goods of sundry kinds, autogen apparatus, &c. It has founded a trade organ entitled *Latwijas Tirgotajs* or the *Latvian Merchant*, and in its last number makes an appeal, in English, for the creation of mutual trade relations with this country, which, it is said, may lead to the opening up of trade with Russia, Persia, and other Eastern markets with which Lithuanian merchants are connected. The Germans have hitherto monopolised this market, and German is the only foreign tongue known there; but the Letts have taken steps to remedy this by having English taught in their leading schools. The Union of Latvian Merchants (10, Aspasia bulv., Riga), owners of the periodical mentioned, offers its services to those seeking further information regarding this new market.

New French Companies.—The Société de Distribution de Gaz et d'Electricité de Saint André et Extensions has been constituted at the place named (Eure department) with a capital of 190,500 fr. in 380 500-franc shares, 100 of which are allotted to M. Damoy, the founder of the company.

With the object of the development of a waterfall called "Roche-qui-Bruit" and the supply of high-pressure current in the neighbourhood, a company styled Energie Electrique du Roche-qui-Bruit has been formed at Saint Brice en Cogles (Ile-et-Vilaine), with a capital of 200,000 fr., subscribed in cash.

The Société Hydroélectrique de Rivière Basse has been established at Castlenau (Hautes Pyrénees) for the building and working of a generating station. Capital, 100,000 fr.

There has been formed at Baugé (Place du Château) the Société de Distribution et d'Applications Electriques du Beaugeois, with a capital of 500,000 fr. in 976 shares of 100 fr. each and 120 fifth shares of 20 fr., 186 of the former class and the whole of the latter being given to the Société Beaugeoise d'Electricité as consideration for its assets.

La Distribution Electrique is the style of a company embodied at Paris (11, Rue Bouchardon), with a capital of 220,000 fr., with the object of installing and working electric lifts in Parisian houses.

Buying Organisation in Birmingham.—Steps are being taken to give effect to the principle of co-operative buying for the purpose of standardising and co-ordinating the purchase of all goods and stores required by the various departments of the Birmingham Corporation. Mr. A. Baker, of the tramways department, is chairman, and Mr. E. J. Jennings (secretary of the electric supply department) vice-chairman.

Book Notices.—"The Metropolitan-Vickers Gazette," October, 1922. Price 1s. post free.—The principal articles in this issue are: "The Raanaasfoss Power Station," by G. Franklin; "Electric Traction," by Sir V. Raven; "Protective Apparatus for Turbo-generators," by J. A. Kuyser; and "Post-War Electrical Driving Equipments in Lancashire Cotton Mills," by V. Mallalieu.

"*Journal* of the American Institute of Electrical Engineers," Vol. XLI, No. 11. November, 1922. New York: The Institute. Price $1.

"The Quantum Theory," by F. Reiche. Pp. v+184; figs. 15. London: Methuen & Co., Ltd. Price 6s. net.

"Administration of London: Electricity Supply, 1920-21." (58 pp. and two maps). London: The London County Council. Price 5s.

Callender's Musical Society.—We are pleased to learn that Callender's "Anchor" Cable Works Musical Society (Leigh), established only three years ago, attracted crowded houses to the local Hippodrome every night last week with its production of the ever-popular Gilbert and Sullivan opera, "The Mikado," achieving success highly creditable to principals and chorus alike. The opening performance was under the personal patronage of Sir T. O. Callender, J.P., accompanied by representatives of the firm's London and Leigh management. On the Friday night 1,200 school children were present in response to an invitation to compete for prizes offered for the best essays on the performance; the Mayor and Mayoress were present. A special film showing the process of cable-making at the "Anchor" works was screened each evening.

International Court of Arbitration.—The International Court of Arbitration will hold its inaugural session in Paris on January 15th, when it is hoped that 100 delegates from all parts of the world will be present. The Court has been formed by the International Chamber of Commerce for the purpose of hearing commercial disputes and settling them without the disputing parties having recourse to legal proceedings. An executive resident committee has been elected. Decisions given by the Arbitration Court will, of course, be morally binding, as contending parties will be asked to sign an agreement consenting to abide by the Court's decision; but in certain countries such decisions are also legally binding. The committee is preparing a brochure for the use of commercial men, showing how far commercial arbitration is admitted by the legislation of different countries. The International Chamber of Commerce advises business men to insert a clause in their international contracts, whereby the contracting parties agree to submit to the Arbitration Court any difference which may arise with regard to the contract, and to abide by the decision of the Court. It is estimated that the Court will not take more than a maximum period of 60 days to render a decision with regard to any dispute submitted to it.—*Reuter* (Paris).

Sentence for Lamp Stealing.—Christopher O'Brien (29), of Liverpool, at one time a meter-reader employed by the Liverpool Corporation electricity department, was last week, at the Liverpool Police Court, sentenced to four months' imprisonment for stealing twelve electric lamps, value £3, from the premises of Boots' Cash Chemists, Church Street, and six electric lamps from Messrs. Downes & Davies, Stanley Street.

Large A.E.U. Expenditure.—A circular showing the amount expended during the two years ended in June last has been issued by the Amalgamated Engineering Union. Unemployment benefit absorbed a sum of £4,056,458, and sickness payments and superannuation took £800,000. Special levy payments amounted to £577,256. Administration costs totalled £522,307, equal to 2s. 6½d. in the pound.

E.D.A. Activities.—The Electrical Development Association heralds the near approach of the Christmas season with a bunch of special "literature" aiming at the inculcation of the "electrical gift idea." This includes a large poster depicting a postman about to deliver a parcel, and indicating the wide selection of electrical appliances which form suitable Christmas presents. Two pamphlets are in verse. One of these is a quaint combination of 18th-century English and illustrations with electrical appliances and modern terms. The other is reminiscent of the *Ingoldsby Legends*, although it is called "A New Christmas Carol." Another pamphlet deals with the practical nature of electrical gifts, and others are entitled "A Present Problem Solved."

The British Empire Exhibition.—Although it was stated in *The Times* of November 22nd that both Canada and Newfoundland had decided to participate on a large scale in the 1924 exhibition, it was stated in a subsequent issue of that journal that Mr. Larkin, High Commissioner for Canada, contradicted this, so far as Canada was concerned. It appears that the Dominion Government requires a definite assurance that the building materials will come from Empire sources. Mr. Larkin also said that he understood that certain statements had been made by the management reflecting upon Canada's ability to produce the commodities which she proposed to advertise at the Exhibition. He had seen no contradictions of these statements, and considered that a lack of tact had been displayed. The exhibition was designed to prove that the Empire was self-supporting; if it were not so, Canada could not see the use of spending a million dollars to advertise the fact.

Socials.—Last Friday evening a dance and concert was given by the Mullard Radio Valve Company to the staff and employés at the works at Hammersmith and Balham. The directors and their friends were present. The concert was carried out entirely by members of the firm.

The members of the York City Tramways Orchestra gave a concert last week at the City Mental Hospital, under the conductorship of Mr. Corbett. They were assisted by Miss Doris Dobson, Master Dunnington (of the Minster Choir), and Messrs. T. Clay, H. Pearson, and A. Peacock as vocalists.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—January 3rd and 4th, Physical and Optical Societies' Exhibition; February 19th to March 2nd, British Industries Fair; March 4th to 17th, Ideal Homes Exhibition; March 15th to 24th, Photographic Fair; June 1st to 4th, International Mining Exhibition.

Birmingham.—February 19th to March 2nd, British Industries Fair.

Edinburgh.—January 31st to February 14th, Scottish Ideal Homes Exhibition.

Hull.—April 20th to May 5th, International Domestic Economy and Trade Exhibition.

Belgium (*Brussels*).—April 9th to 25th, Commercial Fair.

Canada (*Toronto*).—August 25th to September 8th, Canadian National Exhibition.

Czecho-Slovakia (*Prague*).—March 11th to 18th, Samples Fair.

Finland (*Helsingfors*).—July 1st to 7th, International Samples Fair.

France (*Paris*).—January 20th to 28th, Agricultural Machinery Exhibition. (*Bordeaux*).—June 15th to 30th, Samples Fair. (*Lyons*).—March 1st to 15th, Spring Fair.

Germany (*Cologne*).—Spring, 1923, Samples Fair.

Italy (*Milan*).—April, Samples Fair.

Madagascar (*Antananarivo*).—August 15th to September 15th, International Commercial Fair.

Spain (*Barcelona*).—March 17th to 28th, International Samples Fair.

Switzerland (*Basle*).—April 14th to 24th, Swiss National Fair.

Trust Deed.—Robinson, Fraser & Co., electrical, mechanical and automobile engineers, Galapark Road, Galashiels.—Trust deed granted recently, as there was no offer of composition from the debtor. Claims have to be sent to Messrs. W. and W. B. Galbraith, 87, Vincent Street, Glasgow. The liabilities were estimated at £3,627 and the assets at £899, leaving a deficiency of £2,727.

The following is a list of creditors for over £25:—

Trade Creditors.—British Thomson-Houston Co., Ltd., £330; Baxendale & Co., Ltd., £81; Croall & Croall, £72; Coventry Chain Co., Ltd., £46; J. H. Holmes & Co., £490; W. T. Henley's Telegraph Works Co., Ltd., £41; Johnson & Phillips, Ltd., £483; Metropolitan-Vickers Electrical Co., Ltd., £30; Northern Manufacturing Co., Ltd., £28; F. & A. Parkinson, Ltd., £103; Sloan Electrical Co., Ltd., £161; Union Assurance Society, Ltd., £79; Wood & Cairns, Ltd., £30; sundry creditors under £25, £535—£2,510.

Cash Creditors.—Robert Stark, £200; Clement Oxby, £400; Bank of Scotland, £126; Frank Robinson, £300—£1,116. Liabilities per statement of affairs, £3,626.

New Belgian Company.—With a capital of 4,000,000 fr. in 8,000 500-franc shares has been formed the Société Belge Radio Electrique. Its scope is telegraphy and telephony, with or without wire, and the industrial and commercial utilisation of electricity.

The Motor-Cycle Show.—As is usual in the Cycle and Motor-Cycle Show, this year's display at Olympia contains many makes of magnetos and numerous lighting sets. Among the latter are the Bingdyno system of the Lucas Electrical Co., Ltd., and the "Pedlite" cycle-lighting set made by Dena, Ltd., of Birmingham, which consists of a tiny dynamo operated by the friction of the tire as the wheel revolves. This firm also shows a hand lamp containing a lever-driven dynamo. The Villiers Engineering Co., Ltd., has examples of its fly-wheel magnetos on view; these are very compact and obviate the gear connected with the usual types of magnetos. A wide variety of electrical goods appears on the stand of Messrs. A. H. Hunt, Ltd. The principal feature is a collection of Hellesen batteries of all sizes and shapes for lighting, wireless work, &c. A sign is exhibited which forms a very attractive advertisement. It consists of a semi-cylindrical case with a glass front, in which there are four lamps, each of which is of a different colour, having a reflecting screen in front of it. A thermal flasher gives numerous combinations, and each lamp has three distinct reflections in the back of the case, giving a constantly-changing variegation of colour. Other features of the stand are small protected inspection lamps, small push and screw lighting switches, and the "H. A. H." portable dry-battery hand lamp. The last is of simple but strong construction. The switch contacts, wires, and lamp contacts are all arranged inside a neat nickel-plated cover through which the switch lever projects. It is supplied with a "Hellesen" flash battery.

Messrs. W. Canning & Co., Ltd., exhibit electro-plating equipment, including low-voltage dynamos, unit-type resistance boards, nickel and copper anodes, plating salts, &c. In addition to these, there are polishing lathes, grinders, and polishing brushes.

Batteries, Ltd., have numerous examples of their "Jungner" system nickel-iron accumulators on show. By means of sections and separate plates, the strong construction of the cells is well demonstrated. Among the vehicles themselves there is an electric bath chair by the Argson Engineering Co., Ltd. In this a small motor drives a rear axle through a differential and two-speed gear. The current is supplied by a battery of Edison accumulators carried under the seat. The normal speed is 6 m.p.h., and a distance of 25 miles can be covered on one charge.

It has been observed that one outstanding feature of this year's show is the increased number of combined lighting and ignition systems. To-morrow (Saturday) is the last day of the exhibition.

Inquiry.—Messrs. Robertson Alexander & Co., combustion engineers, of 15, International Exchange, Edmund Street, Birmingham, ask for descriptive information of recently marketed appliances for increasing the efficiency of boiler-house plants.

Röntgen Tube Works at Petrograd.—A Russian journal announces the starting of the only Russian electric works producing Röntgen tubes in Petrograd.

Russia's Electrical Production.—Our contributor on Russian affairs informs us that the programme of production by the Electrotrust of the Central Region of Russia for the coming working year provides for the output by all the factories of the trust of goods to the value of 12,000,000 roubles, based on prices ruling in 1914. Compared with last year, the production scheduled for the lamp factories is increased by about 100 per cent., and for the carbon factory by 30 per cent. The production of the other factories remains at about the same as before, excepting the Elektropribor (electrical apparatus), and the Elektroisolyator (electric insulators), which the Board of the Trust has decided to close down. The production of the required materials will be effected at the "Dynamo" factory instead of at the Elektropribor. For the purpose of the due arrangement of production, the cheapening of goods and increased capacity in the new working year, considerable repair work is in view, besides fresh equipment and converted equipment in the factories. Thus the Poktoffsky and Meschansky lamp factories are to be transferred to other localities for the express purpose of almost doubling their productive capacities. Important work is being done in the fitting out of the Elektrougol factory, in its graphito-carbon section to provide electrodes for the metallurgical and chemical works, &c. At the Isolyator (insulator) factory the laboratory for testing insulators of high voltage will be completed.

Existing staffs will remain, and those of the lamp and carbon factories will be increased to deal with the larger programme of production. The personnel on October 1st this year at all the factories numbered 4,675. By the end of the year this figure is expected to be raised to 5,654.

In the stores of the Electrotrust there are old stocks mostly of non-current goods valued at over 7,000,000 pre-war roubles. These are not expected to yield more than 2,500,000 roubles.

Sales of new incandescent lamps are expected to yield 3,500,000 roubles; the porcelain factory has orders for high voltage insulators for six months, and department orders are expected. In the machinery factories, with a production capacity of 2,350,000 roubles, orders are expected for 1,650,000 roubles. In the cable branch, orders are expected for 3,925,000 roubles, the productive capacity being 5,500,000 roubles value.

Vickers, Ltd.: Extended Objects.—On November 21st, in the High Court of Justice Chancery Division, the petition of Messrs. Vickers, Ltd., to extend the objects of the company was heard before Mr. Justice P. O. Lawrence. Among the reasons which led the company to make this application for the extension of its powers was the fact that although the objects of the company were extended in 1918 to enable it to use in post-war trade the buildings and plant which it had acquired during the war for national purposes, it was not then known in detail what use it might be possible to make of some of these assets. The powers then granted to the company were considerably extended by the present Court proceedings. After hearing the arguments put forward by Mr. Clauson, K.C., for the petitioners, there being no opposition, Mr. Justice Lawrence made the usual order confirming the resolutions extending the objects of the company. The additional powers conferred upon the company include: the holding of interest in coal and iron mines, brick-works, quarries, &c.; the manufacture, &c., of locomotives, tractors, motor cars, aircraft and other vehicles; dealing in explosives and the manufacture of all classes of optical and scientific apparatus; the construction of aircraft for commercial purposes, and of tramways, railways, roadways, bridges, tunnels, canals, hydraulic, electric and gas works, smelting works, refineries, kilns, cement works, quarries, garages and aerodromes; the manufacture of by-products of the company's various industries and other chemical and natural products; the granting of pensions, &c., to any employés and the establishment of institutions for their benefit; and the carrying out of research work.

The Russian Import Trade.—The Russian Trading Delegation in Berlin has issued figures showing the respective shares of Great Britain and Germany in the import trade of Russia in gold roubles in various years. The figures are as follows:—

Russian Imports in Gold Roubles.

Year.	From England.	From Germany.
1913	173,000,000	652,000,000
1918	17,873,000	385,000
1920	7,513,000	7,766,000
1921	64,935,000	54,891,000

The values for 1921 do not include food products sent from England for the relief of starving inhabitants. Definite statistics are not available for the first half of 1922, but it is assumed that the ratio of English to German trade was 25 to 8.

Swiss Manufacturers' Troubles.—The annual report for 1921 of the Swiss Association of Commerce and Industry contains some highly interesting information regarding conditions in the engineering business in Switzerland. Her export trade naturally suffered owing to the high value of her franc, and a crisis developed, which reached its culminating point last year. Her difficulties were accentuated by the imposition of high duties in most foreign markets, by the diminishing purchasing capacity of her own population, and by the growth of competition from abroad, particularly from Germany. The number of workpeople employed by members of the Machine Builders' Association fell from 50,610 at the end of 1920 to 41,217 at the end of 1921. Comparing the latter figure with the number employed before the war there is, however, a decrease of only 770 hands.

The total exports of machinery parts and vehicles, which rose from 601,000 metric quintals, valued at 115,082,000 fr. in 1913, to 700,800 metric quintals, valued at 302,273,000 fr. in 1920, fell to 515,300 metric quintals, valued at 240,240,000 fr. in 1921.

Some of the more noteworthy items of export are shown in the following comparative table:—

	(Metric quintals)			Difference in 1921
	1913	1920	1921	from 1920.
Steam boilers	20,543	29,086	20,841	− 8,245
Steam and electric locomotives	9,793	11,982	11,170	− 812
Spinning machinery ...	13,047	22,884	23,145	+ 261
Weaving machinery	66,842	76,078	62,629	−13,449
Dynamo-electric machinery..	79,363	66,574	71,543	+ 4,969
Milling machinery	69,703	58,932	35,954	−22,978
Hydraulic engines	49,385	37,372	55,739	+18,367
Steam engines and turbines	55,946	32,491	38,521	+ 6,030
Internal combustion engines	63,720	76,675	47,695	−28,980

It is expected that the 1922 figures will show decreases all round.

Satisfaction is expressed in the report at the orders for steam turbines which were obtained from abroad, due, it is claimed, to favourable steam consumption guarantees. Locomotive builders were fortunate in having a fairly large number of uncompleted contracts on their books. Thanks to these and to work for the State railways, they were busy most of the year.

In the report of the Chamber of Commerce at Basle it is pointed out that whilst the cost of raw material fell continuously, the prices at which it was possible to dispose of electrical machines fell more in proportion. Manufacturers worked for stock as long as they could, and the Government helped matters by hastening the electrification of the State railways, but it was impossible to avert a crisis. Business in insulating material has varied. In low-pressure goods there has been a slump, but the makers of high-pressure material have been working busily at a satisfactory profit. Anxiety is, however, felt regarding the future, particularly on account of the lack of business in neighbouring countries, due largely to tariff barriers.

The Austrian Glow Lamp Industry.—The present position of the Austrian glow lamp industry is the subject of consideration in a recent issue of the *Handelsmuseum*. Says the journal:—The Austrian glow lamp industry, like other industries, suffers from the currency variations, the conditions of labour, and, not least, from the customs policy of the victorious States, as it is especially directed against exports. The procurement of raw materials from abroad is, furthermore, exceedingly difficult, owing to the steady depreciation of the Austrian krone. The volume of the home market is small in comparison. In Vienna at the end of April, 1922, the number of 500-watt glow lamps affixed to the network of the city's electricity works totalled only some 2.8 million. Reckoning a single change of the lamps in use on the Vienna network, this gives, since the Austrian industry turns out 27,000,000 a year, about one quarter only of the total sales taken by the home market. To this total of sales, German and Hungarian firms having branch houses contribute one fifth, so that the home production outlet is still further restricted by this amount. The export of the rest is rendered difficult by protective tariffs of other countries, which are either much higher than the price of the lamps, or are so high as to be above the cost of the raw materials. Taking Spain, for example, in recent times she has, to the 12 pesetas gold per 1 kg. glow lamp, added a currency impost for Austrian imports which is revised month by month. This has in practice killed the export trade to Spain. The sale price of a 110-volt 10 to 50 c.p. lamp is 1.22 pesetas, the Customs tax to-day is 25.85 pesetas per kilogram. With a weight of 36 g. per lamp, the customs tax, freight, and packing (0.12 pesetas) total 1.08 pesetas, so that for the covering of the cost of production only 0.14 pesetas remains, an amount obviously representing only a fraction of the cost of production. In the case of the export of glow lamps to France, Austria has to pay four times as much tax as either Holland or Switzerland. That France has no need to hinder the exports is shown by the fact that Holland exported thither in the first half of 1921 metal filament lamps up to a weight of 260,000 kg., having a value of 2.4 million gulden. Notwithstanding these extraordinary difficult circumstances, the Austrian glow lamp industry is seeking to keep the home price some 40 per cent. below production cost, the loss thus arising being covered by exports. This will only be possible, however, when the customs difficulties are abolished. If this be not effected, keener labour methods must be resorted to to still further lower the cost of production.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Henlex. No. 429,382. Class 5.—Telegraph wire. No. 429,383. Class 8.—Electric cables. W. T. Henley's Telegraph Works Co., Ltd., 13-14, Blomfield Street, London, E.C. November 15th, 1922.

B. & D. The Black and Decker Manufacturing, Baltimore, Md., U.S.A. (lettering and design). No. 425,518. Class 6.—Portable electric drills and parts, electric air compressors, &c. The Black & Decker Manufacturing Co., 600, East Pennsylvania Avenue, Baltimore, U.S.A. (McKenna & Co., 31-4, Basinghall Street, London, E.C.). November 15th, 1922.

Electrads (lettering and design). No. 428,571.—Machinery of all kinds in Class 6. Electrads, Ltd., Evelyn House, 62, Oxford Street, London, W. November 15th, 1922.

Heatrae Electric Fires (lettering and design). No. 428,792. Class 18.—Electric stoves and electric heating and cooking appliances. Electric Fires, Ltd., 147, King Street, Norwich. November 15th, 1922.

Aerolectric. No. 426,514. Class 8.—Apparatus for wireless telegraphy, telephony, and radio instruments and parts. The Æolian Co., Ltd., Æolian Hall, 131-137, New Bond Street, London, W. November 15th, 1922.

Macradio. No. 428,512. Class 8.—Apparatus for use in wireless telephony and telegraphy. Alfred MacArthur, 20, Queen's Crescent, London, N.W. November 15th, 1922.

Gegosite. No. 429,113. Class 8.—Instruments and apparatus for use in wireless telephony. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. November 15th, 1922.

Film Publicity.—On November 22nd the Cinema Publicity Service, Ltd., exhibited a number of films showing the activities of a number of industrial companies, including automobile manufacturers, at the West End Cinema, Coventry Street, W.1.

Messrs. Goldwyn, Ltd., are taking the advantage offered by a film called "The Invisible Power" to advertise electricity in its domestic applications.

Lantern Slides.—Messrs. Brook, Hirst & Co., Ltd., inform us that they have prepared a selection of lantern slides illustrating their "Safety First" motor-starting panels. These slides, with explanatory notes, will be lent to any lecturer upon application to the firm, and special additions can be made if necessary.

A Russian Electrical Finance Company.—A meeting of the founders of the Electrical Industry Finance Co., at which were present representatives of the Glavelektro, Narkomzen, Elektrostroya, and of a number of co-operative associations, has been held. The statutes of the concern were examined and a board of the founders was appointed which will put the final touches to the statutes and prepare financial issues and the like. It was clearly shown at the meeting that the 500,000 gold roubles capital will be quickly subscribed if certain rights are made to appertain thereto.

LIGHTING AND POWER NOTES.

Accrington.—Extension of Supply.—The Corporation has decided to provide Oswaldtwistle with electricity. There will be 4,600 yd. of distributing main, 1,360 yd. of feeders, and five distribution pillars.

Australasia.—Tasmania.—A new hydro-electric station, with a capacity of 50,000 h.p., was opened at Risdon on November 23rd. This station is the largest in the Southern hemisphere.—*Reuter* (Hobart).

Sydney (N.S.W.).—The Municipal Council has received a letter from the Under Secretary of Public Works stating that the Cabinet has approved of the introduction of a Bill to confer on the Railway Commissioners the necessary powers to enable them to generate and supply electricity and to make the necessary contracts. The Bill has been drafted and the measure will be introduced immediately.

Bathurst (N.S.W.).—The Council is applying for a loan of £40,000 for the purpose of an electric lighting scheme for the district.

Maclean (N.S.W.).—The Municipal Council is applying for a loan of £7,000 for the purpose of installing electric light within the municipality.

Barnes.—Loan Sanctioned.—The Council has received sanction from the Electricity Commissioners to a loan of £17,000 for the installation of a 1,500-kW turbo-generator.

Birmingham.—Price Reductions.—As from the beginning of the March quarter 1925, a reduction in the charges for electricity of ½d. per kWh is to come into force.

Blackrock (Dublin).—Electricity Extension.—The Irish Free State Ministry of Commerce and Industry has approved the Urban Council's Electric Lighting Extension Order, as amended, intimating that, on compliance with formalities, Parliamentary approval will be sought.

Bury.—Electricity Supply.—The Corporation has been notified that in connection with the proposed bulk supply of electricity to Rochdale, the Electricity Commissioners have decided in favour of the supply being obtained from the Lancashire Electric Power Co. in preference to Bury.

Crompton.—Special Order.—The District Council is applying to the Electricity Commissioners for a Special Order authorising the Council to supply electricity within the district in accordance with the agreement entered into with the Oldham Corporation.

Canada.—Toronto.—The deal, whereby Toronto acquires the Mackenzie interests, power and radial, has been concluded, the consideration being $32,734,000. The Hydro Commission thus obtains the assets of the Electric Development Co., the Toronto Power Co., the Toronto & Niagara Power Co., the Toronto Electric Light Co., the Toronto and York Radial Railway Co., and the Aurora and Schomberg Railway Co. The directors of all these companies have resigned and a new board has been appointed on the nomination of the Hydro-Electric Commission, under the terms of the agreement, to administer each of these companies. The new board consists of the following: Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, president; Col. D. Carmichael, vice-president; Mr. W. W. Pope, secretary; Mr. F. A. Gaby, chief engineer of the Hydro-Electric Power Commission, a director; and Mr. J. W. Wilmour, treasurer.—*Reuter's Trade Service* (Toronto).

Cardiff.—Year's Working.—The annual statement of accounts of the municipal electricity department (engineer: Mr. Morley New) shows that the capital expenditure during the year was £47,776. The income was £168,370 for the year, an increase of £7,473. Working expenditure amounted to £117,404, an increase of £8,295. The gross profit was thus £50,966, a decrease of £823. Loan charges for the year increased by £19,255 to £43,930, leaving a net surplus of £21,517, a decrease of £2,194. Charges for the year were reduced from 90 per cent. above pre-war rate to 75 per cent., the average rate for the year being 82½ per cent. higher than in 1913. This reduction was offset by increased sales. The output was increased by 1,344,662 kWh to 11,967,013 kWh, principally due to power and heating demands. The output generally was affected by the stoppage of the collieries. Traction supplies are not included in the figures given. There were 1,044 new consumers, 17 miles of feeder and distributor cables were laid, and 5¼ miles of service cables.

Proposed Extensions.—Mr. Morley New recently submitted a report on electricity supply in the added areas. There were 1,000 new consumers available, but while the Corporation system could be immediately extended on the west side of the Taff, the electricity supplies in the added areas on the east side up to 150,000 kWh per annum would have to be taken from the South Wales Power Co. The present consumption in the added areas was about 25,000 kWh. The South Wales Power Co. retained its full powers in the added areas, which meant that the Corporation would be in competition. Mr. New recommended that supplies be established in Llandaff at an estimated cost of £2,600; in Ely at a cost of £1,375; that the present overhead system in Gabalfa be restricted wherever practicable, and that the underground system of mains be adopted. The question of supplies for Llanishen was deferred. These reports were adopted, and it was agreed to make an application for the borrowing of £5,000 for expenditure on substations.

Ceylon.—Reorganisation of Distribution.—In order to overcome the large voltage drop in outlying districts entailed by the present system of distribution, the Kandy municipal electricity department proposes to establish feeding points at six places in the outskirts of the area of supply to which untapped cables will be laid from the power station.

Continental.—France.—Application has been made by a syndicate representing eight communes in the department of the Basses Alpes, including that of Saint Maime, for sanction to construct a network to supply the communes concerned with electricity.

The Société des Forces Motrices de la Vienne has applied for a concession to set up a network to supply electricity to a number of communes in the departments of Vienne and Charente. The current distributed will be alternating, three-phase, at 50 cycles and a pressure of 15,000 volts.

Turkey.—According to the report of the Société Ottomane d'Electricité for last year, the company is now supplying electricity to 24,658 consumers, an increase of 4,451 during the 12 months. The length of the distributing mains has also been increased from 297 to 335 kilometres. A new 10,000-kW steam turbine and generator is being erected at the central station, while, in order to meet the increasing demand, a contract has been placed for a further set of the same capacity to be ready for the 1923-24 winter season.

Dumfries.—Special Order.—The Town Council has been granted an Order authorising it to supply electricity within the borough, and also in the Borough of Maxwelltown.

Dunstable.—Electricity Supply.—The Urban Council has decided to approach Luton Town Council with a view to obtaining a supply of electricity for the town.

Hoylake and West Kirby.—Price Reductions.—The Urban Council has decided to reduce the charge for electricity by 1d. per kWh for the first 500 kWh, and ½d. per kWh beyond, as from January next.

India.—Burma.—An extensive scheme is in contemplation for the supply of electricity to Burma. It is proposed to divert the waters of the Yunzalin river down a slope and through tunnels, thereby supplying the motive power for the generation of electricity for transmission to Rangoon.—*Reuter's Trade Service* (Bombay).

Kilkenny.—Electricity Scheme.—The Corporation has accepted the proposal of Mr. F. Walsh to light the town by electricity. The new system is expected to be in operation in two or three months.

Llandudno.—Price Reduction.—The Council has decided to reduce the price of electricity from 10d. to 8d. per kWh.

Nottingham.—Extension of Supply.—In a Bill which is to be promoted in the ensuing Session of Parliament, the Nottingham Corporation is seeking powers to extend its area of suuply, to include Hucknall Torkard, Radcliffe-on-Trent, Stapleford, and Toton.

Okehampton.—Purchase of Undertaking.—The Town Council is approaching Mr. G. K. Blatchford with a view to purchasing the electricity undertaking.

Oldham.—Loan Sanctioned.—The Electricity Commissioners have intimated, in connection with the Electricity Committee's application for permission to borrow £70,000 for mains and transformers, that they are prepared to sanction the borrowing of £60,158.

Preston.—Loan Sanctioned.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £250,000 for plant for the new power station.

Queenstown.—Damage to Electricity Works.—The power station was broken into some time about midnight on November 22nd, and the plant has been completely put out of action. Entering the station early the following morning the chief engineer found that engines and generators were seriously damaged. There was evidence that heavy hammers had been used on the commutators, some of which had been damaged beyond repair.

Rawmarsh.—Electricity Supply.—The Urban Council has under consideration a proposal to obtain a supply of electricity from the Rotherham Corporation.

Selby (Yorks.).—Electricity Supply. The Selby Portholme Mills have been secured by the Electrical Distribution of Yorkshire, Ltd., to serve as a distributing station for the district.

Skipton.—Supply from Keighley.—At the November meeting of the Town Council a letter was received from the Electricity Commissioners stating that Keighley Corporation had agreed to supply electricity in bulk to the Yorkshire Electric Power Co., at Eastburn, for transmission to Skipton. The Commissioners undertook to do all in their power to expedite the completion of the necessary arrangements in order that there should be no further delay in providing the power so urgently needed.

Silverton (Somerset).—Electricity Supply.—A proposal to light the district by electricity has been so well received that immediate operations to carry out the project are proposed.

Waltham Abbey.—Electricity Supply.—The North Metropolitan Electric Supply Co. has informed the Urban Council of its intention to extend its supply of electricity to the district partly by underground and partly by overhead cables.

TRAMWAY AND RAILWAY NOTES.

Belfast.—Reduced Fares.—At a recent meeting of the Corporation, a recommendation from the Tramway Committee for reducing the present minimum three-halfpenny fare to one penny was approved.

Canada.—Ontario.—The Provincial Government is considering plans for the electrification of the Temiskaming and Northern Ontario Railway at a cost of approximately $9,000,000. It is contended that, with the enormous water powers in the Northland, the substitution of electric power for steam power would effect a considerable saving. It is understood that the Provincial Ministers are favourable to the project and that the Lieutenant-Governor-in-Council will direct that the change be made.—*Reuter's Trade Service* (Toronto).

Continental.—Spain.—The Council of Ministers has approved the project of electrification of the line from Rivas to Puigcerdá, the trans-Pyrenean line built by the State. The officers of this railway are at Bilbao. Particulars may be obtained from Señor Don Ramón Lontagut, Ingeniero Jefe de la Segunda División de Ferrocarriles, Balmes 32, Barcelona.—*Reuter's Trade Service* (Madrid).

London.—"Underground" Extensions.—The long-contemplated branch of the Metropolitan Railway from Sandy Lodge to Watford is to be commenced shortly, a contract for the work having been awarded to Messrs. Logan & Hemington, a Doncaster firm. The extension entails two miles of track and three new stations—Watford, Watford Golf Links, and Croxley Green. It is expected that the construction will occupy about two years and give employment to large numbers of men.

"Underground" Fares.—In the House of Commons on November 27th, Mr. Gilbert asked the Parliamentary Secretary to the Ministry of Transport whether an inquiry was ordered by his department into certain fares charged by the Underground Railways of London; if so, when was the inquiry ordered and commenced; had any Report yet been presented thereon; and, if so, could he state its purport.

Col. Ashley replied that the Rates Advisory Committee was asked on July 27th last to consider and advise the Minister what, if any, modification should be made in the fares charged under the provisions of the London Electric Railways (Fares, &c.), Act, 1920. The Committee advised on October 27th that proposals made to it by the companies for the reduction of ordinary fares, with corresponding reductions in workmen's fares, might reasonably be accepted as sufficiently meeting the circumstances of the case at the present time, and that they should be brought into operation on January 1st next. The companies undertook to bring the reduced ordinary and workmen's fares in question into operation on that date, and they had advertised particulars of the reductions, which included reductions in certain season ticket rates. It had been arranged that the Committee should present a further report in final discharge of its reference in the course of the early months of next year.

The L.C.C. has decided to withdraw the open trailer cars employed on the South London routes, and experiments are being carried out with top-covered cars of larger capacity.

Manchester. [illegible] Alteration of Routes.—A joint committee of [illegible] transport and highway interests has proposed a scheme for relieving the congested traffic in the heart of the city [illegible] suspension of certain tramway routes and the alteration of others.

Mexico.—Railway Electrification.—The International General Electric Company has closed a contract for the electrification of [illegible] track of the Mexican Railway Co., Ltd., between [illegible] and Esperanza, on the main lines between Mexico City and Vera Cruz. The cost of carrying out the work is [illegible] between 2,000,000 and 2,500,000 dollars. The electrification of this stretch of road will be the first [illegible] railway in Mexico.—*Reuter's Trade Service* (New [illegible])

TELEGRAPH AND TELEPHONE NOTES.

Denmark.—Telephone Extensions.—The Copenhagen Telephone Co. has concluded a 10,000,000 kr. 5 per cent. bond loan with a Copenhagen private bank, repayable in 20 years. There is no public subscription. A further 10,000,000 have been authorised and will probably be raised in a year's time, and possibly a further 20,000,000 two years later. The money is required for extensions and renovations, and more especially for new cables connecting Copenhagen with the provinces.—*Financier.*

France.—Radio Control of Aircraft.—In the last few days experiments with an aeroplane flying without a pilot and guided by means of radio telegraphy have been carried out at the Ville-sauvage Aerodrome, Etampes, under the direction of MM. de Marcay, Bouche, and Percheron.

Flights were made without a pilot on November 24th and on the 25th with a pilot in the aeroplane, although he used, instead of the ordinary machinery of steering and engine control, the gyroscopic stabiliser and the steering motors which will eventually be worked by Hertzian waves directed from a station on the ground. A Voisin biplane with a 300-h.p. motor was used, and Capt. Arbanère was the pilot. The experiments are stated to have been very promising.—*The Times.*

Eiffel Tower Extensions.—The power of the radio installation at the Eiffel Tower, from which the meteorological reports are transmitted to the agricultural districts of France, will shortly be increased, says *The Times.*

India.—Strowger Automatic Telephones.—Following the example set by the Post and Telegraph Administration of the Indian Government in installing Strowger automatic telephone equipment at Simla, Lahore, and Amritsar, and the successful results obtained thereby, the Bombay Telephone Co. has decided to give its subscribers the benefits of Strowger service also, and will shortly proceed with the installation of equipment to serve a total of 11,000 lines in the City of Bombay. The contract for this equipment has been secured by the Automatic Telephone Manufacturing Co., Ltd., whose Liverpool factory the whole of the apparatus will be manufactured. It is anticipated that the installation will be completed and the new system ready for the cut-over early in 1924. Bombay is particularly well adapted for the successful exploitation of the Strowger system, no fewer than 62 different languages and dialects being in common use among its population of approximately one million. The proposed total of 11,000 lines will be housed in two exchanges, the present "Central" accommodating immediate equipment for 6,500 lines, and making provision for an ultimate capacity of 15,000. The other exchange, to be known as "Gell Street," will replace a temporary manual exchange which has just been completed at the Northern end of the city, and equipment will be provided there for immediate requirements with 4,500 lines and an ultimate capacity of 15,000. The five-digit system will be adopted and provision made for connection to all long-distance toll lines entering the city. The scheme embraces line switches of the rotary type, together with covered type selectors and connectors. Economies in floor space and cabling will be secured by the adoption of the "Unit" type intermediate distributing frame for the line circuits. Under this arrangement cross connecting frames are mounted on top of the individual units and, whilst affording exactly the same facilities, dispense with the necessity for a separate intermediate distributing frame. Standard selector and repeater trunk boards will be installed, together with power equipment designed to carry the ultimate load except for the batteries which, at the outset, will only be fitted with sufficient plates to provide ampere-hour capacity for immediate requirements.

Ireland.—Communication Interrupted.—Telegraphic communication between Dublin and all towns in the south and west of Ireland was suspended on November 28th, the circuits having been cut by irregulars in the early hours of the morning. Communication with Cork was, however, restored during the evening.—*Daily News.*

Italy.—New Atlantic Cable.—A preliminary agreement has been concluded between the Italian Government and the Western Union Telegraph Co. for the laying and working of a cable between a station near Rome and one near New York. The Italians will be responsible for the laying and working of the section of the cable between Italy and the Azores, the Western Union Telegraph Co. for the section between the Azores and America. The cable in question will serve not only Italy, but considerable portions of Central Europe and the Near East. This is the first time that Italy has made such a contribution to the telegraphic means of international communication.—*Daily Telegraph.*

Radio Telegraphy.—Crime Detection.—Having in view the probabilities of radio telegraphy in connection with the detection and prevention of crime, the Huddersfield Watch Committee has given permission to the Chief Constable (Capt. J. W. Moore) to install a radio telegraph and telephone set at the Central Police Station.

THE KILMARNOCK ELECTRICITY UNDERTAKING.

RECENT DEVELOPMENTS.

The Kilmarnock Corporation obtained a Provisional Order in 1899 to supply electricity in the Burgh of Kilmarnock. On the advice of Sir Alexander B. W. Kennedy, a power station was erected on the site of the present station in 1901, and the following plant was installed: Four Belliss compound engines working at a pressure of 165 lb., coupled to Dick, Kerr generators having a total capacity of 170 kW. The boiler house contained three Lancashire boilers.

In 1907 a further 275-kW Belliss-Dick, Kerr set was installed, with a water-tube boiler having a steaming capacity of 5,000 lb. per hour; in 1913 a duplicate of the Belliss-Dick, Kerr set was installed, making the total generating capacity of the station 1,030 kW.

From 1901 to 1913 the supply in the Burgh of Kilmarnock was direct current, 3-wire, at a pressure of 480 volts between the outer conductors and 240 volts between the outer and middle wires, and, in addition, there was a d.c. supply for the tramways at a pressure of 500 volts.

The first turbine was installed in March, 1914, and was manufactured by Messrs. James Howden & Sons, of Glasgow, it being of the mixed-pressure type, and was designed so that the exhaust steam from the Belliss engines could be utilised. This turbine was coupled to a Brown, Boveri alternator capable of giving an output of 500 kW at 3,300 volts, 3-phase, 50 cycles, 3,000 [illegible] per [illegible]. In 1914 the first [illegible]-phase supply was introduced into Kilmarnock.

Owing to the great increase of the load on the station it was found necessary to install further plant. In December, 1914, a 1,500-kW curtis alternator using superheated steam, together with condensing plant, was [illegible]

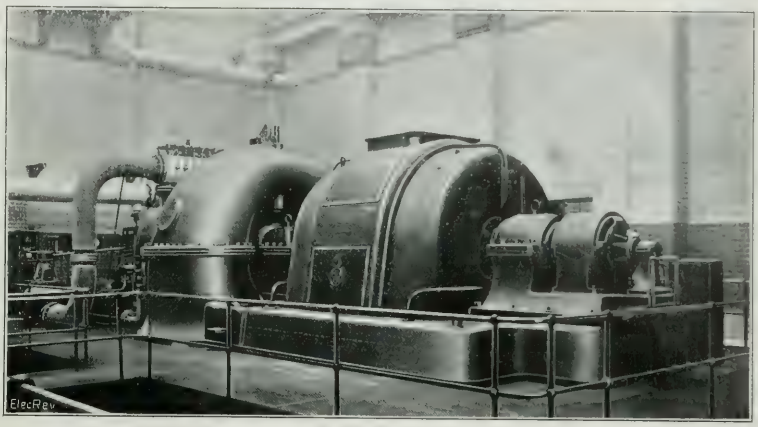


Fig. 1.—A 12,500-kW B.T.H. Turbo-Alternator.

two boilers capable of evaporating 18,000 lb. of water per hour, while in the pump room a further feed pump was installed.

In 1911 the Town Council obtained a Provisional Order to supply outside the Burgh of Kilmarnock, including a large part of Ayrshire and also the following burghs: Troon, Irvine, Galston, Newmilns, and Darvel, for which purpose transmission lines were run across country working at a pressure of 11,000-12,000 volts, a.c., 3-phase, the pressure being reduced by means of static transformers to suit domestic and power purposes in the various burghs.

The supply in the outer district was first available at Hillhouse Quarry in November, 1914. Immediately there was a great demand for electricity, and in order to meet the load a further 2,500-kW turbo-alternator was commissioned in March, 1916, making the total capacity of the station 5,530 kW.

Early in 1917 the whole of the original machinery was sold so that the space it occupied could be utilised for the accommodation of more efficient plant, and by the middle of 1918 a 5,000-kW turbo-alternator was in commission, thus making the capacity of the generating plant 10,000 kW, and two water-tube boilers, each capable of evaporating 20,000 lb. of water per hour, were installed.

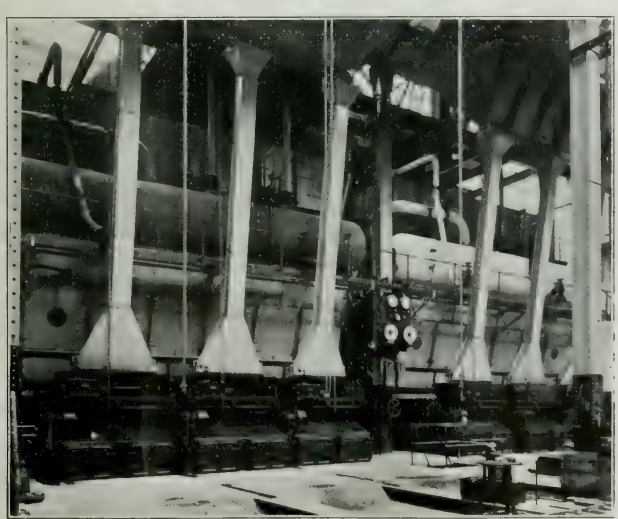


Fig. 2.—Two 50,000-lb. B. & W. Boilers.

Certain large manufacturers made application for a supply of electricity in 1918, but the Corporation, not having the necessary Parliamentary powers to supply these consumers, had to obtain Special Orders to do so. By October, 1919, a transmission line was completed to Ardrossan, and a supply was available

in the Ardrossan Shipyard and Harbour to the extent of 2,000 h.p. The transmission lines were continued to Dalry in 1920, and in 1922 the Corporation again obtained permission to supply 31 parishes and burghs, all in the County of Ayr.

During 1920 it was realised that the capacity of the station was not sufficient to meet the load, should at any time one of the generators be out of commission, and it was decided to practically double the capacity of the

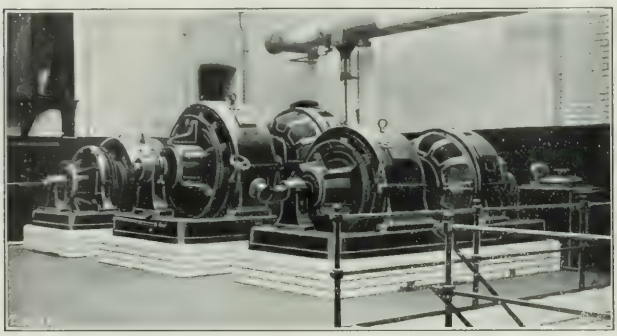


Fig. 3.—Motor Converters.

whole of the generating plant, which necessitated the building of an almost new station, which was commenced in May, 1920, and is now completed.

In the new engine room the following plant is installed: One turbo-alternator running at a speed of 1,500 r.p.m., fig. 1, designed for a steam pressure of 250 lb., superheated 250°. The alternator is capable of giving a continuous output of 12,500 kW at 3,300 volts, 3-phase, 50 cycles. A 50-ton electrically-operated travelling crane has been provided, and in the basement are the necessary condenser and circulating pumps and air filter. The condenser, fig. 4, is capable of dealing with 140,000 lb. of steam per hour in a vacuum of 28½ in. with the barometer at 30 in. The cooling surface is 16,000 sq. ft., and the circulating pump is capable of delivering 735,000 gallons per hour. The rotary combination is driven by a 300-b.h.p. motor running at a speed of 960 r.p.m. The auxiliary plant of the remaining turbines is driven by auxiliary turbines, the exhaust steam of which is used for heating the feed water through a direct contact heater.

In the new boiler house, fig. 2, there are erected two marine type water-tube boilers capable of evaporating 50,000 lb. of water per hour from a feed temperature of 100° F. into steam at 250 lb. per sq. in. The total heating surface of each boiler is 7,445 sq. ft., and above them are the necessary economisers, each having a total heating surface of 5,133 sq. ft., above which are installed the induced-draught fans and chimneys. A considerably increased evaporation can be obtained, however, if a better class of fuel is used, as the boilers are capable of giving the above evaporation when using coal having a calorific value of 8,000 B.th.u. In the basement is the necessary forced-draught plant. The hot air from the alternator is discharged into the fan inlet, thus providing hot air underneath the furnaces.

The coal is brought in trucks along the sidings by the Corporation locomotive, and is then tipped into the coal bunker; from there it is elevated into the storage tanks at the top of the boiler house, and falls by gravity into the hoppers of the boilers. The ashes fall by gravity into hoppers situated in the basement, where they are broken up and then carried by means of suction into a receiver outside the works.

In the pump room are installed two Weir turbine-driven rotary feed pumps, capable of delivering 15,000 gallons of water per hour against a pressure of 325 lb. per sq. in. The exhaust steam from this pump is used for heating the boiler feed water. Suitable recording instruments are provided to check the efficiency of the boiler and generating plant.

The amount of circulating water required for the condensing plant is considerable, and during dry seasons there would have been difficulty in taking this quantity continuously from the river, to overcome which a barrage has been erected across the river immediately outside the works, fig. 5. When the barrage is down, the water, which has already passed through the condensers and been discharged into the river, is dammed back up to the weir. Close to the weir is a pump house, and should at any time there not be sufficient circulating water coming down the river, the water which has been dammed back by the barrage will be pumped again through the condensers.

Amongst the contractors for the new extension were: Turbine and operating switchboard, the British Thomson-Houston Co., Ltd. (which supplied all the other turbine machinery except the 500-kW turbo-alternator); condensing plant, Messrs. Worthington-Simpson, Ltd.; boilers, economisers, suction ash plant, and coal-elevating plant, Messrs. Babcock & Wilcox, Ltd.; barrage, Messrs. Glenfield and Kennedy, Ltd.; Callender's Cable and Construction Co., Ltd., was the successful contractor for the laying of the cables in the original scheme in 1904, and also obtained the contract for practically the whole of the Corporation's cable work. This firm has also erected a large amount of the Corporation's overhead transmission lines on "Kay" towers.

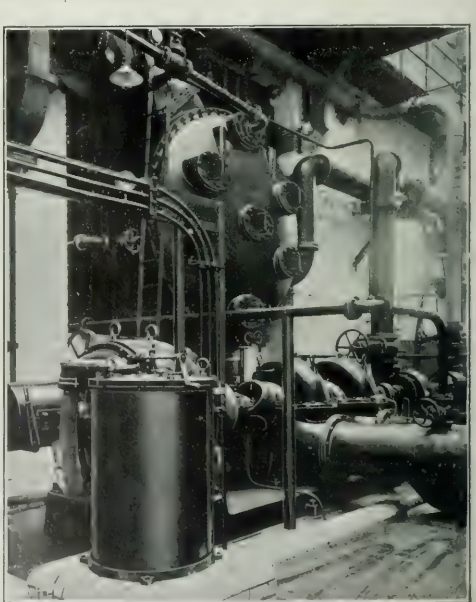


Fig. 4. Condenser and Circulating Pump.

The whole of the distribution work in the various burghs outside Kilmarnock has been done by the Corporation's own staff.

The Corporation now finds it necessary to increase the pressure of the supply to the outer districts, and recently a transmission line, fig. 6, has been erected to Kilbirnie and is working at 25,000 volts. With a view to saving expense, outdoor sub-stations are now being erected, together with overhead switches.

Mr. W. C. Bexon, the engineer and manager of the undertaking, has some 100 square miles to supply, and has some 80 miles of overhead transmission line working at 11,000 volts, 3-phase, 50 cycles, and also some 20 miles of transmission line working at 25,000 volts. The 11,000-volt transmission lines pass over agricultural land and a number of farms. The Corporation supplies all these farms by means of small pole transformers; altogether some 50 farms use electricity for practically all purposes—lighting, heating and power.

Regarding the outdoor sub-stations, the arrangement is as follows:—The structure is either lattice work or steel girder work. On a six-wire through feeder line both feeders pass through switches, choking coils, lightning arresters and, in some cases, fuses, which are erected in a horizontal position at the top of the sub-station; the open-air switches controlling the transformer are erected in a vertical plane on the side. All the open-air switches are arranged to be operated from the ground by means of a long rod. In a sub-station which has been constructed recently the open-air switches are erected as explained above, but a small building containing oil switches is also erected at the top of the sub-station. The transformers themselves are specially designed for being installed in the open, and some of them are wound in series-parallel so that either 11,00 or 22,000 volts can be obtained. Inside the transformer is the necessary potential transformer, and bolted on the outside case is a voltmeter enclosed in a water-tight cast-iron box. In

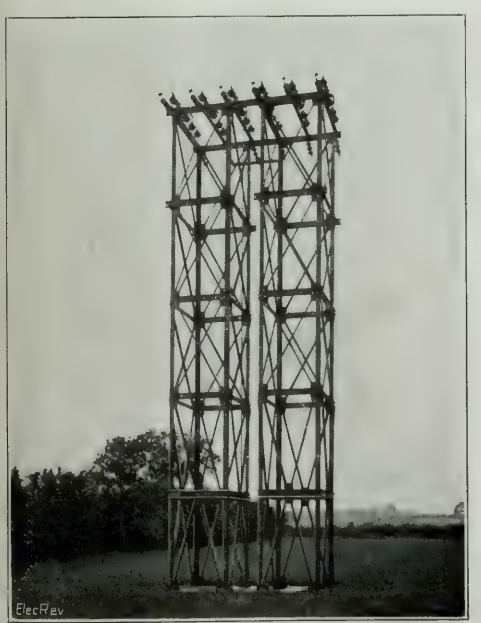


Fig. 6.—A 25,000-V Isolating Tower.

an open-air sub-station where there are two feeders in and out, the arrangement of switching is such that the transformers can be switched into any feeder either on the in-coming or out-going side.

In conclusion, it may be mentioned that the output of the undertaking during the year 1922 amounted to 17,333,660 kWh, the revenue being £103,080, and the total capital expenditure £574,641.

HADFIELD'S "HECLA" STEEL WORKS.

New Rolling-mill Plant.

The Hecla & East Hecla Works at Tinsley and Attercliffe, Sheffield, of Messrs. Hadfields, Ltd., are amongst the most widely known steel-making organisations in the world, and are particularly prominent in the production of special steels. For the purpose of further increasing



Fig. 5.—General View of Barrage.

their facilities there have recently been installed three electrically-driven rolling mills, including a reversing 28-in. blooming and finishing mill and 11-in. and 14-in. bar mills. The two smaller mills are used for rolling billets to the various commercial sizes, and have proved very useful also for the production of special alloy high-tensile steels.

They are of the continuous running bar type, each driven direct by an electric motor having a flywheel and flexible coupling interposed between the motor and the mill. The mills are complete with the usual reeling machines, shears and hot saws, &c., all driven by individual electric motors. A roll-turning department is provided in which are situated electrically-driven lathes and other equipment. Overhead electric travelling cranes handle the raw and finished materials.

The 11-in. mill is arranged with five sets of housings, *i.e.*, one three-high and four two-high, driven by a 400-800-h.p. compound interpole motor having a rated speed of from 150 to 250 r.p.m. through a totally-enclosed machine-cut double-helical reduction gear to reduce the speed of the mill to a minimum of 110 r.p.m. Interposed between the reduction gear and the motor is a flywheel 10 ft. diameter and weighing 17 tons. A buffer spring flexible coupling connects the motor shaft to the flywheel shaft, and a concentric coupling connects the flywheel shaft to the reduction gear. The starting panel for the motor is of the contactor type. The mill rolls $2\frac{1}{2}$-in. billets to rounds of from $1\frac{1}{4}$-in. to $\frac{1}{2}$-in. diameter, and to squares of from $1\frac{1}{4}$ in. to 1 in., also to flats of equivalent section within the capacity of the mill and other special sections as required.

The 14-in. mill is arranged with six sets of housings two-high, driven by a 500/1,000-h.p. compound interpole motor having a rated speed of from 75 to 150 r.p.m., the rolls running at the same speeds. Interposed between the mill and motor is a cast-iron flywheel, 12 ft. diameter, weighing 40 tons. A buffer spring flexible coupling connects the motor shaft to the flywheel shaft. The starting panel for the motor is of the contactor type. This mill rolls 5-in. billets to rounds of from 3-in. to 1-in. diameter and to squares of from 3 in. to 1 in., also to flats from 7 in to 1 in. down, and other special sections as required.

The 28-in. mill with its reversing motor, will roll 1,500 tons of special steel $1\frac{1}{4}$-ton ingots down to $2\frac{1}{2}$-in. billets per week. The motor is supplied with current on the Ilgner system, is rated at 3,200 h.p., and can deal with a transient peak of about 11,600 h.p.

The steel plant to serve this particular mill is housed

in the adjoining building and comprises open-hearth furnaces, each having a melting capacity of from 28 to 55 tons per charge. The output capacity is about 1,200 tons per week. There are also nine electric furnaces of 6-7 tons capacity, and three smaller furnaces. The complete plant has a total melting capacity of about 2,300 tons per week, and was built at a cost of £260,000. The total output capacity of the Hadfield steel works amounts to over 4,000 tons per week.

The mill plant was constructed by the Brightside Foundry and Engineering Co., Ltd., Sheffield. The electric motor is connected to the bottom pinion by a coupling of the "Ortman" sliding type, constructed entirely of steel, the engaging portions of which are renewable. It can be engaged or disengaged by hydraulic gear enabling the motor to be run independently of the mill for testing or other purposes, and the oil for the pinions and bearings is circulated by a motor-driven rotary pump.

The mill motor, built by the British Thomson Houston Co., Ltd., which has an r.m.s. rating of 3,200 h.p. and a maximum rating of 11,600 h.p., is capable of exerting a constant torque of 125 ton-ft. from standstill to 60 r.p.m. in either direction, and gives a constant horse-power of 3,200 between the speeds of 60 and 120 r.p.m. The overload capacity corresponds to a torque of 453 ton-ft. between standstill and 60 r.p.m.; and 11,600 h.p. between the speeds of 60 and 120 r.p.m.

Fig. 2 illustrates the motor looking at the driving end. The double armature weighs 62 tons and had to be handled by two of the overhead 35-ton cranes.

The motor, which is of the double-armature type, is shunt wound, with compensating windings in the pole faces, and is provided with commutating poles, the two armatures being connected in series for a maximum of 1,300 volts. Ventilating air for the motor is cooled and cleaned by passing through a wet-air filter of the "Invincible" type capable of dealing with 25,000 cu. ft. of air per minute.

Power is supplied to the motor from a flywheel motor-generator set comprising an induction motor of 1,800 h.p. running at 600 r.p.m. (synchronous speed) at a pressure of 3,300 volts, coupled direct to two shunt-wound compensated generators, each rated at 1,300/

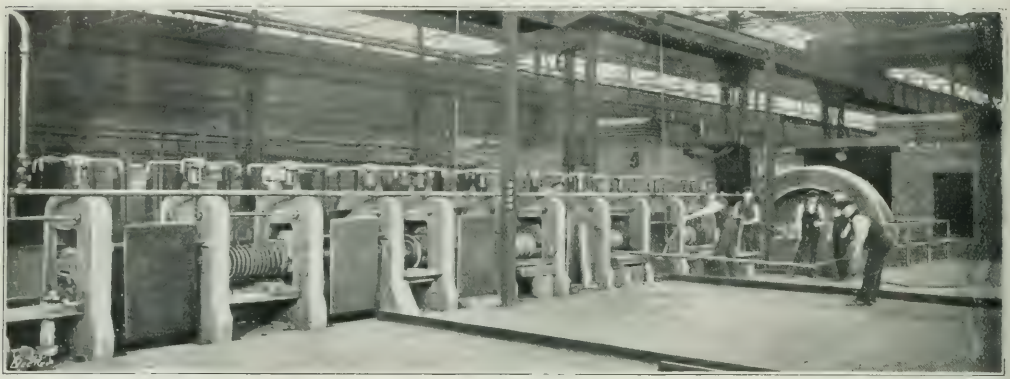


Fig. 1.—Hadfields' 44-in. and 44 in. Rolling Mills.

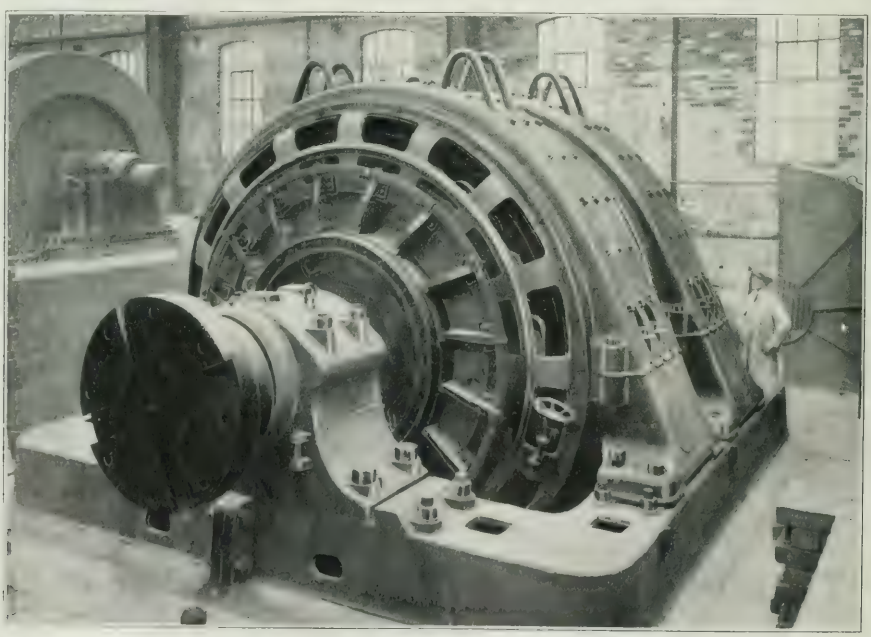


Fig. 2.—A 3,200-11,600-h.p. B.T.H. Motor for 28-in. Reversing Rolling Mill.

4,750 kW when running at 500/600 r.p.m. at 650 volts. The shaft extension of the outer generator is fitted with a buffer-spring type flexible coupling, connected with a cast-steel flywheel 11 ft. 6 in. diameter and 30 tons in weight.

A water-cooled brake is provided to bring the flywheel to rest quickly in case of emergency. The speed of the flywheel is indicated on two instruments, one located on the main instrument board and the other on the control platform.

The mill motor and generator fields are energised by a three-unit set, which comprises a d.c. motor, mill-motor exciter, and generator excitor. The field windings of the excitors give rapid control of the mill motor, and since all speed variation is obtained by control of exciter fields, only small currents have to be handled, a Ward-Leonard controller mounted on the control platform being used for this purpose.

The power for driving the mill is taken from the Sheffield Corporation mains at 11,200 volts, 50 cycles, 3-phase, and transformed by static transformers to 3,300 volts. The supply to the induction motor is controlled by switchgear of the ironclad drawout-truck type, starting and speed being controlled by a special contactor starting and slip-regulating panel, which makes the starting operation entirely automatic.

The maximum power demanded from the Sheffield Corporation should not exceed from 1,800 to 2,000 h.p., and this only when the flywheel set is required to do more than ordinary running; the main motor is capable of being reversed from full speed in one direction to full speed in the other direction in from three to four seconds. The grand total weight of the mill is about 1,600 tons, and the approximate weight of electrical equipment is 400 tons.

The 11 auxiliary motors for driving the live rollers, skids, and screw-down gear on cogging rolls are all of 40 h.p. running at 500 r.p.m., and of the reversing steelworks type, totally-enclosed, series-wound with commutating poles. They are rated on a basis of one hour's duty and will carry 100 per cent. overload without sparking, and can also be run at still greater overloads without serious sparking. They are all arranged for remote control by means of ironclad totally-enclosed reversing master controllers and control panels of the contactor type, with separate specially-rated protected-grid type resistances.

The master controllers for the motors driving the ingoing and outgoing live rollers of the cogging and finishing mills, also for the screw-down gear for the cogging mill, and for the skids between the cogging and finishing mills, are all situated on the main control platform; whereas, for the run-out live rollers to the hot saw and beyond, also for the hot saw and the skids at the cooling bank, the controllers are fixed on separate platforms.

An electric telegraph system is established between the control platform and the electrical equipment house, by which orders may be communicated between the mill-driver on the platform and the attendant in the electrical equipment house, and *vice-versa*.

Decimal Coinage and Metric Weights and Measures.—At the annual meeting of the Decimal Association on November 23rd, the President, Sir Richard Gregory, D.Sc., F.R.A.S., remarked that the use of the metric system was now obligatory in 46 countries; Japan was the latest addition to the list. Until we in this country adopted this universal language of quantity we should continue to be handicapped in comparison with our competitors for the trade of the world. The metric system was used in the electrical industry, in radio communication and broadcasting, in aviation and in international athletics by the whole world, and only this country and the United States still retained the old measures in use for other purposes. The policy of the Executive Committee which advocated the "10-penny shilling" for the purpose of arriving at a decimal coinage without altering a single coin (merely increasing the value of the penny by 20 per cent.) was unanimously approved.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Abertillery.—December 15th. Electricity Department. One 2,200-V, h.p., feeder, one 200-kW and one 30-kW converting sets; h. and l.p. switchgear; static transformers and l.p. switchgear; a.c. overhead and underground distributing system. (November 24th.)

Atherton.—December 20th. Urban District Council. Two 30-kV.A. single-phase transformers and one 150-kV.A ditto. (See this issue.)

Australia.—Perth.—January 17th. Postmaster-General's Department. Telephone and telegraph apparatus, testing instruments, and protective apparatus.*

Belgium. — December 6th. Belgian State Railway authorities at La Salle Madeleine, Brussels. Rotary converter set and a switchboard at the signalling sub-station at Ghent-St. Pierre, and a switchboard at the signalling sub-station at Denderleeuw.

December 11th. Municipal Council of Schaerbeek, near Brussels. 1,100 dividing boxes, 100 junction boxes, and 1,000 5-amp. single-phase electricity meters. Specification from the Service de l'Electricité, Hôtel Communal, Schaerbeek.

Belgian Congo.—February 10th. Belgian Ministry of the Colonies, 20, Rue de Namur, Brussels. For system of distribution of electrical energy at Stanley Pool, Kasai, in the Belgian Congo.

Bolton-upon-Dearne.—December 21st. Dearne District Light Railways Committee. Construction and equipment of the Dearne District Light Railways.—Rails and fishplates; points and crossings; permanent way, road widenings, and bridge works; overhead line equipment; feeder cables; sub-station plant; rolling stock; buildings. (See this issue.)

Edinburgh.—December 4th. Electricity Supply Department. One 500-kW converting set. (November 17th.)

France.—Paris.—December 11th. Post and Telegraph Department. Supply of metallic filament lamps for one year. Service Central du Matériel des P.T.T., 75, Boulevard Boune, Paris.

Glasgow.—December 5th. Corporation. Electric lighting installation in connection with the Moss Park housing scheme. City Electrical Engineer, 75, Waterloo Street.

Headington, near Oxford.—December 9th. Board of Guardians. Installation of electric lighting in the infirmaries, &c. (November 24th.)

India.—January 9th. Great Indian and Peninsular Railway Co. Electrification of Bombay suburban lines: Electrical equipment of coaches, overhead equipment of permanent way, and overhead distribution lines. (November 17th.)

Leeds.—December 8th. Board of Guardians. Switchboard for private telephone installation at the Lodge of the Institutions, Beckett Street. Particulars from the Master of the Institution, J. H. Ford, clerk to Board of Guardians, Poor Law Offices, South Parade, Leeds.

London.—Barking.—December 19th. County of London Electric Supply Co., Ltd. Water-tube boilers for the Barking power station. (November 24th.)

Long Eaton.—December 11th. Electricity Department. Storage battery, 3-wire booster, switchboard, and steel platform. (See this issue.)

Manchester.—December 4th. Electricity Committee. Two 2,500-kW, one 1,500-kW, and one 1,000-kW rotary converters, with static transformers; or, alternatively, motor converters, with switchgear, l.p. transformer, &c. Four 500-kW automatically-controlled rotary converters and static transformers; or, alternatively, motor converters, complete with the necessary switchgear and full automatic equipment. (November 17th.)

New Zealand.—Wellington.—January 30th. Posts and Telegraph Department. 2,000 g.i. earth rods, 5 ft. x ¾ in.*

South Africa.—Malmesbury.—January 26th. Municipal Council. Electric lighting plant, including two 75-kW d.c. units, boilers, poles, battery, &c.*

St. Helier, Jersey.—Parish Assembly.—Concession for the establishment of an electricity undertaking to supply electrical energy for all public and private purposes within the Parish of St. Helier. (November 24th.)

Torquay.—December 18th. Electricity Committee. Two 400-kW rotary converters and one 300-kW rotary converter, complete with transformers, switchgear, and accessories. (See this issue.)

Warrington.—December 11th. Electricity and Tramways Department. Motors. (November 24th.)

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*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Sydney.—The City Council has reversed its previous decision, and has awarded the contract for the supply of meters to the Electricity Meter Manufacturing Co., of Sydney, the price being £42,000.—*Reuter's Trade Service (Sydney).*

According to the *Sydney Morning Herald*, the Sydney Corporation Electricity Supply Committee declined to consider a tender sent in for what were termed Swiss electricity meters, though the tender was the lowest, the aldermen fearing that the meters were of German manufacture (27s 8d., free of all duty and landing charges; the Customs duty on foreign meters is 45 per cent. and on British meters 35 per cent.). The cheapest British meter was that offered by Noyes Bros., at £1 13s. 4d. The Australian Meter Manufacturing Co. offered meters made in Sydney at 35s. each, or, as an alternative, at the cheapest price quoted for a meter landed in Sydney that complied with the terms of the City Council's specification.

Ald. Courtenay said that this local firm had been supplying the City Council satisfactorily for some years, and if it were driven out of business there would be no more local competition, and the City Council would have to pay much more for the next supply of meters. By four votes to two the Committee decided to recommend the City Council to purchase the meters from the local firm at the price of the British meters. The Council accepted the recommendation.

At a subsequent meeting of the City Council, says the *Sydney Daily Telegraph*, Messrs. Noyes Bros. protested against the acceptance of the alternative tender of the Electricity Meter Manufacturing Co. to supply 5,000 light meters "at the cheapest price quoted for any British meter," stating that their tender was the lowest, and the acceptance of the other tender eliminated fair competition. Mr. Forbes Mackay, general manager of the Electricity Supply Department, reported that the alternative offer should not have been considered. Although he wanted to see the manufacture of meters encouraged, such a precedent would keep good firms from tendering. This was, however, a special case, and it was not the Council's intention to make a practice of considering alternative tender offers.

Blackburn.—Accepted:—

Electric lighting installation at Savoy Picture Theatre, Bolton Road.—Mr. W. Fickup.

Edinburgh.—Corporation. Accepted:—

Fifty-six double-decked cars (£40,000).—Leeds Forge Co., Ltd. This was the lowest tender, others submitted ranging up to £58,000.

Government Contracts.—The following Government contracts were placed during October, 1922:—

Admiralty.—Contract and Purchase Department.

Electrically-driven air compressor.—Alley & MacLellan, Ltd.
Accumulator cells.—Fuller's United Electric Works, Ltd.
Electrodes.—Quasi Arc Co., Ltd.
Electrically-driven ice-making plant.—P. Brotherhood, Ltd.
Switchboard, complete with instruments.—Park Royal Eng. Works, Ltd.
Transformer and switchgear.—General Electric Co., Ltd.
Control valve panels.—MacTaggart, Scott & Co., Ltd.
Motor-driven circulating pumps.—Rees Roturbo Manufacturing Co., Ltd.

War Office.

Secondary batteries.—Pritchett & Gold and E.P.S. Co., Ltd.
Electric wire.—British Insulated & Helsby Cables, Ltd.

Crown Agents for the Colonies.

Batteries.—D.P. Battery Co., Ltd.
Porcelain insulators, &c.—Taylor, Tunnicliffe & Co., Ltd.
Telephone apparatus.—Western Electric Co., Ltd.
Telephone cable, &c.—Siemens Bros. & Co., Ltd.; Johnson & Phillips, Ltd.
Telephone material.—British L.M. Ericsson Manufacturing Co., Ltd.
Bronze line wire.—T. Bolton & Sons, Ltd.
Copper wire, &c.—Elliott's Metal Co., Ltd.
Wireless apparatus.—Radio Communication Co., Ltd.

Air Ministry.

Ammeters.—Johnson & Phillips, Ltd.
Batteries.—Siemens Bros., Ltd.
Generators.—W. Mackie & Co.; Evershed & Vignoles, Ltd., and Marconi's Wireless Telegraph Co., Ltd.
Modified T.F. receivers.—Muirhead & Co.
Wire spreaders.—McGruer Hollow Spar Co., Ltd.
Transformers.—W. Mackie & Co.
Transmitters.—H. W. Sullivan.
Transmitter spares.—C. A. Carter & Co., Ltd.
Valves.—General Electric Co., Ltd.; Mullard Radio Valve Co., Ltd.

Post Office.

Telegraph apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd. (Peel-Conner Telephone Works); Siemens Bros. & Co., Ltd.
Testing, protective apparatus, &c.—Phœnix Telephone & Electric Works, Ltd.
Submarine cable.—Telegraph Construction & Maintenance Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Cords for telephones.—General Electric Co., Ltd. (Peel-Conner Telephone Works); Siemens Telegraph & Electric Works, Ltd.; Western Electric Co., Ltd.
Duris [illegible] & Co., 1920, Ltd.
Steel pipes [illegible] Ltd.
Earth plates.—T. & W. [illegible] Ltd.
Insulated bronze wire [illegible] & Phillips, Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; Enfield Ediswan Cable Works, Ltd.; R. Johnson & Nephew, Ltd.; F. Johnson, Clapham & Morris, Ltd.; Pirelli-General Cable Works, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (Incorporated with the London Electric Wire Co. and Smiths, Ltd.); J. Wilkes, Son & Mapplebeck, Ltd.

Manufacture, drawing-in, and jointing cable (Manchester-Preston).—Western Electric Co., Ltd.
Rewinding generators (Mount Pleasant sub-station).—English Electric Co., Ltd.
Lifts (Dundee Post Office).—Marryat & Scott, Ltd.
Power plant (Marlborough telephonic repeater station, Taplow).—General Electric Co., Ltd. Sub-contractors for batteries.—Premier Accumulator Co., Ltd. For engines.—Ruston & Hornsby, Ltd.
Telephone exchange equipment (Liverpool (Royal)).—Western Electric Co., Ltd. Sub-contractors for batteries.—D.P. Battery Co., Ltd. For charging and ringing machines.—Crompton & Co.

Kent.—County Council. Accepted:—

Electric lighting and heating installation at the Lenham Sanatorium (£6,134).—Messrs. Cash, London.

London.—Battersea.—Electricity Undertaking Committee. Recommended:—

Two new cubicles, fitted with switches, for dealing with the linking-up mains and for a large coupler switch (£1,342).—General Electric Co., Ltd.

Leyton.—U.D.C. The Council is recommended to seal the following contracts:—

Turbine blading.—English Electric Co., Ltd.
Spare armature.—Lancashire Dynamo and Motor Co., Ltd.

Maidstone.—Board of Guardians. Accepted:—

Telephone installation at the Coxheath Institution.—Mr. Hedley Brown.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, December 2nd. At the Royal Technical Institute. At 6.30 p.m. Annual general meeting.

Institution of Electrical Engineers.—Informal meeting, Monday, December 4th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "An Electrical Installation at a Model Farm," to be opened by Mr. F. A. Sclater.

Thursday, December 7th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Possibilities of Transmission by Underground Cables at 100,000/150,000 V.," by Mr. A. M. Taylor.

(Students' Section).—Sunday, December 10th. At 3 p.m. Visit to the City & South London Railway reconstruction works.

(Western Centre).—Monday, December 4th. At the Public Library, Swansea. At 6 p.m. Mr. R. O. Kapp will read the late Dr. G. Kapp's paper on "Improvement of Power Factor."

Royal Society of Arts.—Monday, December 4th. At John Street, Adelphi, W.C. At 8 p.m. Cantor lecture, "Brown Coal and Lignites," by Prof. W. A. Bone, F.R.S.

Institute of Transport.—Monday, December 4th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Passenger Transport by Road in Rural Areas," by Mr. S. E. Garcke.

Electrical Society of Glasgow.—Tuesday, December 5th. Paper on "Industrial Illumination by Electrical Energy," by Mr. G. Herbert.

Greenock Association of Electrical Engineers.—Tuesday, December 5th. At 22, West Stewart Street. At 7.45 p.m. Lecture on "Wireless Telegraphy and Broadcasting," by Mr. A. P. M. Fleming.

Roentgen Society.—Tuesday, December 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Ordinary meeting.

Institution of Civil Engineers.—Tuesday, December 5th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "Strengthening of the Floor, &c., of the Forth Bridge," by Mr. W. A. Fraser.

Sheffield Electricity Inquiry.—Tuesday, December 5th. At the Town Hall, Sheffield. At 10.30 a.m. Resumption of Electricity Commissioners' North-East Midlands Electricity District Inquiry.

Northampton Engineering College Engineering Society.—Wednesday, December 6th. At the Northampton Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Oxy-Acetylene Welding," by Capt. D. Richardson.

Association of Consulting Engineers (Incorp.).—Wednesday, December 6th, At St. Stephen's Club, Westminster. At 7 p.m. for 7.30 p.m. Annual dinner.

Industrial League and Council.—Wednesday, December 6th. At Holborn Restaurant, W.C. At 5.15 p.m. Annual general meeting.

Institution of Railway Signal Engineers.—Wednesday, December 6th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 3.0 p.m. Paper on "Intermediate Block Signalling," by Mr. C. Carslake.

Chief Technical Assistants' Association.—Thursday, December 7th. Discussion on "Mercury Rectifiers," to be opened by Mr. H. F. J. Thompson.

Chelmsford Engineering Society.—Thursday, December 7th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Wireless and Aircraft," by Capt. P. P. Eckersley.

Edinburgh Electrical Society.—Friday, December 8th. At the Philosophical Institute. At 8 p.m. Paper on "Power Transmission," by Mr. T. Orr.

Physical Society of London.—Friday, December 8th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Institution of Heating and Ventilating Engineers.—Friday, December 8th. At the Engineers' Club, W.C. At 7 p.m. Paper on "Centrifugal Pumps as Applied to Heating Installations," by Prof. A. H. Barker.

Junior Institution of Engineers.—Friday, December 8th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "The Michell Thrust Bearing," by Mr. J. Ward.

Birmingham and District Electric Club.—Saturday, December 9th. At the Grand Hotel. At 7 p.m. General meeting.

Association of Mining Electrical Engineers (Lothians' Branch).—Saturday, December 9th. At Bathgate. Paper, "A User's Criticism of Design of Electrical Machinery for Collieries," by Mr. E. Cunningham.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following are asked for:—

Edolite electric torches.
Bowland daylight lamps.
Trumbull switches.

NOTES.

Railway Electrification.—The Cabinet Committee on Unemployment, of which Sir A. Griffith-Boscawen, Minister of Health, is chairman, met at the House of Commons on November 27th, and formulated proposals which were to be submitted to the Cabinet before being outlined in the House of Commons by the Government in the debate on unemployment yesterday, November 30th.

Work, not doles, is the guiding principle of the present committee, and the encouragement of schemes of work by local authorities and by big corporations, such as railway, electric power, tramway, and water development companies, forms an essential part of the new plans.

In this connection the railway managers were received by the Prime Minister on the 28th to discuss railway electrification and other schemes that would absorb some of the unemployed. Following this meeting Mr. McKenna, chairman of the London Joint City and Midland Bank, and a former Chancellor of the Exchequer, conferred with Mr. Bonar Law. It is understood that interest on the loans needed for putting in hand the work, which is estimated to cost in all between £50,000,000 and £60,000,000, will be guaranteed by the Government.

Electrification, plans for which have been long maturing, and much other necessary work on the trunk railways has been held up pending the amalgamations which come into force at the beginning of the New Year. The following railway schemes have been outlined :—

South-Eastern and Chatham.—Electrification of suburban lines. Scheme A deals with a 15 miles radius, and includes North Kent and Greenwich lines, Dartford loop, main line to Orpington and Bromley North, Crystal Palace and Greenwich Park branches, and Catford loop. This will be put in hand almost at once.

Scheme B, to follow, includes Stroud and outlying portions of the line to Tonbridge, Sevenoaks, and Catherham. Approximate cost of schemes, £5,000,000; 650 miles of track are involved.

London and Brighton.—Electrification of 300 track miles, including main line to Lewes and Brighton. Work in the northern area alone would give employment to 7,600 men for four years. Approximate cost of schemes, from £8,000,000 to £10,000,000.

Great Eastern.—Electrification of routes from Liverpool Street to Enfield, Palace Gates, Chingford, Loughton, Epping, Ongar, and Woolwich, with suburban sections of main lines to Broxbourne and Gidea Park.

London and South-Western.—Electrification of main line to Woking and Guildford, and two routes *via* Oxshott and Effingham Junction to Guildford.

Midland.—Electrification of London, Tilbury, and Southend line to Upminster, and eventually to Tilbury and Southend; also widenings and new lines in conjunction with the Great Eastern between Stepney and Gas Factory Junction.

North-Eastern.—Electrification of main line between York and Newcastle and associated sections.

Great Western.—Electrification of the eastern and western valley lines in Monmouthshire.

The Electrical Trades Benevolent Institution.—At the Festival Dinner on Wednesday last, Sir James Kemnal, presiding, announced that his appeal, together with the collection at the tables, had brought in £857 10s. 3d., making with the existing fund a total of £19,637. The guests numbered about 130.

International Electro-Technical Commission. — At the meetings of the I.E.C. Advisory Committees, which took place in Geneva from November 20th to 26th, a total of 58 delegates were present, representing eleven nations, including Germany, and the subjects dealt with are as follows: (1) rating of electrical machinery; (2) graphical symbols; (3) screw lamp-caps and holders; (4) standard pressures and regulations for overhead transmission. Mr. Roger T. Smith acted as chairman of the British delegation to the Advisory Committee on Rating. After four days' discussion it was agreed eventually to recommend all the National Committees of the I.E.C. to consider the acceptance of the 40 per cent. rating with overload as an additional international standard. We are also informed that good progress has been made in the work of the other advisory committees.

Blind Soldiers as Telephone Operators.—Universal as is the sympathy with the wonderful work accomplished by St. Dunstan's for the men of the Imperial Forces who lost their sight in the war, we are particularly impressed with the business-like lines upon which this organisation has always been conducted. It is St. Dunstan's proud boast that it has made "useful citizens again" of nearly 2,000 war-blinded men. May we direct the attention of employers to the way in which very practical help can be given to St. Dunstan's work at the present moment? Many of St. Dunstan's men have been specially trained as telephone operators, and have filled positions all over the country in this capacity with success. St. Dunstan's always endeavours to secure positions for its men as near their own homes as possible, and we are informed that Manchester, Liverpool, Bristol and London, are the areas in which it is at the moment desired to find positions for them. However, the Secretary of St. Dunstan's After-care Organisation, Inner Circle, Regent's Park, N.W.1., will give every information to firms which may be able to engage a blinded soldier as telephone operator, and thus show them that they are independent wage-earning citizens of the Empire for which they sacrificed so much.

Appointments Vacant.—Representative, capable of interviewing and advising prospective consumers regarding lighting, heating, and cooking (£230), for the Bristol Corporation Electricity Department; charge shift engineer for the Yorkshire Electric Power Co.; second distribution assistant and one installation assistant, for the Newport, Mon., Corporation Electricity Department. (See our advertisement pages to-day.)

"The Gas World"—2,000th Number.—On November 18th our esteemed contemporary *The Gas World* published a special issue to signalise the attainment of its 2,000th number—an achievement upon which we offer our sincere congratulations. The *Gas World* was first published on July 26th, 1884, at a time when there was little collaboration or communication between the gas undertakings; but that condition was gradually altered, largely by the influence of our contemporary. We are glad to express our appreciation of the fair-minded and public-spirited attitude which has always characterised the editorial conduct of the journal; though concerned with an industry which in some respects is in rivalry with that which we serve, it has always commanded our respect and esteem, and it has our best wishes for its continued prosperity and enhanced prestige.

The special issue, which is a remarkably large one, contains numerous portraits of past and present leaders of the industry, and special articles dealing with various aspects of the business and the progress made in 40 years, forming an admirable review of the "gas world" then and now.

The Society of Technical Engineers' Unemployment Insurance Scheme.—This scheme, which has recently been thrown open to the whole membership of the Society, is an extension of a limited scheme which has been in operation for a year in one of the largest branches, namely, Stretford. In this scheme, unlike the Government Insurance Scheme, unemployment benefit is paid not only on loss of salary due to dismissal, but also on loss of salary due to suspension on account of a trade dispute to which the members are not parties, and on partial or complete loss of salary due to absence from work on account of illness or accident.

The total period for which benefit may be paid is limited to 46 weeks; the amount of benefit being reduced to three-quarters of the original amount at the end of the 12th week of unemployment, and to one-half at the end of the twenty-fourth week.

Membership of the scheme is quite voluntary, but is limited to members of the S.T.E., and loss of membership of the S.T.E. entails withdrawal from the scheme. During the preliminary year's working (limited as has been stated to one branch of the Society) the membership was about 160.

Since the scheme was commenced in the middle of the trade depression last year, it was arranged that members of that branch who were already dismissed or under notice should receive benefit during the first six months of the scheme without any qualifying period whatever, so that in some cases members of the S.T.E. received unemployment benefit without having paid a penny into the unemployment funds.

Eleven claims in all were paid during this first year, of which seven were cases of dismissal due to reduction of staff, two were suspensions during the recent lock-out, and two were cases of loss of salary due to prolonged absence from work arising from accident and from illness respectively. The total amount paid out to these eleven members amounted to £362, in two cases payment being only necessary for one week, while the longest period of payment was 6½ months.

The total contributions during the period amounted to £858. Bank interest covered slightly more than the working expenses, so that the balance on the year's working amounted to £497. This balance forms the nucleus of the enlarged scheme for the whole society, the members of Stretford branch agreeing to this balance being applied to this purpose.

The funds of the scheme are quite separate from the funds of the Society of Technical Engineers, and the unemployment insurance scheme has its own trustees.

It should be emphasised that, unlike the Government Insurance Scheme, the only contributions to the funds of the scheme are from its members, and that no contributions are received either from the State or from the employer.

An Electric Totalisator.—The latest development of betting by means of the totalisator is a new electrical installation at the Ellerslie Racecourse, Auckland, New Zealand. It embodies recent improvements in the automatic type of machine, and has a registering capacity of 3,000 bets per minute.—*Daily Mail.*

Sheffield Electricity Inquiry.—The Electricity Commissioners' inquiry with respect to the North-East Midlands Electricity District will be resumed at the Town Hall, Sheffield, on December 5th at 10.30 a.m.

Dinner.—On Saturday last, members of the No. 7 Anti-Aircraft Searchlight Section of the London Electrical Engineers held their annual re-union dinner at the Holborn Restaurant. The following were present: Messrs. F. Childs, R. Collins, E. Moore, H. Thomas, H. Verey, A. W. Martin, E. McCarthy, J. Skeen, and H. Payn. A letter was read from Major H. G. G. Clarke regretting his inability to attend, owing to absence from London, but expressing his appreciation of the Section's work in France, both active and experimental, many of the Section's early experiments later becoming standard practice in the searchlight sections of the Royal Engineers.

Fatality.—On November 24th, Frank Brinkworth, a warehouseman, was killed by his coming into contact with a live rail at Dalston Junction. A train passed over his body before it could be taken from the line.

Lecture.—Mr. E. H. Whysall, M.I.E.E., burgh electrical engineer, Greenock, in a recent lecture to the Paisley Association of Electrical Engineers, dealt with the national aspect of electricity supply. Generally speaking, he said, we might be assured that all things were working together for the good of the electricity supply industry, and that the labours of the Electricity Commissioners were already bearing fruit. Both municipalities and companies had already shown signs of a development of a profitable sort of commercial broadmindedness that was very hopeful for the future. Greenock municipality, for instance, had entered into a contract with a sugar refining company to buy from it electrical energy generated by the steam raised from sugar refining. The proper thing, in his opinion, was for the supply authorities to come to an arrangement with all undertakings of this kind for the purchase of surplus energy.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—Informal Meetings Section.—At the informal meeting held on November 20th, Mr. W. E. Warrilow was in the chair, when Mr. F. J. Pearce opened a discussion on "Electric Light Wiring." He divided his paper into two parts; in the first he reviewed the various systems of wiring that have been in practice and criticised them in detail. In the second switch fittings provided for the more trying conditions such with. He explained the peculiar requirements of installations under these conditions; he did not think the lighting and switch fittings provided for the more trying conditions such as acid and fume-laden atmospheres were as yet all that was required, and suggested improvements, but he gave general approval to a screwed-metal-sheathed cable with heavy brass fittings. The paper was followed by an animated discussion, but no striking improvements were suggested. Some 21 speakers took part in the discussion.

A.M.I.E.E. Examination Results.—The list of successful candidates who sat for the A.M.I.E.E. examination in October, 1922, contains the names of 20 candidates who passed the whole of the examination; five passed Part II only, and two passed Part I only. The list also shows that 67 officers of the Corps of Royal Engineers successfully passed the examination. Results relating to candidates who sat for the examination abroad are to be published later.

Dinner.—Arrangements have been made for members of the Institution to dine together at the Engineers' Club after the ordinary meeting of the Institution to be held on December 7th. The charge per cover will be 5s. 6d. Members wishing to be present at the dinner are requested to send their names to the secretary in advance, either in writing or by telephone.

South-Midland Territorial Centre.—*Annual Dinner.*—On Friday last the annual dinner of the South-Midland Centre was held at the Grand Hotel, Birmingham. Prof. W. Cramp, D.Sc., chairman of the Centre, presided, and there was an exceptionally large attendance, considerably exceeding 200 guests.

Proposing the "Institution of Electrical Engineers," Mr. W. Grant Robinson, M.A., C.V.O., principal of Birmingham University, referred to the importance of the Institution, whose functions were to elevate the status of the profession, to improve the education and training of electrical engineers, and to promote research. The University was profoundly interested in the second and third of these functions; it was promoting research as fully as possible, and recently one of its members, Dr. Aston, had been honoured by the award of one of the Nobel prizes in recognition of his discoveries. Thanks were due to the General Electric Co. for its donation to research in the electrical department. It was the first University to establish a professorial chair in electrical engineering, and would cordially co-operate with the Institution in advancing the interests of that science.

Mr. Frank Gill, O.B.E., president I.E.E., in responding, bore witness to the high esteem in which British scientists were held in the United States, which he had recently visited. The Institution, he said, existed to promote the general advance of electrical science, and he laid special emphasis on the duty of each member to consider what he could do towards that end, rather than what he could get out of the Institution. They should read papers and discuss them, and subscribe for *Science Abstracts*. The Territorial Centres had abundantly demonstrated their usefulness; but London was obviously the right place for the headquarters. The Board of Education had invited the assistance of the Institution in organising a scheme of technical education for the whole country, and he asked the members to help in that work with suggestions and in other ways. For instance, they could afford opportunities for University students to work in their workshops during the vacations. Service to others was the highest motive to which men responded.

Proposing "The City of Birmingham and Electricity Supply," Mr. Austen Chamberlain, M.P., quoted history to show that the present depression was but a repetition of past experience, and as on previous occasions, prosperity would be restored by new industrial developments, for which he looked to the electrical profession. Electricity would play an immense part in the revival and reconstruction of the country, but they should bear in mind that whilst they were electricians they were also citizens, and they should do their duty in that capacity; let them not be so wrapped up in their important work that they had no time to help in guiding their country through these difficult times.

The Lord Mayor, Ald. David Davies, J.P., responded, and eulogising the spirit of those who devoted their lives to public service in Birmingham, he stated that the City had invested four millions sterling in electricity supply, and was determined to meet every demand for power that was made upon it.

Prof. Cramp proposed "Kindred Societies and Guests," and took the opportunity to advocate co-operation and affiliation between the engineering associations. There were too many societies, and he appealed to them to come together.

Mr. Neville Chamberlain, M.P., H.M. Postmaster-General, responded, remarking that no Government department owed so much to the electrical industry as the Post Office. The prosperity of that department depended upon the trade of the country, and he would see that it was not conducted in such a way as to check the development of industry and commerce.

Mr. R. A. Chattock, City electrical engineer, Birmingham, proposed "Electrical Industry," which was going to rejuvenate the world. Electricity supply was a barometer of the country's trade, and the enormous amount of power now taken by manufacturers at industrial centres was an indication of the progress that was being made. In Birmingham during the past three quarters the demand had increased at the rate of 7, 30 and 39 per cent. respectively compared with the previous year, and was till growing. The idea put forward in Mr. Gill's presidential address was taking shape, as a conference was to be held to deal with international telephony.

Mr. Hugo Hirst, chairman of the General Electric Co., responded, claiming that industry was the foundation of all civilisation; it had suffered a severe dislocation, but the worst was over, and business was moving again. If they worked hard, prosperity would soon return. Cheap and efficient transport and communication were prime essentials to progress. Some years ago his company had searched the country for an ideal place to start new works, and found Birmingham the best; now a thriving community had grown up where twenty years ago was a waste, and young engineers stationed all over the world were sending orders home to Birmingham.

A programme of music was performed during the dinner, and the arrangements were thoroughly successful in every way.

Liverpool Sub-Centre.—Professor Miles Walker, D.Sc., read the late Dr. Kapp's paper before the Sub-Centre on November 27th. A very interesting discussion followed the reading of the paper, the following taking part:—Messrs. Hollingsworth, Breach, Higham, Teago, Houghton, Midgly, and Dr. Marchant, Messrs. Prescott, Rettie, and Malpas, and a written contribution from Dr. Wall was read.

Institute of Metals.—The Institute has published an index to the first 25 volumes of its *Journal*. A special offer is made to students as an inducement to join the Institute. Very favourable terms have been arranged for student members, and particulars can be obtained from the Secretary, Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W.1.

Association of Mining Electrical Engineers.—"The Efficient Control of Super-Power Stations, with Special Reference to Heat Balance," was the subject of a paper read by Mr. John Bruce, testing engineer, Glasgow Corporation Electricity Department, to the members of the local branch of the Association of Mining Electrical Engineers at Glasgow on November 18th. The paper dealt with the distribution and destination of the heat units liberated by the combustion of coal. It was thought that with the extended use of oil fuel during the last coal miners' strike many undertakings would be able to supply reliable data concerning the results obtained with that fuel, but the time was too short for conclusive results to be arrived at, as, owing to the very high cost of oil, users were glad to go back to the comparatively cheap coal fuel. After describing the various available methods of furnishing auxiliary power, and at the same time controlling the heat balance, Mr. Bruce said that the results at Dalmarnock compared very favourably with those obtained in super-power station practice in America. Operating figures for similar stations in this country were difficult to obtain, the designers and engineers concerned being ex-

ceptionally conservative in the matter of making public results so far obtained. The figures revealed the efficiencies of the numerous stages between the coal and units generated. —*Glasgow Herald.*

Edinburgh Electrical Society.—On November 24th, Mr. James Walker, A.M.I.E.E., read a paper on "Overhead Transmission," in which he dealt with the survey and lay-out of overhead lines. He described the types of poles, the considerations which affected their selection, and the methods adopted in erection. The line accessories, insulators, guys, arresters, and isolating links, were illustrated. The importance of efficient leading-in and earthing appliances was emphasised. Numerous diagrams and lantern slides were shown.

Chelmsford Engineering Society.—On November 23rd, Mr. W. B. Statham, M.Inst.C.E., read a paper entitled "Industrial Refrigeration and Ice Making." The president (Capt. H. Riall Sankey, C.B.) occupied the chair. The lecturer dealt with machines using ammonia gas, carbonic acid gas, and sulphurous acid, and said that the first was the most extensively used, as the least power was required per ton of ice. There was a great advantage also in the fact that leakage from the ammonia plant could not fail to be detected. The lecture was illustrated with lantern slides showing various kinds of refrigerating and ice-making plant.

Finsbury Technical College Old Students' Association.—Manchester Section.—The second annual general meeting and smoking concert was held on November 24th, at the Grand Hotel, Manchester, Mr. A. P. M. Fleming, C.B.E., the chairman, presiding. A very good attendance was recorded and an excellent programme contributed to the enjoyment of a thoroughly successful meeting. A walk is being arranged early in the New Year and the annual dinner will take place in February. Any old Finsbury students in the Manchester district, desirous of joining should write to the Local Secretary, H. F. Coucher, 74, Victoria Road, Stratford.

Faraday Society.—At the annual general meeting, held on November 20th, the following officers and council were elected to serve for the year 1922-1923:—*President*, Sir Robert Robertson, K.B.E., F.R.S.; *Vice-presidents*, Professor C. H. Desch, Professor F. G. Donnan, C.B.E., F.R.S., Dr. J. A. Harker, F.R.S., Professor T. N. Lowry, C.B.E., F.R.S., W. Murray Morrison, Professor J. R. Partington, Dr. G. Senter; *Treasurer*, Robert L. Mond; *Council*, W. R. Bousfield, K.C., F.R.S., Cosmo Johns, Dr. R. Lessing, Professor W. C. McC. Lewis, Professor J. W. McBain, Dr. H. Moore, C. C. Paterson, Dr. J. N. Pring, Professor A. O. Rankine, Dr. E. K. Rideal.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

The Portrush Urban Council received 34 applications for the post of manager of the electricity supply works, rendered vacant by the resignation of Mr. Greene. Seven applicants were chosen for the short list, and in the result Mr. O. W. P. Elliott, Donaghadee, was appointed.

Mr. George D. Killey, J.P., has been appointed chairman of the Directors of the Liverpool Overhead Railway Co., in place of the late Mr. Harvey C. Woodward, J.P.

Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, whose comments on the electrical position in New Zealand we were able to publish in our last issue, has been appointed Senior Trade Commissioner in Canada, in succession to Mr. G. T. Milne, who retires in February.

According to *The Times*, Mr. W. Murray Wilson has been appointed chairman of the La Plata Electric Tramways Co., and Mr. John Adams and Major G. O. S. Pringle directors.

At the Redditch U.D.C. Electricity Works, last week, Mr. R. N. Mayne, the chief engineer and manager, was the recipient of a solid silver inkstand and pair of candlesticks on the occasion of his marriage. Mr. V. F. Bush, chief assistant electrical engineer, made the presentation in the presence of a large gathering of staff and employés.

Mr. H. Stanley Deacon, the managing director of Cryselco, Ltd., is retiring at the close of the year. He has been associated with the company since its inception in 1895, in the old carbon lamp days, and was chairman of the British Carbon Lamp Association prior to the advent of the tungsten filament lamp. He has been personally responsible for the policy of the company for many years, and has successfully steered the business through many difficulties which have assailed the lamp industry. He is a Justice of the Peace for the County of Bedford, a member of the County Council, and chairman of the House Committee of the County Hospital, and intends to devote himself to public work.

The Secretary for Mines has appointed Lt.-Colonel R. A. Thomas, C.B.E., R.A., one of H.M. Inspectors of Explosives, to be an additional member of the Explosives in Mines Research Committee which was recently appointed to inquire into the causes of, and the means of preventing the ignition of firedamp and coal dust by the firing of permitted explosives.

As was briefly announced in our last issue, Sir Philip Nash, K.C.M.G., C.B., managing director of the Leeds Forge Co., Ltd., has been appointed chairman of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, in



Photo by [*Vandyk*

Sir Philip Nash,

Who succeeds Mr. Annan Bryce as Chairman of the Metropolitan-Vickers Electrical Co., Ltd.

succession to Mr. J. Annan Bryce, who has retired owing to ill-health. Sir Philip Nash, who was director-general of the traffic branch of the Ministry of Transport up to the time he joined the Leeds Forge Co., Ltd., is a mechanical engineer. He commenced his railway career in 1887 at the Great Northern Railway Co.'s locomotive works, Doncaster, and two years later he entered the service of the East Indian Railway in the locomotive department, being appointed assistant general manager in 1911. In March, 1915, Sir Philip Nash returned to this country, and in the autumn of 1915 was appointed director of the National Filling Factories in the Ministry of Munitions. In the summer of the following year he accompanied Sir Eric Geddes to France to inquire into military transportation in October of that year, and succeeded Sir Eric Geddes as Director-General of Transportation in the following May. Sir Philip Nash became Inspector-General of Transportation of the whole British front on the Continent in March, 1918, and British representative on the Inter-Allied Transportation Council. Sir Philip, who is an officer of St. Maurice and St. Lazarus, Commander of the Legion of Honour, Commander of the Order of Leopold, Grand Officer of the Order of the Crown of Italy, and has the American Distinguished Service Medal, retains his position with the Leeds Forge Co., Ltd.

St. Pancras Borough Council Electricity Committee has appointed Ald. J. H. Mitchell chairman, and Councillor S. Bolsom deputy chairman, for the ensuing year.

Ald. T. A. Beckett has been appointed chairman, and Councillor E. R. Armfield vice-chairman of Fulham Borough Council Electricity Committee.

The Consolidated Pneumatic Tool Co., Ltd., has appointed Capt. Conroys C. Walcott, R.N. (Ret.), as its district manager for the Bombay territory. He is on his way out to take up his duties in the place of Mr. Rowland Jones, late district manager, who has unfortunately been ordered home owing to ill-health, and has had to relinquish his post.

Mr. J. D. Jones was the recipient of a suit case, subscribed for by the staff, on leaving Messrs. Sandycroft, Ltd., to take up a position with the English Electric Co., Ltd., in London. The presentation was made by Mr. J. E. Davies (chief of the department).

Preston Corporation Electricity Committee recommends that the appointment of Mr. J. F. Simpson be varied by his release from the duties of tramways engineer, and that he devote the whole of his time to the duties of borough electrical engineer, at a salary of £600, with bonus.

Obituary.—Mr. J. C. Griffiths.—*The Times* records the death of Mr. J. C. Griffiths, C.V.O., late president of the Institute of Chartered Accountants, who was engaged on behalf of the Electric and International Co. when the Government took over the telegraphs in Great Britain. He acted as advisory accountant, it is said, to most of the telegraph cable companies and was a director of the Western Telegraph Co. Mr. Griffiths was born in 1845.

Mr. A. Churchill.—The death is announced of Mr. A. Churchill, who was for 27 years on the engineering staff of the County of London Electric Supply Co., Ltd., by whom he was much appreciated and held in the highest esteem.

Will.—The late Mr. W. F. Hamilton, K.C., who was a director of the Anglo-Argentine Tramway Co., and many other concerns, left £24,183 gross, and £22,762 net personalty.

NEW COMPANIES REGISTERED.

Marshall Electrical Co., Ltd. (185,795).—Private company. Registered November 17th. Capital, £3,000 in £1 shares (2,300 5 per cent. cum. pref. and 700 ord.). To acquire the business carried on at 50, Marshall Street, W., as the "Marshall Electrical Co.," and to adopt an agreement with W. N. Ibbotson, G. Marr, and Mary A. Bancroft, and to carry on the business of electricians, electrical and mechanical engineers, &c. The directors are:—R. W. L. A. Ham, 24, The Parade, Golders Green, N.W., civil engineer (chairman); W. N. Ibbotson, 50, Marshall Street, W., electrical accessories manufacturer. Registered office: 50, Marshall Street, W.1.

G. F. Barrington & Co., Ltd. (185,816).—Private company. Registered November 17th. Capital, £500 in £1 shares. To adopt an agreement with G. F. Barrington and to carry on the business of manufacturers of, and dealers in all wireless apparatus, electrical appliances, dials, scales, rules, name plates, engineers' tools and machinery, &c. The subscribers (each with one share) are:—A. Gowell, 94, Holland Park Avenue, W.11, contractor; G. F. Barrington, 7, Clifton Road, Twickenham, engineer. C. Raggett signs as director. Registered office: 30, Red Lion Square, Holborn, W.C.1.

Luminograph Co., Ltd. (185,849).—Private company. Registered November 20th. Capital £1,000 in £1 shares. To carry on the business of proprietors and managers of luminous or electric advertisement signs, "tableau" advertisements, and other contrivances, &c. The first directors are: Tomaso Nattero, 11, Via Cesare Cabello, Genoa, merchant; Guglielmo Nattero, 53a, Shaftesbury Avenue, W.1, advertising agent. Secretary: T. Guist. Registered office: 53a, Shaftesbury Avenue, W.1.

Oxford Wireless Telephony Co., Ltd. (185,879).—Private company. Registered November 21st. Capital, £1,500 in £1 shares. To adopt an agreement with H. Lawley and A. H. Shirley, and to carry on the business of a wireless telephone and telegraph company. The first directors are: H. J. Bradley, 290, Iffley Road, Oxford; J. K. Wilkins, 4, Chalfont Road, Oxford; H. J. Butterfield, 286, Iffley Road, Oxford; H. Lawley, 25, Farndon Road, Oxford; A. H. Shirley, 13, Water Eaton Road, Oxford. Qualification: 1 share. Secretary: H. Lawley. Registered office: 22, Queen Street, Oxford.

Native Lamp Co., Ltd. (185,944).—Private company. Registered November 23rd. Capital, £100 in £1 shares. To adopt an agreement with the General Assets Realisation Co., Ltd., and to carry on the business of manufacturers of and dealers in all kinds of electric lamps and accessories, &c. The first directors are: Mrs. E. Brown, Burwood, Longford Avenue, Stretford, Manchester; J. H. Catlow, 10, Park Row, Leeds, solicitor. Secretary: J. H. Fawcett. Registered office: 10, Park Row, Leeds.

Western Wireless Telephones, Ltd. (185,948).—Private company. Registered November 23rd. Capital, £1,000 in £1 shares (750 ordinary and 250 6 per cent. preference). To take over the business of wireless manufacturers and agents carried on by Colley, Marriott & Co., Ltd., at 15, Cheapside, Liverpool. The permanent directors are: E. Emmerson, 39, Ravenswood Avenue, Rock Ferry, Cheshire; A. H. Colley, Bungalow, Plymdale Estate, Bromborough, Cheshire. Qualification: £25. Remuneration as fixed by the company. Secretary: A. H. Colley. Registered office: 41, North John Street, Liverpool.

Wilton Wireless Co., Ltd. (185,892).—Private company. Registered November 21st. Capital, £800 in £1 shares. To carry on the business of manufacturers of and dealers in wireless, telegraphic and telephonic apparatus, goods and appliances, electrical apparatus and accessories, &c. The first directors are: G. H. Moody, 134, Coteford Street, Tooting, S.W.17, wireless engineer; A. J. Oakham, 16, King's Road, Tottenham, N., accountant; W. J. A. Hale, 40, Park Road, Hampton Wick, merchant. Qualification: 10 shares. Solicitors: W. I. Thomas, 33, Chancery Lane, W.C.2.

3B Telephone Manufacturing Co., Ltd. (185,831).—Registered November 18th. Capital, £20,000 in 1s. shares. To carry on the business of mechanical and electrical engineers, manufacturers of and dealers in apparatus and devices for use in connection with telegraphy and telephony with or without wires, &c. The first directors are: Edith M. Russell, 8 and 9, Stephen's Buildings, Gresse Street, Rathbone Place, W.; Elizabeth J. Bedingfield, 8 and 9, Stephen's Buildings, Gresse Street, Rathbone Place, W. Minimum cash subscription, 7 shares. Qualification (except first directors): £20. Registered office: 14, South Hill Park, Hampstead, N.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

United Kingdom Lighting Trust, Ltd.—A. N. Harper, of Austen Friars House, E.C., was appointed receiver on November 13th, 1922, under powers contained in debentures dated November 12th, 1919.

Lighting, Heating and Power Installation Co., Ltd.—F. S. Burman, of 29, Princess Street, Manchester, was appointed receiver on November 10th, under powers contained in debentures dated June 27th, 1922.

James Keith & Blackman Co., Ltd.—(a) Issue on November 11th, 1922, of £1,600 debentures—part of a series; and (b) satisfaction in full on November 11th, 1922, of first debentures dated December 5th, 1902, September 17th, 1912, and January 6th, 1913, securing £1,500.

Electromobile, Ltd.—Mortgage on certain land and premises in Derby, dated November 3rd, 1922, to secure all moneys due or to become due from company to Bank of Liverpool and Martins not exceeding £1,800.

Exceloid Co., Ltd.—Particulars filed of £200 debentures authorised September 30th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Lloyd & Ramsden, Ltd.—Particulars filed of £500 debentures authorised October 18th, 1922, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £250.

Pryco, Ltd.—Particulars filed of £1,000 debentures authorised October 30th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £700.

Willesden Electric, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital dated November 16th, 1922, to secure all moneys due or to become due from the company to Lloyd's Bank not exceeding £4,000.

Ozonair, Ltd.—(a) Satisfaction in full on November 17th, 1922, of debenture and second debenture dated June 5th, 1915, and May 9th, 1919, securing £4,000 and £1,000 respectively. (b) Particulars filed of £8,000 debentures authorised June 12th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital (if any), the amount of the present issue being £1,500.

CITY NOTES.

Mexican Light and Power Co.

In the first annual report since 1913, the managing director states that the net earnings since 1917 were:—1917, $5,918,508; 1918, $6,094,461; 1919, $6,698,947; 1920, $7,316,572; and 1921 (after allowing $1,000,000 for depreciation), $3,917,325. The set-back during 1921 is attributable to the failure of the water supply. The balance-sheet as at December 31st, 1921, shows under liabilities:—Accrued bond interest, $5,676,923; accounts payable and accrued charges, $1,220,168; general reserve for depreciation, amortisation of franchises, and other assets, $7,000,547; and profit and loss account, $467,716. On the asset side the capital account stands at a total of $68,134,496, floating assets (including securities at market value $2,155,292, and cash $749,835) amount to $4,885,057, and accounts due by Mexican Governments at face value are shown at $3,240,827.—*The Times.*

Amazon Telegraph Co., Ltd.

For the year ended June 30th, 1922, the gross revenue amounted to £57,308, and the working expenses to £40,233. After providing £5,844 for income tax, £9,702 for debenture interest, £13,145 for the sinking fund, and bringing in the balance of £5,790 brought forward, it has been necessary to transfer £6,000 from the general reserve account to meet the deficit, and there will then remain £173 to be carried forward. Trade on the Amazon has, unfortunately, not shown any improvement during the year. The company's receipts have decreased by a further £5,214, and the directors are again unable to recommend the payment of a dividend. The average rate of exchange for the year was 7½d. per milreis, compared with 10½d. for the previous year.

Mexico Tramways Co.

The report to December 31st, 1921, states that the last report was issued in 1914. At that time conditions in Mexico had become very disturbed; they soon grew much worse, and the tramway undertaking was seized by the Government, who continued to operate it and take earnings until May, 1919, when the property was returned to the company in a very run-down condition. Since May, 1921, fair progress has been made in rehabilitation of property, and although the estimate of earnings has not been completely realised, operating receipts have been reasonably satisfactory, and to-day the company is, owing to arrangement made with its bondholders, in a safe financial position, with an adequate reserve fund to meet rehabilitation and other expenses. Current interest on first mortgage bonds is being paid regularly, and it is hoped that payment of arrears of interest on first mortgaged bonds can be begun at no distant date. With reference to the seizure of the tramways property by the Mexican Government, a large claim for damages has been filed with the Government, and although no arrangement has yet been reached, it is hoped that ultimately a satisfactory settlement will be arrived at. This may have an important bearing upon arrears of interest on first and second mortgage bonds of the company, for if a substantial sum in cash should be realised the time at which these arrears could be paid could be materially advanced. The directors take this opportunity of acknowledging the fact that, during more recent labour troubles, effective protection, under instructions of the President of Mexico, was given to the company in its endeavours to maintain a proper service of tramways. Another matter which has caused the board considerable anxiety is

what is known as "jitney competition." Jitneys are either small automobiles or small 'buses formed by placing a light body upon a cheap motor chassis, many hundreds of which are operating in Mexico City. Steps are being taken to deal more effectively with this competition, which is a serious matter for the Tramways Co.—*Financial Times.*

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be officially quoted :—

Shropshire, Worcestershire, and Staffordshire Electric Power £50,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 450,001 to 600,000. (Special application.)

Dealings in the following securities have been specially allowed by the Committee under Rule 159 :—

River Plate Electricity Co., Ltd.—£120 ordinary stock.

The undermentioned have been ordered to be officially quoted :—

Calcutta Electric Supply Corporation.—125,000 ordinary shares of £1 each, fully paid, Nos. 800,001 to 925,000.

River Plate Electricity Co.—£49,573 ordinary stock.

Manx Electric Railway.—The accounts for the year ended September 30th, 1922, show that the gross receipts amount to £64,962 and the expenditure to £40,504, leaving a net profit of £24,457 (compared with £18,081), plus £915 brought forward, making £25,373. Interest on debenture stock, £8,851; interest on second mortgage debentures, £2,025; and first mortgage debenture stock sinking fund, £1,000, leaving £13,497. Preference dividends of 5½ per cent. for the year ended September 30th, 1917, and of 4 per cent. on account of 1918 are paid, leaving £1,128 to be carried forward. The ratio of working expenses to receipts was 62.35 per cent., compared with 70.21 per cent. in the previous year.

Isle of Thanet Tramways & Lighting Co., Ltd.—Total receipts for the year ended September 30th, 1922, were £112,561, against £105,628 in the previous year. Net profit £41,814, against £31,448. Balance available £35,642. The directors propose placing to reserve £10,000 (increasing reserve to £30,000), to credit of permanent way reserve £7,366, to credit of rolling stock reserve £5,000; to write off £1,787 from cost of motor vehicles; and to pay nine months' dividend on preference shares, from July 8th, 1908, to April 8th, 1909, being 3s. 9d. per share; £5,863 being carried forward.

Norwich Electric Tramways Co.—The annual report on working up to June 30th, 1922, shows total receipts £86,147, an increase of £6,332, and total expenditure £72,753, a decrease of £3,127, leaving a net profit of £13,394, which is an increase over the previous year of £9,460. £5,280 is appropriated in payment of a 2 per cent. dividend, subject to income tax; £8,000 is put to reserve account; and £114 is to be carried forward. Car miles run, 1,000,402; passengers carried, 11,857,956; earnings per car mile, 20.67d.; expenses per car mile, 16.82d.; earnings per passenger, 1.72d.

Manila Electric Corporation.—According to the Financial Press, the directors have authorised a distribution of 20 per cent. of common stock to holders of record on December 20th, 1922. The $1,000,000 of stock held in trust for the corporation is to be used for this distribution. A special meeting is to be called forthwith to increase the authorised capital from $6,000,000 to $10,000,000, and if this is approved it is planned that $1,000,000 of common stock will be distributed at an early date. It is expected that the 8 per cent. dividend rate will be maintained on all stock.

Newcastle and District Electric Lighting Co., Ltd.—According to the *Financial Times*, this company has resolved to create £100,000 6½ per cent. third mortgage debentures repayable in 15 years, to enable it to meet the increasing demand for energy. It is proposed to issue £60,000 at present in multiples of £100, and this issue will involve the conversion or repayment of the existing third mortgage debentures amounting to £29,400.

German Capital Increases.—The following augmentations of capital have now been decided upon: Berlin Electrical Undertakings Co., 150,000,000 marks in ordinary shares; Berlin Electric Light & Power Investment Co., 110,000,000 marks in ordinary and preference shares; and the Lorenz Co., 65,000,000 marks in ordinary and preference shares.

An Austrian Dividend.—The Austrian Brown, Boveri Co. reports net profits of 371.62 millions of crowns for 1921-22 and a dividend at the rate of 150 per cent. These figures compare with 8.82 millions and 20 per cent. respectively in the preceding year.

French Thomson-Houston Co.—It is stated that the directors of the Compagnie Thomson-Houston have decided to convene a meeting of the shareholders to authorise an increase in the share capital by one or several issues up to 300,000,000 fr.

National Telewriter Co., Ltd.—The profit for the year ended June, 1922, was £978, increasing the credit balance carried forward to £2,168.

Electric Supply Corporation, Ltd.—Interim dividend at the rate of 6 per cent. per annum, less tax, for the half-year ended June last.

Castner-Kellner Alkali Co., Ltd.—Final dividend of 12 per cent., making 20 per cent. for the year.

Globe Telegraph & Trust Co., Ltd.—Quarterly interim dividend of 5s. per share on the ordinary shares.

Western Telegraph Co., Ltd.—First quarterly dividend of 5s. per share, free of tax, being at the rate of 10 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening

Stock Exchange markets pursue a placid, not to say a rather dull course. One of the features this week is the appearance of an unusual number of new issues, the promoting houses evidently being wishful to get their ventures launched before the advent of the Christmas season shall act as a further check to investment and speculative enterprise. Most of the newcomers possess a good deal of attraction, as, indeed, it is necessary to give them this in order to secure a favourable reception from the public. Existing securities maintain their prices tolerably well, and the release of the half-yearly interest payments on the 5 per cent. War Loan at the end of this week should have the effect of strengthening the securities in the gilt-edged market, and those which depend upon them.

It is interesting to notice that the 4½ per cent. debenture stocks of the three Tube railway companies are being absorbed in such a manner as to leave comparatively little supply now available. In view of the Government's desire to provide employment during the winter, and the meeting of railway managers called by the Prime Minister, it is expected that electrification and railway work of all kinds will shortly be undertaken, upon a large scale, throughout the country. This would mean fresh issues of stock on lines similar to those adopted by the Central London, City & South London and London Electric railways, so that the investor is not likely to lose the chance of acquiring Government-guaranteed stock at reasonable figures.

The electric railway market is a good one, a feature being the strength of Districts. The price rose 3 to 46½ before any reaction occurred. It is said that people are taking their substantial profits on Metropolitan Consolidated, the price of which is up to 60, and utilising the proceeds for the purchase of Districts. This is likely enough, although the supporters of Metropolitans maintain that the price is likely to go to 70. It is rather curious to notice that Districts at the present price pay little more than 2 per cent. on the money on the basis, of course, of the last declared dividend. Underground Electrics are a little dull; East London remains steady at its improved price of 5.

It is more or less an open secret that the electrification of the South-Eastern Railway will be undertaken by the London Electric Supply Corporation, but the price of Londons has eased off to £3. Those who have followed with any close degree of attention the London company's experience with its Brighton Railway contract may be excused for asking whether the South-Eastern work is likely to bring much more profit than that which has rewarded the company's enterprise in carrying out its Brighton contract. The London Company has for some time past been rather the Cinderella of the group, both as regards dividends and the price of its shares.

The Eastern cable stocks remain on the dull side, and the annual report of the Western Telegraph Co. gives pause to those who were prospective buyers of the securities in this group. For the period just ended, the Western Telegraph Co. took £1,680,000, which is £320,000 less than in the previous year, and a million less than that for the 1919-20 period. Expenses last year were reduced, but in smaller proportion, and the net profit of £447,500 shows a decline of about £160,000 over that of the previous twelve months. The dividend is held at 10 per cent., free of tax, but allocations to reserves, &c., are on a more modest scale than those of a year ago. Westerns, Eastern Extensions and Globe Preference are all down about ½. Eastern Telegraph ordinary at 188 is 2 points lower. Marconis eased off to 2¼, and the wireless group is somewhat dull, the company's recently issued debenture being 3 premium. Chadburn's (Ship) Telegraph announces a gross profit of £62,600 for the last two years, and the net profit of £18,700 is £4,000 better than that of the preceding two years.

Electricity supply shares, with the exception of Londons, are good throughout. The feature is a rise of 15s. in Brompton ordinary, to £10 per share, in consequence of the proposal to distribute bonus shares, to which reference has already been made here. City of London ordinary rose to 2¼, on confident anticipations that the dividend of 14 per cent. will be increased. Chelseas and Kensingtons are both higher. South Londons have changed hands as high as 91s. Edmundsons improved to 38s. 9d. There is a strong tone about the market as a whole, and proprietors are not selling except where they are obliged to do so.

Anglo-Argentine Tramways first preference hardened to 3⅜ and the second preference hold their improvement at 3⅛. There are vague hints as to the possibility of a scheme being formulated in the near future whereby the second preference will receive some kind of scrip by way of clearing-off the arrears of dividend on these shares. Some people may object to the back dividends being met in this way, but it is worth

pointing out that for the company to make a show of prosperity at a time when Socialistic tendencies are rife in the Argentine Republic, might lead to a demand for lower fares and for other facilities. British Columbia Electric stocks exhibit marked strength, the deferred being 4 points higher at 86½ and the 4½ per cent. debenture stock at 80 showing a similar advance.

Improvement also characterises the list of Mexican Utility issues, the particular feature being a jump of 8½ points in Mexico Tramway 6 per cent. bonds, which has carried the price to 55½. The company's first mortgage debentures are 5½ higher at 81½. Mexican Light and Power common and preferred shares have begun to participate in the strength shown by the Mexico Tramways issues. The companies have recently issued reports, giving figures and information which certainly suggest that, with a more settled government in Mexico, there should be no difficulty in restoring both concerns to profitable conditions. Brazilian Tractions went back to 50.

Babcock & Wilcox gained half-a-crown at 3⅜, but, apart from this, there is no particular movement to be noted amongst manufacturing shares. General Electrics eased off to 17s. Callenders at 2½ are 1/16 down. Siemens stick at 21s. 3d., at which price, however, there are buyers in the market. British Aluminium ordinary remain heavy. The price of rubber, the produce, strengthened to 1s. 1½d. per lb. without bringing about any particular increase in the volume of business transacted in rubber shares. The market keeps firm, but having regard to the substantial rise in prices which took place when the commodity started to improve, it is not surprising that speculative investors should refrain from venturing into the market.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Nov. 28. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	10	+ ½	£6 0 0
Charing Cross Ordinary	8	9	7¾		5 16 2
do. do. do. 4½ Pref.	4½	4½	4		5 12 6
Chelsea	6	6	6¾	+ ¼	4 9 0
City of London	14	14	28	+ ⅛	6 11 9
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1½	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1¼		5 4 4
Kensington Ordinary	9	10	7⅜	+ ⅛	6 7 0
London Electric	2½	4	3		4 0 0
do. do. 6 per cent. Pref.	6	6	5¼		5 17 1
Metropolitan	7	7	6½		5 7 8
do. 4½ per cent. Pref.	4½	4½	4		5 12 6
St. James' and Pall Mall	12	12	9½		6 9 9
South London	7	7	4⅜		6 7 10
South Metropolitan Pref.	7	7	1⅜		5 18 0
Westminster Ordinary	10	10	7½		6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102		5 17 6
do. Def.	1¾	34/6	23⅜		6 9 0
Chile Telephone	6	6	6¾		4 16 0
Cuba Sub. Ord.	7	7	7⅛		4 17 10
Eastern Extension	10	10	19½	½	5 4 7
Eastern Tel. Ord.	10	10	188	−2	5 6 5
Globe Tel. and T. Ord.	10	10	19½		5 4 0
do. do. Pref.	6	6	11¼	− ¼	5 7 10
Great Northern Tel.	24	22	28		7 17 2
Indo-European	10	10	35⅜		7 1 0
Marconi	25	15	2¼	— 1/16	6 13 4
Oriental Telephone Ord.	12	12	2⅝		*5 4 0
United R. Plate Tel.	8	8	7⅜	—	*5 16 0
West India and Panama	Nil	Nil	5/-		Nil
Western Telegraph	10	10	18⅝	− ⅛	*5 6 0
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	61	+1	3 18 9
do. District	Nil	1	46	+2½	2 8 6
Underground Electric Ordinary	Nil	Nil	9¾	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	93⅞	+ ⅛	7 6 9
do. do. 2nd Pref.	Nil	5½	38	—	7 2 0
do. do. 5 per cent. Deb.	5	5	85½		5 17 0
Brazil Tractions	Nil	Nil	50	− ½	8 0 0
British Columbia Elec. Rly. Pce.	5	5	80		6 5 0
do. do. Preferred	5	9⅜	76½	+1	*6 8 6
do. do. Deferred	3	12⅜	86½	+4	*7 8 6
do. do. Deb.	4½	4½	80	+4	5 6 8
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½	+5½	6 2 8
do. 6 per cent. Bonds	Nil	Nil	55½	+3½	Nil
Mexican Light Common	Nil	Nil	2¾	+2	Nil
do. Pref.	Nil	Nil	5¼	+2	Nil
do. 1st Bonds	Nil	5	67½	+2	7 8 2
Manufacturing Companies.					
Babcock & Wilcox	15	16	38	+ ⅛	4 14 8
British Aluminium Ord.	10	5	16/9		5 19 5
British Insulated Ord.	15	15	2⅛		6 17 0
Callenders	15	15	2⅛	1/16	7 1 2
do. 6½ Pref.	6½	6½	1¼		5 15 7
Crompton Ord.	10	7	15		6 13 4
Edison-Swan	10	Nil	2/6		6 Nil 3
do. do. 5 per cent.	5	5	64		7 16 4
Electric Construction	10	10	1		7 12 4
English Electric	8	5	15		6 7 0
do. do. Pref.	6	6	18 3		6 8 0
Gen. Elec. Pref.	6¾	6¾	21 9		5 19 6
do. Ord.	10	7	17/0	6d	5 17 8
Henley	15	15	2/6		6 Nil 3
do. 4½ Pref.	4½	4½	42		5 2 10
India-Rubber	—	—	12/6		
Met.-Vickers Pref.	8	8	9¾		6 14 9
Siemens Ord.	1	10	1⅝	—	—
Telegraph Con.	20	20	26¾		*4 18 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, November 29th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	7d.	½d. dec.
a Ammoniac, Sal	per ton	£62	£1 dec.
a Ammonia, Muriate (large crystal)	,,	£48	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£90	...
a Copper Sulphate	,,	£26 15s.	...
a Potash, Chlorate	per lb.	5d. to 5½d.	...
a ,, Perchlorate	,,	7¾d.	...
a Shellac	per cwt.	£17 10s.	
a Sulphur, Sublimed Flowers	,,	£9	...
a ,, Lump	,,	£7 15s.	
a Soda, Chlorate	per lb.	9½d.	...
a ,, Crystals	per ton	£6	...
a Sodium Bichromate, casks	per lb.	5d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£100	...
b ,, Wire	per lb.	1/9 to 2/6	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£165	£8 dec.
Grade II	,, ,,	£122	...
Grade III	,, ,,	£68	£2 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c ,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c ,, Wire, basis	,,	9½d.	...
c Copper Tubes (solid drawn)	,,	1/1½	...
c ,, Bars (best selected)	per ton	£96	...
c ,, Sheet	,,	£96	...
c ,, Rod	,,	£96	...
d ,, (Electrolytic) Bars	,,	£69 15s.	30s. dec.
d ,, ,, Sheets	,,	£145 10s.	...
d ,, ,, Wire Rods	,,	£79 15s.	30s. dec.
d ,, ,, H.C. Wire	per lb.	9½d.	½d. dec.
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	2/6	...
h Gutta-percha, fine	,,	12/6	...
h India-rubber, Para fine	,,	1/1	½d. dec.
i Iron Pig (Cleveland Warrants)	per ton	92s. 9d.	...
j ,, Wire, galv. No. 8, P.O. qual.	,,	£24	...
g Lead, English Pig	,,	£27 10s.	
g Mercury	per bott.	£11 17s. 6d. to £12	2/6 to 5/ dec.
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/1	...
p ,, drawn bars and rods	,,	1/3	...
p ,, rolled strip & sheet	,,	1/2½	...
p ,, wire	,,	1/3½	...
o Platinum	per oz.	£23	...
d Silicium Bronze Wire	per lb.	1/0½	½d. dec.
r Steel, Magnet, in bars	,,	10d.	...
n Tin, Block (English)	per ton	£173 10s. to £174	£6 dec.
a ,, Wire, Nos. 1 to 16	per lb.	3/2	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Disintegration of Glowing Tungsten Filaments.—The well-known fact that glowing wires, even of metals having a high melting point, when placed in exhausted bulbs, are gradually disintegrated and deposited on the surrounding walls, has generally been considered as a case of sublimation. The metal is supposed to vaporise at the high temperature and the vapour to be deposited as a metallic coating on the cool glass.

As a result of numerous careful photomicrographs, both of the deposit and of filaments in various stages of disintegration, Mr. A. Goetz has come to a different conclusion.

As is well known, it has not yet been found possible to prepare tungsten filaments from molten metal. They are usually formed of finely powdered crystalline tungsten held together by some binding material. Pure tungsten shows comparatively little power of occluding gases, but the binding material has this power to a much greater degree. When the filament is heated, the occluded gases begin to escape and, if the temperature is raised sufficiently, the gas cannot diffuse quickly enough through the gaps between the crystals, and a very great force is exerted on the already somewhat insecure crystals. The outermost crystals are consequently torn off and forcibly discharged from the filament surface.

The photographs of the deposit show irregularly arranged tungsten splinters, whilst those of the filament show a series of blow-holes which, in some cases, may grow quite large.

The fact that filaments glowing in nitrogen show far less tendency to disintegrate than when in a vacuum is attributed by the writer to the presence of an absorbed surface layer, which is quickly destroyed in a vacuum, whilst it is little, if at all, affected in a gas atmosphere.—*E. T. Z.*

THE "THERMIX" AIR HEATER.

The "Thermix" Air Heater for boiler plant forms the subject of an interesting brochure recently issued by the Emile Prat-Daniel Co., of Paris, through its British representative, Mr. S. Utting, M.I.Mech.E., A.M.I.E.E. The publication is of particular interest at the present time, when, owing to the comparatively high cost of fuel for steam raising purposes, it is necessary to consider very carefully every possible means to improve efficiency and reduce production costs to the lowest practicable figure.

Although M. Emile Prat has devoted some twenty years to the specialised study of combustion matters, and the draught system which bears his name, it is only in recent years that his researches on combustion with preheated air have been brought into prominence through the evolution of the "Thermix" air heater for the recuperation of waste

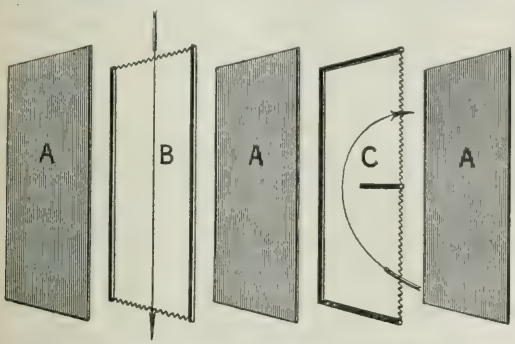


Fig. 1.—Elements of the "Thermix" Air Heater.

heat in furnace gases and the improvement of the combustion process.

Useful notes are given on the subject of chimney gas losses from boiler furnaces, and it is shown that the losses vary directly as the temperature of the gases and inversely as the percentage of carbon dioxide present. A simple formula for the calculation of these losses is given, and assuming a coal of average quality, the sensible heat carried away in the furnace exit gases can be expressed as an approximate percentage of the total heat in the fuel as fired.

It is evident that for efficient working, a high degree of combustion must be attained, and at the same time the chimney loss must be kept down by cooling the gases to the lowest practicable figure and utilising the sensible heat in connection with the boiler plant.

In power plant, this latter desideratum is often partly secured by the adoption of the well-known fuel economiser, which, although quite a satisfactory arrangement in practice, does not generally admit of the maximum heat recuperation possible, whilst in the most modern plant, the developments in high-pressure boilers, steam turbines and feed-water heaters, preclude to an appreciable extent the most efficient use of the economiser heating surface.

The air heater in such cases provides the necessary secondary recuperation, and with the present tendency towards higher steam pressures and temperatures there is a distinct field for the employment of air heaters, apart from the question of the more efficient combustion attainable by the use of preheated air for the furnaces. The principal advantages of the air heater are briefly :—

(1) Good heat recuperation from the gases.
(2) Less weight, less cost, and less space occupied than a corresponding economiser, and a reduction in capital cost of the boiler house.
(3) All air for the furnaces can be preheated, thereby promoting more efficient combustion, particularly with low-grade fuel.
(4) Heated air for industrial purposes is obtained at a cost of almost nil.

These points are discussed in the brochure, and it is interesting to note that an appreciable reduction in capital expenditure on boiler-house plant is possible under modern conditions by the provision of a moderate amount of economiser surface and an air heater, or if the feed water is sufficiently heated by live or exhaust steam, the air heater alone could be installed in many cases.

The use of preheated air for combustion undoubtedly results in an increased boiler efficiency, the flue gases leaving the boiler at a lower temperature than when cold air is supplied to the furnace. The increase of furnace temperature results in more complete combustion of the fuel and a reduction in the excess air supplied, and this is particularly so in the case of low grade fuels which are difficult to burn efficiently in ordinary practice. Tests conducted by the Paris Steam Users' Association on a Belleville boiler, appear to have shown that with the "Thermix" heater in operation an increase of 13 per cent. in thermal efficiency was obtained and the output of the boiler was increased by no less than 16 per cent., whilst the amount of clinker was also reduced when burning preheated air for combustion. On the Continent, where fuel economy is probably receiving greater attention at the moment than in Great Britain, the use of preheated air is extending, and temperatures up to 300 deg. F. have been successfully utilised in practice up to the present.

The constructional features of air heaters have altered materially of recent years, the usual iron or steel tubular type of heater having unfortunately a rather low coefficient of heat transmission, necessitating large heating surfaces and considerable fan power if high air velocities are adopted. The modern type of steel plate heater possesses important advantages, and the Emile Prat-Daniel Co. has developed the design of heaters which are simple in construction, possess a high coefficient of transmission, and are cheaper in both first cost and maintenance than the older patterns in use.

The "Thermix" heater consists of a number of flat rectangular steel plates about No. 10 B.W.G. in thickness, separated by distance pieces of small channel section joined by steel wire spirals, the whole being grouped in an outer framing of angle iron. The construction of the elements is shown in fig. 1, the steel plates (A) and the distance pieces(B) and (C) being assembled into alternate gas and air elements, the gas passing vertically between the plates and the air circulation being contra-flow on one of the four or more methods of circulation which can be adopted in any specific case to suit the boiler plant. This arrangement enables the heater to be applied to all types of boilers, and possesses the important features of simplicity in construction, ease of extension of heating surface if required, and accessibility for renewals of the plates, although in practice a life of ten years or more can be reasonably anticipated.

The general arrangement of the heater with the elements assembled in the framing is shown in fig. 2, the whole being a sound mechanical job after the clamping bolts in the framing have been screwed up to ensure tight joints between the elements.

In practice, it is found that the heater seldom requires cleaning, unlike an economiser, and this is probably due to the fact that the gas velocity is about six times greater than in an economiser, and also there is an absence of vapour

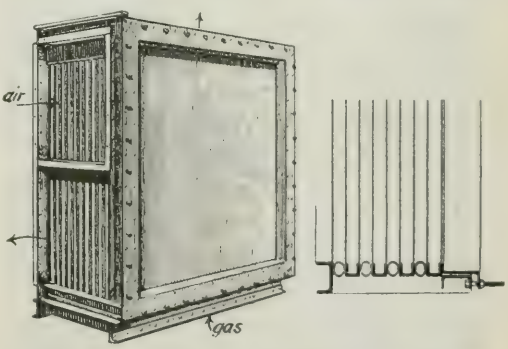


Fig. 2.—General Arrangement of "Thermix" Air Heater.

condensation, the exit gases being usually above a temperature of 130 deg. F. Arrangements are made, however, so that in the event of cleaning being required this can be simply carried out by an acceleration of the gas velocity by moving the damper deflectors.

In many large power houses the combination of an economiser and air heater would prove to be a sound proposition, the capital costs being appreciably reduced and a high thermal efficiency obtained if a suitable disposition of the recuperative surfaces were adopted. This point is explained in the brochure, and a series of curves have been drawn for various temperatures and proportions of heating surfaces.

Data with regard to one or two interesting tests on boilers fitted with "Thermix" heaters are given, but owing to development in the design of large heaters it is rather early as yet to give any definite figures for the important installations which have just been completed.

Illustrations are given of the lay-out of some typical installations, amongst these being that at The Hague electricity works, where chain grate stokers are in use with preheated air and most satisfactory results are being obtained. In conclusion, it is interesting to note that at the Gennevilliers electricity works, near Paris, a combination of economisers and air heaters has been adopted for the fifteen very large boiler units installed.

THE ENGINEERING TRADE OF INDIA.

(WITH ELECTRICAL IMPORT STATISTICS.)

Mr. T. M. Ainscough, H.M. Senior Trade Commissioner in India and Ceylon, has written a very informative report on the conditions and prospects of British trade with India during the fiscal year ending March 31st, 1922. The report has been revised to September last and issued by the Department of Overseas Trade (price 2s. 6d.).

Taken as a whole and without stressing too greatly the possibility of further political troubles, the report reveals a satisfactory position. Notwithstanding the world-wide depression and the peculiar difficulties which have been experienced by British industry during the past year, the Trade Commissioner says that the United Kingdom is maintaining its place in its most valuable overseas market in a remarkable way, which augurs well for the future.

American Competition.

Imports from the United States, which are probably of more concern than any to the engineering world, fell from 10.5 per cent. of the pre-war total to 8.1 per cent. last year, whilst those from Japan fell from 7.9 per cent. to 5.1 per cent. Meanwhile the share of the United Kingdom declined only from 61 to 57 per cent. Machinery and millwork rank second in importance amongst American imports and iron and steel third. The few American merchant houses established in India have suffered as great, if not greater, losses than their British rivals. One of the most powerful, the report says, is winding up its Indian business with a view to cutting its losses, and those firms which conducted a commission indent business with the bazaars have largely spent the year in clearing up their outstanding orders. There is, however, considerable activity on the part of American manufacturers in sending specialists to India, so that they may be organised when trade improves. Mr. Ainscough reports several instances where American technical representatives have been very energetic in studying the wishes of large buyers of plant, and have spared no effort in meeting their special needs. On several occasions he has heard the expression of opinion that American travelling salesmen are frequently more fully conversant with the practical working of their machines and are able to give more valuable advice on technical matters than their British rivals, who are often merely commercial salesmen and not engineers in addition.

Japan and Germany.

It is satisfactory to learn that Japanese competition, except in certain grades of cotton textiles, is no longer a serious factor. Regarding German undercutting in machinery, millwork, and electrical accessories, Mr. Ainscough naturally utters a warning, for the feature was marked during a large part of the period covered by his report. It is now known that the edge of this competition has been blunted by financial difficulties. Whether it will be sharpened again, when and if the mark is stabilised, it is difficult to say.

With regard to future competition of native engineering industries, since Mr. Ainscough's report was completed, a new phase seems likely to begin, judging by the report of the Indian Fiscal Commission, which is frankly protectionist. It is noteworthy in the case of machinery that the original Budget proposal was to increase the import duty from 2½ to 10 per cent., but industrial interests in the Legislative Assembly were too strong, and the proposal fell through. The tariff on power machinery remains, therefore, at 2½ per cent. The increase in that on iron and steel from 2½ to 10 per cent. will give, for the first time, appreciable protection to the Indian iron and steel industry, although it may adversely affect the local engineering industries, which have to rely on imported iron and steel. To the Trade Commissioner it seems regrettable that at a time when India requires such large quantities of structural steel to make good the depreciation during the war and to build up her nascent industries, the cost of steel—the raw material of almost all industries—should be artificially raised as a result of import duties.

£100,000,000 on Railway Work.

Mr. Ainscough thinks that British manufacturers are bound to benefit from the expenditure of £100,000,000 which is proposed on the Indian railways during the next five years. In his view they should be able to secure the bulk of the orders, owing to the fact that they are thoroughly conversant with Indian railway requirements, and have supplied almost the whole of their equipment in the past. Interested firms are recommended to read the section of the report which deals with the changes that are contemplated in the method of purchase of Government stores.

Mr. Ainscough's advice is that in those cases where the Indian Government normally takes a large share of a company's productions and where manufacture in India shows a reasonable chance of success, British manufacturers should seriously consider the establishment of works in India. The present tendency is all towards the protection and development of India's industries, and with the transfer of more and more power into Indian hands, this tendency will be accentuated. Moreover, there is a danger that unless British makers take their opportunities and move with the times, they will find that their foreign competitors may steal a march on them. India is determined to develop its industries and would welcome foreign enterprise if British capital and energy are not available. This would mean the introduction of foreign standards and practice and would do incalculable harm to our interests.

Machinery and Millwork.

Meanwhile the outstanding feature of the year has been the prodigious import of machinery of all kinds, and this item now takes third place in the import trade, being exceeded only by cotton textiles and sugar. The origin of the imports of machinery and millwork during the past two years is indicated below :—

Countries of consignment	1920-21. Rupees (lakhs).	1921-22. Rupees (lakhs).
United Kingdom	17,53	28,32
Germany	17	55
Switzerland	3	11
Japan	12	4
United States	4,02	4,51
Other countries	50	72
Total	22,37	34,25

The following table shows the relative importance of the three principal suppliers both before the war and during the past two years :—

Country.	1913-14. per cent.	1920-21. per cent.	1921-22. per cent.
United Kingdom ..	90.0	79	82.5
United States	3.0	17	13
Germany	5.5	.75	1.5
Other countries ...	1.5	3.25	3
Total ...	100.0	100.00	100.00

It is most satisfactory to note that, although the United Kingdom has not yet regained her pre-war position, she bids fair to do so in a few years' time, and is recovering ground lost during the war in a remarkable way. Although American shipments have steadily declined in the aggregate, United States competition is still serious in many branches, such as electrical plant, sawmilling and woodworking machinery, agricultural machinery, machine tools, and industrial plant of all kinds. Moreover, by dint of active representation on the spot, she is obtaining a footing in very many lines which have hitherto been supplied by British makers.

During the first quarter of the new fiscal year imports in this class have not been maintained, but declined about 30 per cent. compared with April to June, 1921. Whilst the share of Great Britain and the United States was reduced, that of Germany increased considerably. Taking electrical machinery alone, however, the British share was greater, whilst the American was very much smaller.

Somewhat similar tendencies are shown in the trade in electrical instruments and apparatus. During the 12 months under review, British makers improved their position, the shares of the chief supplying countries being :—United Kingdom, 69.2 per cent.; United States, 22.7 per cent.; Japan, 3 per cent.; Italy, 2 per cent.; and Holland, 1½ per cent. Between April and June this year imports were not maintained; the British share fell more than 50 per cent. and that of America 80 per cent. Italy increased her proportion.

Technical Representation.

Seeing that India's imports of machinery and plant last year totalled £23,000,000 in value, of which nearly £19,000,000 worth was obtained from the United Kingdom, the question of representation is vital. The view which Mr. Ainscough strongly holds is that British engineering manufacturers who already have a large interest in the market should open their own office and selling organisation in the field in those cases where the trade to be gained warrants the expense, and in other cases they should form group-selling organisations in conjunction with other manufacturers of non-competing lines, and the group association should open its own offices in Calcutta and/or Bombay as circumstances direct. The following are a few of the reasons on which Mr. Ainscough bases this opinion :—

The firms of mercantile agents in India, who have in the past held many of the leading machinery agencies, are usually houses of standing who hold the agency of some 10 to 30 British manufacturers of various lines. They frequently act as piece-goods importers, shipping and insurance agents, exporters of all kinds of produce, managing agents of local industries, and conduct a general merchant's business. The numerous machinery agencies are, therefore, relegated to an engineering department staffed by two or three European assistants, with sometimes a qualified mechanical engineer in charge. It is obvious that, with the best will in the world, it is impossible for such a firm to do adequate justice to each of the agencies held. In the case of machinery in general demand in India, the ideal method of representation, from the British manufacturer's point of view, is to have his own office staffed with competent engineers and salesmen and—in

the case of heavy plant—provided with an expert staff of erectors. There are, of course, a few firms who specialise in conducting machinery business and who give their principals good service. In these cases the British manufacturing engineer should attach one of his own men to his agents, to assist them by travelling the country, demonstrating the value of the machines, putting right defects in previous deliveries, advising probable purchasers, and generally promoting his employers' interests.

The Indian industrialist is branching out into many highly complex activities and is determined to have the most highly scientific advice and to purchase the most improved forms of plant obtainable. There are very few firms of consulting engineers in India to-day. The trained managers of the branch offices of home engineering and machinery firms have, in the past, filled this gap. In the future they will be needed more than ever.

Mr. Ainscough also recommends the British engineering manufacturer to maintain an erecting staff in conjunction with his selling and technical organisation.

Hydro-Electric Survey.

Owing to the transfer of the hydro-electric department from the Central to the Provincial Governments as a result of the constitutional reforms, the scheme for a co-ordinated survey of the whole of India has been abandoned. Mr. J. W. Meares, O.I.E., who held the post of Chief Engineer of the Hydro-Electric Survey, and who has been Electrical Adviser to the Government of India for many years, returned from India recently, both the posts he held having been abolished. While it is true that Provincial Governments are themselves, in some cases, appointing committees to consider what steps they should take, it is to be feared that, in most instances, funds will not be forthcoming and that the hydro-electric development of the country will be retarded for many years.

Electrical Imports of India.

The following statistics of the imports of electrical and similar goods into British India in the year ended March 31st, 1921, are taken from the recently-issued official trade returns, details for the year ended March 31st, 1920, being added for purposes of comparison, and notes of any increases and decreases given.

	1919-20 £	1920-21 £	Inc. or dec. £
Control and switchgear—			
Total	*	64,000	—
From United Kingdom	—	63,000	—
,, United States	—	1,000	—
Electrical generators—			
Total	252,000	451,000	+ 199,000
From United Kingdom	189,000	220,000	+ 31,000
,, United States	60,000	229,000	+ 169,000
Electric motors—			
Total	344,000	614,000	+ 270,000
From United Kingdom	126,000	501,000	+ 375,000
,, United States	215,000	96,000	− 119,000
Transformers—			
Total	26,000	43,000	+ 17,000
From United Kingdom	4,000	13,000	+ 9,000
,, United States	22,000	30,000	+ 8,000
Turbo-generating sets—			
Total	*	89,000	—
From United Kingdom	—	87,000	—
,, United States	—	2,000	—
Other electrical machinery—			
Total	619,000	927,000	+ 308,000
From United Kingdom	244,000	608,000	+ 364,000
,, United States	356,000	307,000	− 49,000
,, Italy	4,000	6,000	+ 2,000
,, Switzerland	11,000	—	− 11,000
Mining machinery—			
Total	156,000	298,000	+ 142,000
From United Kingdom	47,000	112,000	+ 65,000
,, United States	108,000	184,000	+ 76,000
Electric fans and parts thereof—			
Total	214,000	399,000	+ 185,000
From United Kingdom	25,000	148,000	+ 123,000
,, Italy	54,000	61,000	+ 7,000
,, United States	135,000	183,000	+ 48,000
Electric wires and cables (rubber insulated)—			
Total	264,000	549,000	+ 285,000
From United Kingdom	207,000	498,000	+ 291,000
,, Japan	21,000	11,000	− 10,000
,, United States	34,000	39,000	+ 5,000
Ditto, insulations other than rubber—			
Total	139,000	417,000	+ 278,000
From United Kingdom	122,000	402,000	+ 280,000
,, United States	12,000	2,000	− 10,000
,, Japan	4,000	11,000	+ 7,000
Telegraph and telephone wires and cables—			
Total	*	31,000	—
From United Kingdom	—	28,000	—
,, United States	—	1,500	—
,, Japan	—	1,500	—
Bare copper wire (electrolytic)—			
Total	15,000	218,000	+ 173,000
From United Kingdom	18,000	64,000	+ 46,000
,, United States	3,000	106,000	+ 97,000
,, Japan	19,000	11,000	− 22,000
Telegraph and telephone apparatus—			
Total	63,000	50,000	− 13,000
From United Kingdom	24,000	32,000	+ 8,000
,, Sweden	10,000	9,000	− 1,000
,, Japan	2,000	1,000	− 1,000
,, United States	27,000	8,000	− 19,000
Electric glow lamps—			
Total	15,000	169,000	+ 154,000
From United Kingdom	7,500	104,000	+ 96,500
,, Holland	2,000	47,000	+ 45,000
,, Japan	1,000	3,000	+ 2,000
,, United States	4,000	8,000	+ 4,000
Electric lamps, other sorts—			
Total	90,000	73,000	− 17,000
From United Kingdom	42,000	35,000	− 7,000
,, Holland	18,000	23,000	+ 5,000
,, Japan	10,000	9,000	− 1,000
,, United States	19,000	5,000	− 14,000
Batteries—			
Total	31,000	28,000	− 3,000
From United Kingdom	6,000	11,000	+ 5,000
,, United States	25,000	17,000	− 8,000
Carbons, electric.—			
Total	*	8,000	—
From United Kingdom	—	7,000	—
,, United States	—	1,000	—
Accumulators.—			
Total	*	153,000	—
From United Kingdom	—	142,000	—
,, United States	—	11,000	—
Condensers, electric.—			
Total	*	5,000	—
Electric lighting accessories and fittings.—			
Total	*	314,000	—
From United Kingdom	—	277,000	—
,, United States	—	23,000	—
Electricity meters—			
Total	34,000	84,000	+ 50,000
From United Kingdom	25,000	71,000	+ 46,000
,, Switzerland	8,000	8,000	—
Electro-medical apparatus.—			
Total	*	7,000	—
Switchboards, other than telegraph and telephone—			
Total	61,000	55,000	− 6,000
From United Kingdom	32,000	36,000	+ 4,000
,, Japan	2,000	—	− 2,000
,, United States	27,000	19,000	− 8,000
Telegraphs, materials for construction and accessories—			
Total	3,000	9,000	+ 6,000
Telephones, materials for construction and accessories—			
Total	19,000	65,000	+ 46,000
From United Kingdom	12,000	42,000	+ 30,000
,, Sweden	4,000	12,000	+ 8,000
,, United States	2,000	19,000	+ 17,000

In addition to the foregoing, the following were imported as Government stores:—

Machinery and millwork—			
Total	447,000	856,000	+ 409,000
From United Kingdom	404,000	849,000	+ 445,000
Telegraph material—			
Total	579,000	419,000	− 160,000
From United Kingdom	578,000	417,000	− 161,000
Instruments and apparatus—			
Total	419,000	664,000	+ 245,000
From United Kingdom	416,000	655,000	+ 239,000
Other electrical goods and apparatus—			
Total	571,000	1,618,000	+ 1,047,000
From United Kingdom	279,000	1,026,000	+ 747,000
,, Holland	2,000	—	− 2,000
,, Italy	3,000	13,000	+ 10,000
,, Japan	19,000	45,000	+ 26,000
,, United States	264,000	513,000	+ 249,000

*Not separately recorded

THE ENGINEERING EXHIBITION, CARDIFF.

Owing to the unprecedented success of the Engineering Exhibition that was opened at Cardiff on November 20th, under the auspices of the South Wales Institute of Engineers, and at the unanimous request of the exhibitors, the run of the show had to be extended and its closing date postponed from November 25th to 29th—a fact which reflects great credit on the quality of the exhibits and on the committee that was entrusted with the organisation of the enterprise. There was such a run on the space available that every part of the Drill Hall was taken, and many of the 70 exhibitors displayed samples of the products of more than one firm.

This year's enterprise was on a much more elaborate scale than that previously attempted; it is felt that the exhibition will now become a permanent institution, and that it will have considerable influence upon the industrial progress of South Wales, as the future prosperity of a country is, to a large extent, in the hands of engineers. Last year the Institute organised a fuel-saving exhibition at its headquarters in Cardiff, and it was the instantaneous success of that venture which inspired the attempt at bigger things. Many applications for stands had to be rejected, and promoters are very well satisfied at the success which has attended their efforts.

The electrical industry was strongly represented, and visitors were greatly interested in the large number of appliances on view. Naturally, with the rapid strides made in radio telephony, there was a big display of apparatus by many of the leading electrical firms, and amateur operators showed more than a passing interest in the latest sets put on the market.

The opening ceremony was performed by Mr. David E. Roberts, M.Inst.C.E., M.I.Mech.E., M.I.E.E. (president of the Institute), who mentioned that the whole of the electrical arrangements for the exhibition were efficiently carried out by Messrs. Page & Stibbs, electricians, Cardiff.

Among the exhibitors were The General Electric Co., Ltd., whose show of electrical plant took a wide range. General colliery switchgear was well represented by a 6,600-volt truck-type cubicle board, a pedestal draw-out type oil-switch panel, a "unit-type" ironclad switchboard (which is being supplied to one of the local collieries), also flame-proof switches, oil switches, cable boxes, and motor-control gear, both automatic and non-automatic. Another type of switchboard shown was a special panel for controlling small lighting sets, this being mounted on the generator of a lighting set. "Kingsway" miners' lamps were arranged on racks to illustrate the method of dealing with the necessary battery charging. Among other exhibits shown by the G.E.C. was a 30-h.p. steelworks motor for driving light rolls. "Gecophones" for broadcasting reception were also prominent, as well as numerous domestic devices.

Colliery signalling apparatus was to the fore, including the Peel-Connor mining telephone, the "Magnet" engine-room shaft indicator, also the "P.D." relay, an entirely new device, which operates with very small currents on both a.c. and d.c. circuits, and enables the bare-wire system of haulage road signals to be retained. A patent device is attached to show the amount of leakage in the signalling circuit, thereby giving due warning before the actual stoppage occurs.

Messrs. Ferguson, Pailin, Ltd., had a large number of exhibits, which included heavy-oil switches, as supplied to the Hydro-Electric Power Commission, Ontario. One of their chief exhibits, apart from their truck speciality and e.h.p. cubicle, was a mining-type, explosion-proof, oil switch, which has been developed to meet Home Office requirements for both fiery and non-fiery mines.

Messrs. Witty & Wyatt, Ltd., had a very good display, making a feature of Henley cables, colliery lighting fittings, switchgear, the Henley wiring system and street unit pillars, and Swedish General Electric, Ltd., a.c. and d.c. motors, &c.

On the stall adjoining the Sterling Telephone & Electric Co., Ltd., had a very interesting display of radio, telephone, and other apparatus, including the "Magnavox" loud-speaking instrument, receiving sets, the mine telephone with a throat transmitter, which is especially effective in noisy places, and also the Sterling shaft signalling systems, designed to prevent accidents in pit shafts.

Colliery officials were much interested in the safety lamps exhibited by Messrs. E. Thomas & Williams, Ltd., which included the new lamp for gas testing, not yet approved, but on the lines recommended by the Mines Committee. It is made in such a way that it feeds from the top, so that it can be placed near the roof, and thus any gas within three-eighths of an inch of the top would be detected, it is claimed. The firm's magnet relighter is self-contained, and can be adapted to relight while underground any type of flame safety lamp. Shot-firing magnetos, together with lighters, unlocking magnets, and accessories for use in the lamp room were also shown.

Messrs. Cooper & King, Ltd., exhibited a number of up-to-date appliances, including mining type switch pillars, oil break switch, cubicle switchboard, lighting transformer, and a gravity conveyor made by the W. & D. Conveyor Engineering Co., Ltd.

A new colliery and industrial-lighting system was exhibited by Messrs. Francis & Co., Ltd., the fittings being designed to meet the requirements of the memoranda relating to the use of electricity in mines. They embody entirely novel features greatly reducing the amount of work required to be done underground, and also simplifying the tracing and rectification of faults.

Messrs. Haslam & Stretton, Ltd., displayed a considerable quantity of electrical apparatus (made by various manufacturers), much of it for colliery use. These included the "Thor" tachograph.

The Relay Automatic Telephone Co., Ltd., attracted attention with its complete installation for an inter-departmental automatic telephone system, giving facilities for connection to 50 telephones. It comprised an automatic switchboard, power board, two sets of 24-volt batteries, and telephone instruments, all connected up for use.

Other exhibitors included the Cambridge & Paul Instrument Co., Ltd. (electrical indicators, recorders, &c.); Messrs. Ferranti, Ltd., Hollinwood (transformer); The Foster Instrument Co. (thermometers, electrical resistance type, &c.); Messrs. Twiss Electric Transmission, Ltd., and Messrs. Allen, West & Co. (electrical control and switchgear for mines and other purposes).

NORTH WALES AND CHESTER ELECTRICITY DISTRICT.

Commissioners' Second Inquiry.

The scheme for the re-organisation of the supply of electricity in the North Wales and Chester Electricity District, approved by the Electricity Commissioners, was the subject of a second inquiry in accordance with the provision of Section 5 (4) of the Electricity (Supply) Act, 1919, which opened at Llandudno on November 21st. A large number of local authorities were represented, including Llandudno, Conway, Penmaenmawr, Llanfairfechan, Carnarvonshire C.C., Chester, and Cwm, as well as the North Wales Power Co. Sir H. Haward presided, and the other Commissioners present were Messrs. H. Booth and A. Page, with Messrs. E. W. Hudson (legal advisor), and Mr. D. S. Cumberledge (secretary). The inquiry was the outcome of a previous one held in February of last year, and the resulting draft Order made by the Commissioners.

The Chester Corporation submitted that the Order was *ultra vires* and was undesirable, but the Commissioners had been advised that they were *intra vires*, said the chairman, who explained that the inquiry was not open for anyone to submit a fresh scheme, and the clauses were dealt with *seriatim*.

Sir Lynden Macassey, K.C., opened the case for the Chester Corporation, and in the course of a long reasoned argument submitted that Clause 7 of the draft Order, which provided that certain rights and obligations of the Joint Authority should be transferred by deed to the North Wales Power & Traction Co., was bad, and was not authorised under the Act.

The Order also extended the area, which could not possibly be done, as it had previously been fixed by Act of Parliament.

Elaborating the objection, Sir Lynden said the Power Co. was a joint stock company, and had borrowed money on the strength of the undertaking, and the memorandum of association would need altering, either in the Chancery Court, or by Act of Parliament. To put it bluntly, the Order was not worth the paper it was written on. An injunction could be made against the company, as the Commissioners had no power to alter the charges or vary the method of charging, as they had done. The powers given to the company explained the fears of the Corporation of Chester and other bodies being placed under the tender mercies of the North Wales Power Co. with regard to the points he had raised.

The Town Clerk of Cwm (Mr. Feltham) at this stage also made a formal protest against the proposal to transfer certain powers from the Joint Authority to the company, as in the 1919 Act no powers of delegation were mentioned.

Mr. C. S. Fame, of the Cheshire C.C., also registered a protest on the same lines.

Sir Lynden Macassey then raised the subject of questions as to the financial stability of the company to carry out its undertakings, and argued that it was desirable that this should be done in the interests of the public, who viewed the matter with apprehension.

Mr. Kennedy, for the Power Co., resisted the application that the private affairs of a company should be made public.

Mr. Wm. Cash, F.I.C.A., president of the Institute, of the firm of Stone & Co., London, then produced the balance sheets of the Aluminium Corporation for the years ending 1919, and for two years ending 1921, and gave his opinion that with the company's liabilities of £1,026,000 it would be difficult to borrow any more money, and that it would not be fair to saddle the public with so much dead capital.

The Chairman remarked that the Commissioners had considered the figures at the last inquiry and before the draft Order was made. There was nothing in the Order to compel Chester to take a bulk supply of electricity from the company if it did not desire to.

Sir Lynden Macassey: Chester can do much better for

itself if allowed to carry out its own salvation. It objects to being included in the district, and can show that it can get electricity at a cheaper rate than from the company. After the last inquiry it found that it could purchase the Queensferry station from the Government, and asked for powers to run it for itself, as it did not wish to be left in the lurch by the Power Co. Chester objected to districts in Wales having the first call on the electricity, and there existed a lively apprehension that if there was a drought the far-away districts would have to get what they could.

The Chairman said the Corporation of Chester never raised that question at the last inquiry. The Commissioners were satisfied that the water power resources would give the required amount of energy.

Mr. Amos Jones, Rhyl, asked would the Order exclude the right of any area like the Vale of Clwyd developing its own water resources?

The Chairman resplied that there would be no difficulty in that direction, as it was open for the Commissioners to alter the Order.

Mr. John Hall Rider, consulting engineer, gave evidence regarding the output of the Queensferry station and the approximate charges. The Chester Corporation had an agreement with the Government until 1924 for the supply of electricity for 3,000 kW at £4 10s. per kW per annum, and over 3,000 kW at £4 per kW per annum, plus actual cost of wages, fuel, oil, &c., and an additional 7½ per cent. on such cost. The Corporation had agreed to purchase the works for £54,000. On his recommendation it had agreed to spend an additional sum of £6,000 for two additional transformers and switchgear, and £1,500 for a pumping plant. There were three 1,500-kW and one 1,000-kW sets, and it was proposed to run at 4,000 kW and have one set as spare, and there was room for two more sets. The pressure was supplied at 33,000 volts, and was reduced to 6,600 and taken to the Crane Street station at Chester, and was there transformed and distributed partly as d.c. and a.c. in parallel with the energy generated at the Chester hydro-electric station, which cost practically nothing to produce after the standing charges had been paid off. From the figures supplied by the Power Co. he estimated that, on a consumption of 4,000,000 kWh per annum, and based on the price of coal at 14s. per ton, in 1923 the saving between the Corporation and Power Co.'s figures would be £3,562, or 23.8 per cent.; in 1924 £5,692 would be saved; in 1925 £8,166; in 1926 £11,133; and in 1927 £14,554, or 78 per cent., when the cost at Queensferry would be 0.754d., against 1.3444d. of the Power Co. The total cost per kWh would fall from 1.145d. in 1923 to 0.745d. in 1927. In his first report to the Corporation fuel was taken at 18s. 5d. He had now taken the figure at 14s., although the Corporation had now entered into large contracts at under 10s. per ton. He was of opinion that further economies could be effected at the Queensferry works.

Sir Lynden Macassey: The maximum price fixed under the Order to supply by the company was £6 per kW per annum, plus 0.75d. per kWh supplied.

Mr. Crosthwaite, on behalf of the North Wales colliery owners, said the latter did not wish to be represented on the Joint Authority if it was to involve them in any financial obligation.

On November 22nd the documents asked for on the previous day were handed to Mr. Kennedy, who proceeded to cross-examine Mr. Rider on the figures regarding the cost of production at Queensferry.

Mr. Rider stated that his figures were not for a full twelve months' working. In his opinion nothing would need to be spent on the works beyond the purchase price of £54,000; the £6,000 for the additional transformers and switchgear; and £1,500 for additional pumping plant.

Questioned by Sir Lynden Macassey, he reiterated that the figure he had given as to the cost of production could be regarded as a most conservative one. If coal doubled in price to the amount he had estimated the increase per kWh would amount to 0.16d., and in 1927 the saving would be £9,000 in favour of the Corporation against the price charged by the Power Co. It would not be economy to scrap the station at Queensferry if it was to cost the Chester Corporation more to buy from an outside source.

Mr. Kennedy: We are really indifferent whether Chester takes a supply from us or any other body. Our quotation was given in response to its invitation. We do not wish you to compel it to discard any station.

Sir Lynden Macassey: Chester can get a supply cheaper from that source than any other.

Mr. Rider was then subjected to questions by Mr. Page, one of the Commissioners, and replied that as regarded the economic life of the Queensferry station, it could be extended by putting in new boilers in a building already erected. This would also effect economy, as much heat was wasted under existing conditions. The conditions at Queensferry warranted the Chester Corporation buying the station. Recently he had saved the Corporation a sum of £100,000 owing to plant having come down in price. Personal control meant less charges than dual ownership; the proper thing to do would be to enlarge Queensferry. He had no objection to linking up with other works provided the combination did not increase the charge to Chester. The plant at Queensferry was not in a bad condition, but the lay-out was bad; heat was lost by a system of open hot wells.

The Chairman said that these questions had been [illegible] owing to the fact that the Commissioners had not [illegible] application for sanction to a loan of £54,000 to buy the [illegible], and he proceeded to put questions to Mr. Rider, who repeated that Queensferry was not an ideal station. The [illegible] good, but the steaming efficiency was low owing to the [illegible] house being faulty.

The Chairman: How would Chester be prejudiced [illegible] by being included in this district?

Mr. Rider: I do not see any advantage in its being added up by adding to a cheap supply a comparatively dear scheme.

The Chairman: You want home rule and all the advantages of being associated with other people.

Mr. Rider: The feeling is abroad that we shall be compelled to take a supply from the North Wales Power Co., and that is where the sting lies.

Mr. Sydney Ernest Britton, Chester Corporation Electrical Engineer, stated that the present price paid for coal by the Corporation was 9s. 8d. per ton.

Mr. Britton was cross-examined by Mr. Kennedy, on behalf of the North Wales Power Co., with regard to the present expenses at the Queensferry station, and the Chairman, interposing, remarked that what they wanted to get at was not whether the figures were accurate, but would the same system be carried out when the Chester Corporation had become the owner of the station.

Mr. Britton then replied that no further expense would be incurred on the management side, and the accountancy work would be done by the present staff at Chester. When they were producing 3,000,000 kWh at Queensferry full use was also made of the Dee hydro-electric works. The present assessment of Queensferry for rating purposes was £1,400, and the rates were 10s. in the £, and the Corporation was at present raising money at 4½ per cent.

Sir Lynden Macassey then addressed the Commissioners at great length, and submitted that there was no ground for the inclusion of Chester under the circumstances created as assuming Chester would be allowed to purchase the Queensferry station it would in any way, to quote Section 5 of the Electricity (Supply) Act, 1919, "conduce to the efficiency and economy of the supply of electricity" and to the convenience of administration. If Mr. Rider's evidence was accepted it was quite clear that as far as Chester was concerned there would be no advantage in including Chester within the area of supply of the Joint Electricity Authority, as it was apparent from the figures he had given that Chester, producing its own electricity at Queensferry, had an advantage over the purchase of energy from the North Wales Power Co. Under the final scheme a Joint Electricity Authority would have been appointed representative of the public authorities, but its responsibilities and powers had been handed over to a commercial company, and Chester objected to being subordinated to a commercial company, as was proposed in the Order.

The Chairman: There is nothing in the Order which suggests that.

Sir Lynden then reviewed the clauses in the Order, and contended that, if the water-power resources were fully developed, the Queensferry station would be closed down.

The Chairman said the Commissioners could not conceive that they would require the Queensferry station to be shut down, and they would not consent to it unless they were satisfied that there was an ample supply of electricity available for Chester; it might be some amendment of the phraseology of the Order was required to meet that particular point.

Sir Lynden then criticised the action of the Commissioners in transferring the powers of the Joint Electricity Authority to a commercial company.

The Chairman: That we absolutely deny. The powers of supply are transferred to the company, but the Joint Electricity Committee to be set up will generally supervise the supply throughout the whole district, and that was the object of setting it up.

Sir Lynden argued that because the North Wales Power Co. was responsible for the supply of energy there was no guarantee to the public that a supply would always be forthcoming, and concluded his address by remarking that no case had been made out for the retention of Chester as part of the area of the Joint Electricity Authority.

Alderman Pain, of the Cheshire County Council, and Mr. Feltham, Town Clerk of Crewe, also objected to being included in the area, and suggested that the area comprising the County Palatine of Chester should be established as a separate or sub-electricity district.

Mr. Tylor, on behalf of the London & N.W. Railway Co., said that it did not intend to depart from the position laid down at the last inquiry by Mr. Tyldesley Jones.

Mr. Amos Jones, Rhyl, looked at the agreement as unjust to the undertakers of North Wales, as simply securing for the Aluminium Corporation a vast fortune.

If ¾d. per kWh was to be charged for ever, they would be debarred from bringing forward the Vale of Clwyd scheme for generating by water at a cheaper rate than was now proposed.

The Chairman: I think it will be quite open to bring up the Vale of Clwyd scheme at some future time and apply for a Special Order in connection with it.

On November 23rd Sir Lynden Macassey said that the Cheshire authorities had arranged that the Chester and Crewe Corporations, in collaboration with the other local authorities of the Cheshire area now included in the draft Order, should prepare a scheme under the Electricity Acts for supplying their districts with electricity, and submit it to the Commissioners on or before June 30th, 1923. Upon such a scheme taking effect that part of the Cheshire area now included in the draft Order—that was to say, in addition to Chester and not immediately excluded under Clause 1, that being Chester, would be transferred from the North Wales and Chester Electricity District, and such part, together with the part excluded under Clause 1, to form the district of the new scheme, adopting a course which was very frequently adopted under similar circumstances in the case of Parliamentary Bills. With regard to the railway companies, they would have the advantage of two separate supplies: one from the North Wales area, and the other from the new district, if it was formed, and in that case they would not have merely supplemental, but competitive, supplies.

The Chairman: The matter cannot be discussed here.

Representations were then made by Mr. Feltham, Town Clerk of Crewe, on the constitution of the Joint Authority, who described it as a Court of First Instance and the Commissioners as a Court of Appeal.

Commander Agglionby, representing the Ministry of Agriculture and Fisheries, made representations on behalf of the Dee Fishery Board.

Other representations put forward referred to the methods of election to the Joint Authority by various public bodies, several of which argued that the Joint Authority should be doubled in point of numbers, as under the Order the representation was inequitable.

Mr. Lawson Taylor, Town Clerk of Wrexham, said that his Council regarded the price of ¾d. per kWh for energy supplied by the Aluminium Corporation to the North Wales Power Co. as extravagant, and some protection was needed against a company which was managed by several officials who apparently acted for the other company. His Council not only suggested that the price be reduced, but that some provision should be made for a periodical revision of that charge, both ways, on the basis of the profits of the Aluminium Corporation.

The Chairman: If Chester's view as to the prospects of the Aluminium Corporation turned out to be right the consumers would suffer badly under the suggestion. The price has been fixed largely in relation to capital expenditure and it is a fair charge. There is no obligation on the part of the Power Co. to take the energy, and if later its works develop it would be open for it if it found it more profitable to give up that supply. The basis suggested could not be accepted.

Mr. Olmot Price, Wrexham Rural Council, also stated that the terms for energy quoted to them by the Power Co. were excessive, and Chester District Council suggested the price should be 25s. per quarter instead of £6 per annum per kW charge.

After luncheon, the Chairman said he had received a note from the solicitor to the Railway Companies in the following terms: "In accordance with the request of the Commissioners, I enclose copies of the clauses which it is suggested should be inserted in the scheme set out in the first schedule."

The chairman said the clauses were almost identical with Sections 36/40 of the North Wales Electric Power Co.'s Act of 1904.

Mr. Kennedy then addressed the Commissioners, and said the scheme had not been propounded by the Power Co., but by the Commissioners, and then proceeded to deal with Sir Lynden Macassey's criticism. With regard to the supply from the Aluminium Corporation's works, the company estimated that in three years' time it would be free of having to take any quantity of supplies from those works. The Power Co. was willing to consider any reasonable safeguards that the Commissioners could suggest in two ways for the supply of energy: (1) to secure the continuance of the supply so long as it was needed from the Aluminium Corporation to the Power Co.; (2) so far as they thought it desirable and it was possible to arrange the continuance by the Power Co. of the supply to the public. The Chester Corporation had taken a parochial view, and in order to enforce it, it was necessary to destroy the scheme. If Chester was of serious importance to the Power Co. he would figth its exclusion persistently. Chester was of little interest to the company, and he was instructed to say so.

The Chairman said that the Commissioners would in due course make an Order embodying their decisions.

American Mine Explosion.—An explosion of coal dust in the Woodward Coal Mine, near Birmingham, Alabama, killed eighty-three men and injured sixty more. Three empty cars on a slope two hundred yards above the mouth of the mine ran downwards, following the breaking of a cable, and broke the high-pressure electric wire. This ignited the coal-dust in the mine yard. The fire then caused an explosion in the mine.—*Daily Express.*

ELECTRIC LOCOMOTIVES.

The resumed discussion on a paper on "Electric Locomotives," by Sir Vincent L. Raven, K.B.E. (North-Eastern Railway)—the paper was abstracted in our issue of August 25th, 1922, p. 284—took place at a meeting of members of the Institution of Mechanical Engineers, in London, on November 17th. The paper advocated the use of one or two classes of shunting engines; one type of freight engine (the double-bogie type with easily accessible parts) and one type of express passenger engine (the quill-drive type). For dealing with suburban passenger traffic, however, the author advocated the adoption of the multiple-unit system. If such a state of affairs could be brought about, there was no doubt that immense economies could be effected.

Lieut.-Col. F. A. Cortez Leigh, R.E. (London & North-Western Railway) opened the resumed discussion. He referred to the figure of £103 for the average cost of repairs, inspection, preparing, cleaning, &c., per engine in 1921, for shunting locomotives in operation on the North-Eastern Railway of the double-bogie type, the daily service being about 18 hours, as being very low. He suggested that it would have been better to have taken an average figure over a number of years. Sir Vincent Raven had expressed the opinion that for the conditions applying to British railways the most suitable and satisfactory arrangement for an electric freight locomotive was the double-bogie design with two four-wheel bogies articulated together, each bogie containing two motors geared to the two axles without any form of coupling-rod transmission. It appeared to the speaker that in the case of freight locomotives requiring a continuous rating of some 2,000 h.p. there might be some difficulty in fixing the motors within the compass allowed by the bogie and framing. Why should they not have the motors fixed on the body of the engine, and adopt an arrangement similar to that on the Swiss locomotives? The author had suggested standardising only one class of electric locomotive for passenger traffic, but the speaker considered that there should be at least two. The methods of handling passenger traffic varied considerably on some railways, and it seemed to him that it would be more economical if a smaller type were standardised for suburban work, which was not capable of being dealt with by the ordinary motor-car system.

Mr. C. H. Merz (consulting engineer to the North-Eastern Railway) said that the electric motor had really, if a proper system of electric traction were adopted, been perfected; but the question was for what purpose did mechanical engineers wish electrical engineers to design the motors? Reliability had been proved provided a proper system were adopted. The question of the adoption of electric traction in this country at the present time was eminently a commercial one; in other countries other considerations frequently came into play very prominently which, in this country, were not likely to influence the matter, and the problem came down to one of £ s. d.; therefore it was very necessary to arrive at the simplest and cheapest form of locomotive. Sir Vincent had called attention to the fact, in connection with the freight locomotive, which he had suggested might be standardised in this country now, that that type of locomotive could not be so conveniently adopted, at any rate with single-phase traction, but he (Mr. Merz) hoped that that was not a question which need concern that meeting very much. The ease with which the bogies could be dropped and the necessary repairs carried out was obviously desirable, but the fact that he had recommended that type of locomotive was in effect a particular recommendation of the electric motor, because it might be argued as a justification for putting the motor in the cab that it was more easily got at. The motors had been very satisfactory; the original windings were still running on all the motors; the commutators had hardly been touched; the brushes had a remarkable life, and did not necessitate any particular dismantling of the locomotive to repair them; therefore, from the point of view of electrical engineers, it was very satisfactory that they had got so far as that with regard to the freight locomotive, which was, after all, the most important from the economic point of view. He did not think it would pay to electrify any line in this country for the express purpose of passenger traffic, and unless the freight traffic was large enough to justify electrification he did not think any line would be electrified. If such a locomotive as that advocated by Sir Vincent for freight work was good enough—and it had been shown that it was—the great advantage of standardising would be that it would enable electrical manufacturers to put down plant and to thoroughly arrange their shop methods for turning out a given equipment in large quantities. The cost would then be greatly reduced, and it would be possible to equip a line electrically at a materially lower cost than with steam locomotives. With regard to first cost, it could be shown that the cost would be less with electricity than with steam. He hoped that mechanical engineers would not be led astray by the numerous types of electric locomotive which existed; the reason for their existence was, to a great extent, the result of the supposed necessity in some other countries for making locomotives suitable for single-phase work.

Lieut. Col. E. Kitson Clark said the public instinct had

decided upon electric locomotives. So far as small repairs were concerned electrical work required very little, but such was the fertile genius of electrical engineers that when the time came for heavy repairs they always had some "better" scheme on an entirely different principle, by the adoption of which a good deal of money could be "saved," not because the electrical material was worn out, but because electricians were always introducing "novel and splendid improvements," so that the "economy" to be gained by the adoption of "improvements" was very expensive. After describing the action of the teeth of the pinion and of the gear wheel when driving and when braking, he said it seemed desirable that there should be some sort of hardening of the pinion, in order that it should wear out at the same time as the wheel.

MAJOR H. E. O'BRIEN (London & North-Western Railway) did not think the stage had yet been reached at which they should be prepared to say that everybody in Great Britain would be ready to accept a particular electric engine as standard. The passenger locomotive used by the North-Eastern Railway had a horse-power of 1,800; that was rather low, as compared with the tractive effort of some of the locomotives on the Continent, presumably because it was the intention to use it on a main line which had not very severe gradients. The severest section of the London & North-Western Railway, on which there was very heavy traffic, was probably that between Preston and Carlisle. To deal with the heavy passenger trains required on that section a considerably more powerful locomotive would be required than that designed for the North-Eastern Railway. The horse-power called for would be more of the order of 2,400. The suggested use of the same type of engine for all fast trains running considerable distances without stopping, and to equip a sufficient number of trains as multiple-unit trains without locomotives for local passenger services seemed to be the correct conclusion. It was improbable that 50 large locomotives would cost very much more than 75 smaller ones, but if they had a small locomotive for the average train, and double-headed the train when it was heavier, they would probably increase the number of locomotive units by 50 per cent. That inevitably meant increased inspection, repairs, and attaching and detaching the second engine, whereas one type of large locomotive could deal with any train, and the continuous use of electric locomotives (which was a most important factor in making a financial success of electric traction) would be greatly facilitated. What was the object of adopting six twin motors, the total voltage being 1,500? It would seem better to have a straight 1,500-volt motor, and 4-motor equipment.

MR. J. DALZIEL (electrical assistant, Rolling Stock Department, Midland Railway) explained that the Midland Railway authorities had, as far back as 1908, made up their minds that they could handle heavier traffic at better gradient speeds and give better line capacity with electric locomotives than with steam. There was on the Midland Railway a section which, of all sections of British railways, called for electrification. Centring on Chinley, the Midland main lines radiated to Manchester, Sheffield, and Derby, all passing over heavy gradients, and carrying a fairly dense traffic. On the 1 in 90 Peak Forest gradient, on to-day's figures, a train of 45 wagons could be taken up at 24 miles per hour with electric traction, as against 30 wagons at 8 miles per hour with steam. They could do their freight work with 43 electric locomotives in place of 100 steamers. At the same time they were not certain, at to-day's prices, that they could electrify to commercial advantage. To electrify the line from Derby to Manchester would cost 2¾ millions. Working that traffic with 115 electric locomotives instead of 251 steamers they could operate the line at £294,000 per annum, against £533,000 for steam, but (taking capital charges at 10 per cent.) they would still have a deficit. Of course, if manufacturers would bring down equipment and electric locomotive costs, the figures would change, but a further reduction of the price of locomotive coal would put the figures in the other direction. With regard to locomotive types, he agreed that for shunting and freight work the type of locomotive advocated by the author was adequate for the requirements. They could be built up to 1,500 h.p., and the cost at the present time would be about £9,000. With further price reductions, standardisation on the lines indicated by Mr. Merz, and with increased demand, they should see those locomotives at something like £5,000. Then there would be much greater possibilities of electrification. He did not see why the mechanical parts of such a locomotive should not be built at much less cost than the mechanical parts of the steam locomotive, apart from the boiler. The low centre of gravity and small wheel diameter were the principal objections to that type of engine, but so far as high centre of gravity had to be purchased at the cost of using a rod and jack shaft design it was not worth it; no rod design was necessary so long as Sir Vincent's design was available.

MR. R. P. C. SANDERSON (Baldwin Locomotive Works) said he had detailed reports of the conditions during the great railway strike in America last summer of every electrification, and, with one small exception (where the conditions were extraordinary) they all ran steadily throughout the strike, in spite of the shop difficulties, without failure, showing a degree of reliability that had never been reached by any steam traction yet. The one failure was on the Cascade Mountains, where the power available was insufficient for hauling the trains, and where they had to use a steam [illegible] to assist them. As the result of the steam engine not being there the driver of the electric train undertook to start his train, and blew up the power house.

SIR VINCENT RAVEN undertook to reply to the [illegible] in writing.

ILLUMINATING ENGINEERING AND THE ARCHITECT.

An interesting departure took place at the meeting of the Royal Institute of British Architects on November 20th, when a paper on the above subject was read by Mr. J. S. Tye, Mr. Paul Waterhouse, president of the Institute, being in the chair.

MR. TYE, in his introductory remarks, recalled the great changes that had recently taken place in artificial lighting, drawing attention particularly to the increased intrinsic brilliancy of illuminants, which made scientific methods of shading essential. Another advance had been the introduction of simple instruments of measuring illumination which had enabled the values of illumination required for various classes of service to be tentatively determined. A list of such values, illustrative of modern practice, was presented. Mr. Tye then explained some of the methods employed in calculating illumination and determining the spacing of lighting units in order to obtain uniform distribution. The lecture was illustrated with a large number of lantern slides, including photographs of typical modern installations. Attention was drawn to the importance of diffused reflection from walls and ceilings—a matter with which the architect was intimately concerned—and the desirability of the general scheme of decoration and the lighting being considered simultaneously.

One of the most important changes during recent years had been the greater recognition of the benefits of good lighting on the part of the public and the authorities—a result due largely to the educational work of the Illuminating Engineering Society, and the efforts of its hon. secretary, Mr. L. Gaster. Joint Committees formed by the Society had issued reports on school and library lighting, and a Home Office Departmental Committee had made a very comprehensive investigation of the subject of industrial lighting.

In conclusion, Mr. Tye referred to the great benefits that would be derived from fuller co-operation between the architect and the illuminating engineer. Consideration of the method of artificial lighting at an early stage in the preparation of plans made the installation of electric light much easier for the contractor. There were many points in which the architect and the lighting expert were jointly interested, such as the important part played by the nature of walls and ceilings in deciding the choice between direct, semi-indirect, and indirect lighting. In particular, artistic success in lighting demanded that the intentions and desires of the architect should be clearly indicated. In that connection Mr. Tye showed some views of interiors where recessed domes in the ceiling and other architectural embellishments, afforded suitable points for the suspension of fittings, and where the lighting arrangements formed an essential element in the general design. Church-lighting provided many points for discussion, such as the desirability of hanging lighting fittings from the terminal points of arches—a convenient practice from the lighting standpoint, but one which some architects did not approve. Spectacular and flood-lighting, again, presented interesting problems, and there was no doubt that success in that direction was very largely dependent on co-operation between the architect and lighting expert.

A vote of thanks to the lecturer was moved by SIR JOHN HERBERT PARSONS, president of the Illuminating Engineering Society, who, as an ophthalmic surgeon, could speak with experience of the benefits of co-operation between the Illuminating Engineering Society and the medical profession. He felt sure that similar good results would follow from co-operation between architects and lighting experts. In considering the effect of light on the eye, they had to survey the whole field of brightness, both by artificial light and the much greater illumination characteristic of daylight. Architects were accustomed to deal with access of daylight, but the study of artificial light was of equal importance.

MR. W. R. RAWLINGS, in seconding the vote of thanks, likewise welcomed co-operation between the architect and the lighting expert, which would be a great aid to the electrical contractor.

MR. L. GASTER, in opening the discussion, pointed out that illuminating engineering consisted in studying, not merely lamps and fittings, but their effect in the form of illumination. The impression received by the eye was necessarily determined by the manner in which surroundings were illuminated, and it was of great importance to the architect that the artificial light should be so arranged as to reveal his work and display it to the best advantage. One of the primary considerations was the avoidance of glare. He had many years ago advocated the screening of lamps in shop windows, and had been criticised by various shop-keepers for so doing. The methods of screening imposed during the war had accustomed the public

to the advantages of proper shading, and to-day concealed lighting was adopted by most of the leading stores in London. The design of shop frontages with a view to the convenient use of artificial lighting for purposes of advertising and spectacular display was one subject that might well receive more attention. He fully associated himself with what had been said regarding the need for co-operation between the architect and the illuminating engineer, who could learn much from each other, and he suggested that in future courses of instruction dealing with illumination should be included in the curriculum for architectural students.

Mr. C. H. Seager discussed at some length the use of light from the æsthetic standpoint, and the president, in closing the discussion, expressed his cordial sympathy with the general desire for co-operation in lighting matters.

NOTES FROM CANADA.

(From our Special Correspondent.)

The Provinces of Nova Scotia and New Brunswick have power commissions somewhat similar to the Hydro-Electric Power Commission of Ontario, although they have not been in existence so long. In connection with the work of the two first-named commissions two interesting events have occurred recently, one in each province.

In Nova Scotia the city of Halifax decided not long ago to obtain its electric power from the local company (*i.e.*, through private ownership), though the company will apparently purchase power from the water-power developed by the province. In New Brunswick the city of St. John has just decided, by a large majority in a popular vote, on purchase its own power directly from the Power Commission (*i.e.*, through public ownership) just as most municipalities in Ontario do. As these two provinces are in many respects very similar, it will be interesting to watch developments during the next few years. It is reported that the Shawinigan Water & Power Co. will start constructional work early next year on a power development at Gives Falls, which will involve an expenditure of ten or fifteen million dollars.

The *Canadian Engineer*, in an article by J. T. Johnston, the Assistant Director of the Dominion Water Power Branch of the Department of the Interior, recently published some very interesting data relating to the water-power situation in the St. Lawrence region.

On the assumption that the rate of growth of water-power development within 300 miles of the St. Lawrence River at the Long Sault Rapids during the past 15 years will be continued into the future, and this is said to be a conservative assumption, the development in h.p. up to the year 1940 will be as follows: 1922, 2,100,000; 1925, 2,350,000; 1930, 2,875,000; 1935, 3,405,000; 1940, 3,935,000. The rate of increase of water-power development for the past 15 years has been 104,000 h.p. per year. There are, within the area specified, no less than 464 water-power sites, capable of yielding 9,348,269 h.p. of 24-hour power at 80 per cent. efficiency, dependable for at least six months of each year, irrespective of betterments from storage; ten of these sites are each of 100,000 h.p. or over, and their total amounts to more than 6,600,000 h.p. Other figures are:—

No. of sites.	H.p. per site.	Total h.p. of all sites.
119	499 or less	29,000
68	500— 999	48,650
169	1,000— 4,999	395,400
68	5,000—24,999	677,600
14	25,000—49,999	511,300
16	50,000—99,999	1,068,000

It has recently been reported that the Ontario Government has sanctioned the construction, by the Hydro-Electric Power Commission of Ontario, of 508 miles of rural lines, 228 miles of which is already in existence and the rest under construction; 6,000 additional rural consumers will be added to the 2,000 already taking power from the Commission.

It is perhaps not generally known in England that Canada exports a very considerable amount of hydro-electric energy to the United States. Figures issued not long ago by the Department of Trade and Commerce at Ottawa show that very nearly 30 per cent. of the energy generated is sold to the United States, 24 per cent. being generated either at Niagara Falls or on the St. Lawrence River.

A little while ago an account was given in the Electrical Review of some electric steam boilers which are being employed by the Laurentide Co. for utilising off-peak power, and it has recently been stated by one of the company's officials that about 5,000 tons of coal per month is being saved by means of these boilers.

"Underground" Publicity.—The Underground Company, in conjunction with the Brighter London Association, has issued an attractive pictorial card announcing the times of the last trains from West End stations to various outlying districts. At the top of the card appears an excellent view of Piccadilly Circus and its electric signs.

LEGAL.

German Electric Vacuum Cleaners.

In the Mayor's and City of London Court, on November 23rd, an action was brought by James H. Brown & Co., Ltd., foreign bankers and dealers in exchange, St. Stephens Chambers, Telegraph Street, E.C., against Margands, Ltd., 24, Holborn, for £27 17s. 5d. as damages for breach of contract.

Mr. J. Douglas Young, plaintiffs' counsel, said that the defendants were carrying on a dental business at Brighton. In September Mr. Margands, who owned the defendants' business, called on the plaintiffs and asked them to help finance him in buying a German factory which made dental chairs. Two days later he said he wanted to buy 500,000 German marks, and plaintiffs put through the deal at 6,900 to the £. They gave him a contract form confirming the deal, and he paid £14, which was a 20 per cent. deposit. The marks were to be delivered in 90 days, which was usual. Defendant's cheque was stopped and Margands said he would be unable to carry through the deal. Marks were a very fluctuating commodity, and plaintiffs offered to buy them back at the current price, but defendants refused, saying they would fight. Plaintiffs then re-sold them at 11,200 to the £ and the present claim was for the loss incurred.

Mr. Ames, plaintiffs' secretary, said that marks were appreciating in value at the time, and when German goods were bought it was good business to buy marks the same day. They had the marks in stock.

Assistant-Judge Shewell Cooper: One may now talk of marks as if they were grocery.

Defendant said it was distinctly understood that the plaintiffs were not to buy the marks for him until his cheque had been cleared. He bought sixty electric vacuum cleaners in Leipsic at £15, which would be 75,000 marks. After he had paid his deposit he found marks were much lower than plaintiffs had quoted and he repudiated the transaction. The vacuum cleaners had not yet been delivered. The Government was encouraging people to trade with Germany because of the reparation duty.

Assistant-Judge Shewell Cooper said that the defendant's version was incredible to him. He was satisfied with the plaintiffs' case, and he found for them with costs.

Workmen's Compensation Claim.

In the Mayor's and City of London Court, on Monday, Walter Mansfield, contractor's engine driver, 62, Priory Road, East Ham, claimed against John Shelbourne & Co., pile drivers and contractors, 29, Mark Lane, E.C., damages under the Workmen's Compensation Act, for injuries that befell him on September 16th at the wharf of the Western Electric Cable Works, North Woolwich, while engaged in lifting a "traveller," which had to be affixed to a pile. The little finger of his left hand was crushed and his right hand and wrist were crushed between the traveller and the wharf. His wages had been £3 15s. per week. He claimed 35s. a week during incapacity. Defendants had paid ten guineas into Court which plaintiff said he would accept in full satisfaction of the claim. Assistant-Judge Shewell Cooper approved.

Colliery Company and Officials Fined.

Aberavon magistrates on Monday imposed a fine of £10 upon the Glynconwg Colliery Co., £4 upon Gwilym Rowlands, manager, and £1 upon Thomas Thomas, electrician to the company, for a breach of the Mines Regulations by having 6,000 yards unarmoured electric cable in their workings on July 20th, and the officials for failing to have live contacts of the electric plant suitably protected and certain metal pipes near machinery properly earthed.

Mr. Windsor Williams, prosecuting for the Home Office, said the omissions rendered the colliery premises liable to a sudden outbreak of fire. There had been considerable correspondence, and the Home Office had given the colliery directorate every opportunity of remedying matters.

Mr. Thomas A. B. Horsley, a Mines Department Inspector, said that when he visited the colliery the manager and electrician were very frank about the unarmoured cable.

Mr. Kirkhouse Jenkins, defending, said that a flood at the colliery involved a temporary breach of regulations. They were now being complied with.

Pathé's Film of Kearney Railway.—The film of the Kearney high-speed railway recently taken by Messrs. Pathés Frères for inclusion in their weekly pictorial was released for exhibition on November 20th. Mr. E. W. Chalmers Kearney is shown subjecting one of his model cars to tests and, in addition to Pathé's production, a more lengthy film embodying the plans and particulars of the proposed Kearney high-speed tube in Sydney is to be shown every day for some weeks at the Australia House kinema.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Device to Prevent Back Running of Tramcars.

Mr. P. Priestley, A.M.I.E.E., general manager of the Liverpool Corporation Tramways, has patented an alteration of, and addition to the present type of tramcar controller, which ensure that when a car is travelling up a gradient and for any reason the current fails or the trolley leaves the wire and the car consequently starts to run back, the motorman has only to throw the controller handle to the off position, with the result that the current generated by the motors operates a special sanding device on the rear wheels which makes the sanding and braking independent of the human element. This does not interfere with the automatic sanding device, which can be used in connection with the rheostatic brake when a car is descending a gradient in the ordinary manner. One of the great troubles which tramway managers have always had has been that of cars running backwards down a gradient, and some of the worst accidents have happened in this way. It is claimed that this device will make such an occurrence practically impossible. The motorman has not to look for a special sand tramp, or rely upon the conductor to be on the rear platform in order to operate the sanding arrangement.

Radio Power Generators.

Two examples of radio broadcasting power generating sets which Messrs. Newton Brothers (Derby), Ltd., Market Place, Derby, have recently designed, manufactured, and delivered for use in the Manchester broadcasting station, are illustrated in fig. 1. The firm has for some considerable time specialised in the design and manufacture of dynamo-electric machinery for radio purposes, having secured excellent results both by way of characteristics related to purity and quality of tone in radio telephony, as well as maximum output per unit weight of the machines. In order to obtain purity and quality of tone in radio telephony, it is claimed to be absolutely imperative that a source of h.p. supply to the valve anodes should be provided with the following characteristics:—(*a*) Direct or unidirectional current; (*b*) unvarying potential under load; (*c*) freedom from slot and commutator ripples; (*d*) potential under instantaneous control to facilitate tuning, valve conditions, and aerial current required.

It is claimed that the d.c. h.p. generators illustrated fulfil these conditions. Fitted with single commutators specially designed, they are capable of giving a steady voltage of from 2,000 to 5,000 volts by shunt regulation when running at constant speed, and by special field and armature construction, slot and commutator ripple is practically eliminated. The machines were tested at 6,000 volts at full-load current on a steady load as for r.t., and on a Morse key w.t. load, and are guaranteed against flashover or sparking under all working conditions. The motors are the firm's standard three-phase

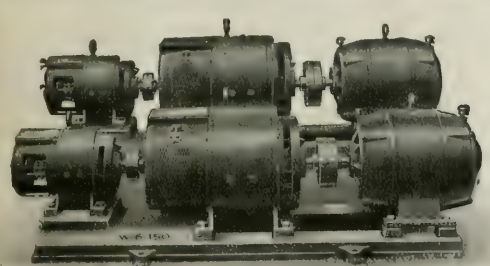


Fig. 1.—Newton Radio Power Generators.

induction machines for 50-cycle supply, and the small exciters are wound to give, in addition to the current for field excitation, direct current at a suitable pressure for charging accumulators and heating valve filaments.

Both sets are fitted with ball bearings, and were manufactured for the Radio Communication Co., Ltd., specially for the Manchester radio broadcasting station; they exhibit the simplest method of utilising three-phase, 50-cycle, a.c. for radio telephony.

In conclusion, it may be stated that both machines were designed, manufactured, and delivered within the extraordinarily short period of two weeks, and it should be remembered that machinery for radio purposes varies within such wide limits with regard to output, voltage, and special characteristics that it is not possible to stock it, it being necessary to design and manufacture for requirements as they arise.

The "Utility" Multiple Toaster.

The multiple toaster illustrated in fig. 2, [illegible] by Electrical Utilities, Ltd., 1a, Sholand Road, S.W.9, is an appliance which should prove extremely useful in restaurants, canteens, &c. It is made in three standard sizes, with eight, six, or four heating elements, capable of dealing with seven, five, or three pieces of toast. The holders are suitable for slices measuring 5½ in. × 4½ in. × ⅜ in., and are provided at one corner. By means of a small lever fitted with a heat-

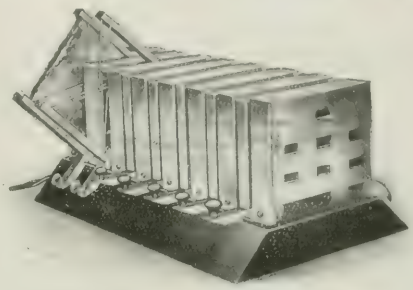


Fig. 2.—The "Utility" Multiple Toaster.

insulated handle each toast-holder can be swung out for the insertion or withdrawal of the bread. The largest size has four, and the next size three, and the smallest two switches, each controlling two elements. The elements take approximately 440 W each, and consist of nickel-chromium wire supported in eyeletted mica strips with polished aluminium frames. The base is of black-enamelled or polished nickel-plated steel, and encloses all wiring, presenting a neat exterior.

The "Paragon" Lamp Lock.

We have received from Mr. F. E. S. Davies, 44, Bloemfontein Road, W.12, a sample of a new form of lamplock which he has designed. It consists of an external collar with a lower rim and a small slot to admit the lamp pins. Inside this is a collar and a spring. This internal collar possesses projections which engage in slots in the exterior case. The method of fixing is as follows: the lamp cap is

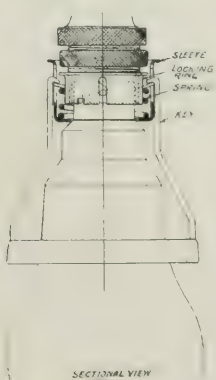


Fig. 3.—The "Paragon" Lamp Lock.

pushed through the bottom of the lock and the pins slide into the slots of the locking ring. The lamp is then pushed into the holder and the action of the spring automatically locks the lamp in position. The lamp lock is removed by means of a special key, which engages with the projections of the inner ring and pulls this down against the spring. The key is held tightly, and the lamp, lock, and key all come away from the holder by releasing the lamp from the bayonet socket. The illustration (fig. 3) shows a sectional view of the arrangement when locked, with the key in position for unlocking.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal, by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS Patent Agents, 285, High Holborn, London, W.C. 1.

30,805. "Cameras &c., for electric lamps." R. Hunt. November 10th.

30,806. "Wireless receiving apparatus." B. G. Culver. November 10th.

30,808. "Transmitters for wireless recording and signalling systems." A. B. Barker, W. Cotton, and J. S. Wilson. November 10th.

30,810. "Wireless receiving, wireless receiver with gramophone, &c." C. Dubois. November 10th.

30,814. "Electrical-discharge apparatus." M. Strickland and Sea-cod Plastic Art Co. November 10th.

30,821. "Electric ship propulsion." British Thomson-Houston Co., Ltd., and O. Wallis. November 10th.

30,826. "Electric cables." B. Davies and Eastern Telegraph Co., Ltd. November 10th.

30,833. "Electrical transmitting and receiving apparatus for telegraphy, &c." S. Lindet. November 10th. (France, December 1st, 1921.)

30,845. "Electric lighting systems for vehicles." T. C. Coles. November 10th.

30,904. "Receiving signals." Marconi's Wireless Telegraph Co., Ltd. November 11th. (United States, November 12th, 1921.)

30,922. "Electric generators for signalling." S. G. Frost. November 11th.

30,929. "Electric power transmission systems." A. M. Taylor. November 13th.

30,939. "Apparatus for heating forgings, &c., by electricity." Dagobert Lamar & Co., and E. Schroder. November 13th.

30,957. "Apparatus for reception of wireless telegraphy, &c." G. Derham, J. W. Hall, and G. Tipping. November 13th.

30,962. "Wireless installations on vehicles." N. H. Clough. November 13th.

30,979. "Galvanic batteries." J. L. Morris, A. H. Railing, and J. T. Kiss. November 13th.

30,987. "Electric controllers." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co. partly) and N. E. North. November 13th.

30,988. "Automatic electric railway systems." A. D. Ferguson and Metropolitan-Vickers Electrical Co., Ltd. November 13th.

30,990. "Automatic electric motor-control systems." A. D. Ferguson and Metropolitan-Vickers Electrical Co., Ltd. November 13th.

30,993. "Receiving apparatus for wireless, &c., signalling." J. B. Bolitho. November 13th.

31,013. "Automatic interrupters for electric heating apparatus." R. Anderson. November 13th. (Sweden, November 28th, 1921.)

31,016. "Trough reflectors." British Thomson-Houston Co., Ltd., and H. C. Wheat. November 13th.

31,028. "Manufacture of electric glow lamp bulbs." A. M. Monnier. November 13th. (France, June 29th.)

31,045. "Continuously-variable resistance." H. D'O. Mantle. November 14th.

31,075. "Separator plates for electric accumulators." P. J. Gruber and Tudor Accumulator Co., Ltd. November 14th.

31,079. "Headlights for motor vehicles." C. W. Done and R. H. Nowill. November 14th.

31,080. "Switches for distributing electric energy." T. E. R. Phillips. November 14th.

31,089. "Rectifying devices." A. R. Angus. November 14th.

31,090. "Rectifying devices." A. R. Angus. November 14th.

31,096. "Electric measuring instruments." W. K. Barker and S. G. Jones. November 14th.

31,102. "Boxes for electric accumulators, &c." W. R. Edwards. November 14th.

31,111. "Device for preventing or extinguishing electric arcs, &c." J. von Clossmann and H. Halberstadt. November 14th.

31,114. "Electric traction." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 14th.

31,117. "Wireless kinematographs, gramophones, &c." J. Hetherington. November 14th.

31,118. "Electron devices." British Thomson-Houston Co., Ltd. November 13th. (United States, November 15th, 1921.)

31,119. "Metallic resistances." British Thomson-Houston Co., Ltd., and N. Laycock. November 14th.

31,120. "Ignition systems for internal-combustion engines." British Thomson-Houston Co., Ltd., E. G. Parrott, and A. P. Young. November 14th.

31,145. "Electric switches." Akt. Ges. Brown, Boveri & Cie. November 14th. (Germany, December 14th, 1921.)

31,150. "Electric burners for singeing textile threads." Soc. Anon. Electro-Textile. November 14th. (France, October 2nd.)

31,168. "Galvanic baths." J. Hess and F. Kitchener. November 14th.

31,178. "Electric resistance grid leaks, &c." G. Marshman. November 15th.

31,196. "Thermionic valves for wireless telegraphy, &c." A. Dinsley. November 15th.

31,207. "Cleaning tool for sparking plugs, &c." L. H. Stevens. November 15th.

31,212. "Flashlight for mines, &c." R. Allen. November 15th.

31,214. "Vacuum tubes." E. Y. Robinson. November 15th.

31,230. "Automatic electric circuit breakers." J. von Clossmann and H. Halberstadt. November 15th.

31,240. "Electric impulse distributing systems." Western Electric Co., Ltd. November 15th. (United States, January 13th.)

31,251. "Oil-immersed electric switchgear." British Thomson-Houston Co., Ltd., and H. Trencham. November 15th.

31,252. "Electron-discharge devices." British Thomson-Houston Co., Ltd. November 15th. (United States, November 15th, 1921.)

31,253. "Enclosed electric switchgear." British Thomson-Houston Co., Ltd., and H. Trencham. November 15th.

31,264. "Apparatus for radiology, &c." F. Holweck. November 15th. (France, November 15th, 1921.)

31,273. "Electric insulators." British Thomson-Houston Co., Ltd., and H. H. Jackson. November 16th.

31,274. "Electric power transmission systems." A. M. Taylor. November 16th.

31,286. "Sanding devices for electrically-propelled vehicles." P. Priestly. November 16th.

31,292. "Electric lamps, &c." J. L. Knox. November 16th.

31,349. "Headlight with electric and acetylene lighting." M. H. H. M. Chaumont. November 16th. (Belgium, November 17th, 1921.)

31,357. "Lead storage batteries." F. Jacobacci. November 16th.

31,360. "Electric cables." B. Davies and Eastern Telegraph Co., Ltd. November 16th.

31,361. "Telegraphic [illegible]." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). November 16th.

31,362. "Protective apparatus, &c., for alternating electric current distribution." British Thomson-Houston Co., Ltd., and A. S. FitzGerald. November 16th.

31,395. "Thermostats [illegible]." H. Davies and J. M. Longe. November 17th.

31,439. "Electrodes." H. Pemberton. November 17th. (Germany, May 12th.)

31,452. "Electric motors." M. W. Woods. November 17th.

31,455. "Vacuum tubes." F. Y. Robinson. November 17th.

31,463. "Electrical insulation of metallic articles, &c., whereby uniform metallic [illegible] is ensured." W. L. Sykes. November 17th.

31,466. "Electric resistance coils, &c." H. P. T. Lefroy. November 17th.

31,481. "Electric couplings." L. Krieger. November 17th. (France, November 18th, 1921.)

31,482. "Ignition apparatus." British Thomson-Houston Co., Ltd., and A. P. Young. November 17th.

31,483. "Electric heating devices." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). November 17th.

31,486. "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.

31,487. "Telephone exchanges." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.

31,488. "Telephone exchanges." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.

31,489. "Telephone exchange systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.

31,490. "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

11,682. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. April 22nd, 1921. (188,001.)

12,562. "Electric meters." F. Holden, and Measurement, Ltd. May 2nd, 1921. (188,066.)

13,304. "Electrically-propelled ships." R. MacGregor. March 13th, 1922. (188,009.)

15,440. "Radio telegraphic transmitting stations." J. Bethenod. September 14th, 1920. (169,143.)

17,021. "Electrically-braking motor vehicles." P. F. Smith and P. V. Powell. June 25th, 1921. (188,021.)

17,360. "Telephone systems." Creed & Co., Ltd., and T. Lenaghan. July 1st, 1921. (188,024.)

19,665. "Electric accumulators." A. Pouchain. July 21st, 1921. (Addition to 170,618.) (188,027.)

19,734. "Electric switching devices of the cartridge-fuse type." A. De Gessler. July 22nd, 1921. (Convention date not granted.) (167,167.)

19,996. "Devices or apparatus for avoiding the glare or dazzle emanating from lamps, such as the electric lamps of automobiles." Butlers, Ltd., and A. Reeves. July 26th, 1921. (Cognate applications 23,178/21 and 29,352/21.) (188,035.)

20,202. "Electrically-illuminated advertising devices." H. S. Coleman. July 27th, 1921. (188,039.)

20,230. "Girder or beam attachment for electrical conduits, gas or water pipes, and the like." H. Laycock and E. Laycock. July 28th, 1921. (188,041.)

20,254. "Process and apparatus for electrolytically oxidising or reducing substances." C. J. Thatcher. July 28th, 1921. (188,042.)

20,299. "Control for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). July 28th, 1921. (188,048.)

20,334. "Construction of ceramic vessels with electric heating." A. Steinhardt. July 28th, 1921. (188,050.)

20,335. "Reflectors." H. Sefton-Jones (W. A. Dorey). July 28th, 1921. (188,051.)

20,361. "Electric switches." F. B. Cox. July 29th, 1921. (188,053.)

20,395. "Electrolytic cell." C. J. Thatcher. July 29th, 1921. (188,056.)

20,405. "Headlights and other lamps for vehicles." A. Graves. July 29th, 1921. (188,057.)

20,504. "Electrode seal and support for mercury-vapour arc rectifiers of glass." E. Marschner. July 30th, 1921. (188,068.)

20,659. "Automatic safety locks for electrically-controlled lifts." W. H. Cocks. August 3rd, 1921. (188,076.)

20,868. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 5th, 1921. (Cognate applications 20,942/21 and 21,473/21.) (188,082.)

21,737. "Traffic-controlling apparatus for railways and the like." J. T. Roberts, P. W. Hardman, W. S. Roberts, and Railway Signal Co., Ltd. August 16th, 1921. (188,097.)

22,380. "Electron-discharge devices." General Electric Co., Ltd., and B. S. Gossling. August 23rd, 1921. (188,103.)

22,870. "Electric light fittings with bowl shades or reflectors." H. C. Pride. August 28th, 1921. (188,117.)

23,612. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). September 5th, 1921. (188,131.)

24,062. "Portable electric heating apparatus with accumulation of heat." Kindlimann & Co. December 13th, 1920. (172,930.)

24,285. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 13th, 1921. (188,138.)

24,650. "Electric switches." A. S. Cubitt. September 16th, 1921. (Cognate application 16,450/22.) (188,144.)

24,980. "Sound-signalling apparatus." P. Haig. September 21st, 1921. (188,147.)

25,145. "Synchronous dynamo-electric machines." E. P. Hill and Metropolitan-Vickers Electrical Co., Ltd. September 22nd, 1921. (188,150.)

25,170. "Electric radiators." Soc. Générale "Le Prométhée." September 22nd, 1921. (169,454.)

26,427. "Portable electric battery lamps." T. Rombach. October 6th, 1921. (188,161.)

27,119. "Electrical connection." P. Tracy. October 13th, 1921. (188,172.)

27,228. "Locking switches for magneto circuits of vehicles driven by internal-combustion engines." J. E. Hailstone. October 14th, 1921. (188,175.)

28,144. "Electric fuses." J. H. Tucker & Co., Ltd., and W. J. Line. October 24th, 1921. (188,189.)

28,160. "Wall and like plugs for electric lighting and power circuits." L. J. Lepine and F. D. Denner. October 24th, 1921. (188,190.)

29,756. "Magazine fuse plugs." Jensen Trading Co., Ltd., Aktieselskab, and P. G. U. Buch. November 8th, 1921. (188,205.)

31,083. "Electric heat radiators." A. J. Ellis and J. C. Vines. November 21st, 1921. (188,219.)

32,282. "Incandescent electric lamp holders." J. R. Sibils. December 8th, 1921. (188,236.)

1922.

2,242. "Electric water heaters." Z. Trotzer. November 24th, 1920. (174,609.)

2,935. "Electric switches." Cable Accessories Co., Ltd., F. H. Reeves, and J. W. Davis. February 1st, 1922. (188,268.)

7,483. "Inert cells." C. S. Mummery and Ever-Ready Co. (Great Britain) Ltd. March 14th, 1922. (188,280.)

11,475. "Combined electric couplings and switches." O. Ellinger. April 23rd, 1921. (178,866.)

13,342. "Loaded signalling conductors." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 11th, 1922. (188,287.)

17,695. "Apparatus for applying curative treatment with a radio-active substance." A. Muguet. June 29th, 1921. (182,469.)

18,935. "Sound amplifiers for sound-reproducing machines." A. Benoit, J. L. Marbieu, and H. H. Duchesne. April 27th, 1921 (Divided application on 188,063.) (188,292.)

20,443. "Insulation of electric cables." C. J. Beaver, A. W. Claremont, and L. B. Claremont (legal representatives of E. A. Claremont (deceased)), and W. T. Glover & Co., Ltd. July 26th, 1922. (Addition to 183,510.) (188,293.)

THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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CO-OPERATIVE POWER SUPPLY ON THE FARM.

The French agriculturist, so often quoted as an example of energy and thrift, appears to be turning his attention to the use of electric power with that oddly logical outlook for which his nation is renowned. The recognised difficulty of providing a ramification of h.p. lines and hundreds of services to scattered farms he is endeavouring to overcome by securing the farmer as a shareholder before he becomes a consumer.

A leaflet has been issued by a company which is being formed to merge the principal power suppliers of the Sarthe district, in which the case for electricity in farm and field is set out clearly; the first essential, an extensive network reaching every district and village, is to be achieved by the help of those who will employ it and who are now asked to invest in the company, securing a safe outlet for their spare capital and helping to bring to themselves and others the benefits of power and to replace or supplement the hand labour now so much more difficult to obtain and pay for. It is of interest to note that in these French proposals the basis prices suggested for the supply are high relatively to figures usually contemplated in this country, being 1 fr. for power and 1 fr. 80 c. for lighting.

In connection with the provision of electricity supply for agriculture and village work, it is desirable that electrical engineers should give careful consideration to the question of basis price; in so many cases we hear that these widespread supplies cannot be given on account of the high cost of distribution, but it is to be feared that this view arises from the difficulty which the English electrical engineer finds in contemplating rates for rural supply very much higher than those to which he is accustomed in the town.

Our business has been built up in active competition with coal and gas, and we have been so accustomed to regard the prices of 1d. to 2d. per kWh as about the right thing for power that we find it difficult to realise that in isolated districts, in villages, and on farms, figures of 6d. or 8d. per kWh may be quite satisfactory for a supply of electric power, and twice as much may be obtained for electric lighting.

It must not be forgotten that in these isolated districts it may well be electric power or nothing, or, at the best, an oil engine with all its attendant troubles, due to weight, fire risk, &c. One has only to consider the cost of electric power per unit of output, as in the thrashing of corn, cutting of roots, and similar work, to see that it is not only unnecessary to quote very low rates for scattered supplies, but that to do so would probably deprive the agriculturist of the benefits of electricity supply altogether.

The French circular draws some interesting comparisons between the costs of man and animal power, putting down, for example, the energy output of a well-cared-for horse at something like 2½ kWh for five hours of steady working, and the energy output of a man at a very much lower figure. Naturally these comparisons are of small direct value owing to the immense difference between the combination of intelligence and flexibility which one gets from man or animal as compared with any kind of machine, but nevertheless they show in a most striking manner how the value of the man can be enhanced if aided by the machine, and there is obviously call for study of the whole subject by the British electrical engineer and for the production of suitable propaganda and advertising treatment for the agriculturist and village resident.

The subject has already been tackled in its usual popular manner by the Electrical Development Associations, and it is natural to be hoped that the prospects of business of this kind may not be spoiled by too hasty an assumption that relatively high rates cannot be obtained for the supply.

At least one technical problem arises in this connection: the makers of transformers and switchgear might well study the question of tapping high-pressure lines for small amounts of energy with economy and safety. To take from an overhead or underground main small parcels of power, perhaps 10 to 50 kW, is apt to be expensive if the security of the supply is carefully considered, and in this connection there is probably room for a good deal of improvement without descending to the very elementary methods which one sees in vogue in foreign countries.

Mr. Kellaway and a Directorship.

We have no desire whatever to discuss the nature of the part taken by Mr. Kellaway as Postmaster-General in any negotiations with the Marconi Co. that arose during his term of office. That matter has formed the subject of questions in Parliament, and Mr. Kellaway has sent to the newspaper Press copies of a communication that he has addressed to Mr. Bonar Law on that aspect of the affair. Whether there were or were not negotiations does not affect our judgment of the case. It has been common knowledge that for many years there have been outstanding claims against the Post Office, and we, with others, have urged that some settlement ought to be arrived at without any further delay. We wish that they could have been finally settled before the late Government went out of office, so that Mr. Kellaway could have joined the Marconi board after all differences had been cleared up. Events, however, were against such a course. We have not a word to say against Mr. Kellaway as a man of honour and uprightness, yet we would rather that any Postmaster-General of recent years had seen fit to decline the directorship in question, at any rate for a time, however excellent his business qualifications for such a post might be. In the event of its falling to the new Postmaster-General to endeavour to arrive at a final settlement, will his position be rendered easier or more difficult because on the other side his predecessor in office (who cannot divest himself of inner knowledge acquired as Postmaster) is, as a director, a party to such settlement?

The British Empire Exhibition.

It is regrettable that any inquiry should have become necessary in order to remove "misconceptions," as they are called, regarding the use of British Empire products at the British Empire Exhibition. It ought to have been possible to ensure complete harmony and co-operation between all parts of the Empire. As differences exist, however, we can do little more than hope that Sir Wm. Joynson Hicks, Parliamentary Secretary to the Department of Overseas Trade, who has been appointed to investigate the circumstances, will be able to report to the Government and to Parliament with a minimum of delay. Everybody who is studying the world trade situation must see that we and our kith and kin overseas should come closer and closer together in the development of a definite Imperial trade policy. The resources of the British Empire are so vast and the needs of the Mother Country so urgent that a concentration of thought and activity in this direction is imperatively necessary. All the schemes advanced for giving employment cannot provide work for a million and a half of our people; general trade recovery must be the chief permanent contributing factor, and we must make any special arrangement for the years that lie ahead of us as we are to bring trade and industry back to the prosperity that means work for all. Our relations with the Dominions are therefore a matter of vital concern, and the cordial co-operation of all in the British Empire Exhibition of 1924 is absolutely necessary. Nothing ought to be permitted to stand in the way of complete success.

The Electrical Section of the Exhibition.

It must not be imagined for one moment that the investigation above referred to renders it any less necessary for electrical and engineering firms to send in their applications for space promptly. It is most important that intending exhibitors should file their applications before the end of the present month, as the Executive Committee should know by that time whether or not adequate space has been provided to meet the needs of all the manifold groups. The Machinery Hall and the Industrial Hall together covering a total floor area of 884,000 square feet (five times greater than the exhibiting space at Olympia), are two of the largest buildings, and already there is talk of one of them having to be extended beyond the area at present planned. As our readers are aware, the B.E.A.M.A. and the British Engineers' Association have made themselves responsible for the organisation of all machinery, engineering and electrical exhibits. Other industries will be provided for by their own special organisations, and many technical committees are at work. We have already given (Elec. Rev., August 11th, p. 193, and November 17th, p. 759) particulars relating to the electrical side of the exhibition, and we would now urge electrical firms, who so far have hesitated, or have deferred action, to come to an immediate decision, and let their requirements be known. We are in for a big electrical exhibition. Let everybody who counts be in it. Let us make it complete and impressive so that no doubt shall ever have place in the minds of visitors that the British electrical and allied engineering industry and its capacity and resources are great like those of the Empire itself. We close this comment with a renewed appeal for urgent attention and immediate action.

Guaranteed Loans for Electrical Undertakings.

The twelve-months' period during which the Treasury could guarantee loans under the Trade Facilities Act expired on November 10th. The limit placed on the guarantees by the Act was £25,000,000. The actual amounts guaranteed amount to about 23 million pounds. The electricity supply industry has come in for a certain share of this windfall. English electricity supply companies have secured £1,470,100, and the Calcutta Company £500,000. Of the English companies, the biggest allocation is given to the Shropshire Power Co. in the shape of a loan of £700,000 for 30 years, the loan to be devoted to the erection of the new generating station on the Severn at Stourport. This is the 105,000-kW station included in the technical scheme for the South-West Midlands Electricity District. The next biggest loan is to the London Electric Supply Corporation of £650,000, to assist it in the capital charges incurred in giving a supply to the South-Eastern Railway. This amount, of course, at one time was included in the covering loan (for electrification) to the South-Eastern Railway Co., but when the Electricity Commissioners decided that the Railway Company should not build its own station, the part relating to the generating station was allocated to the company giving the supply.

A satisfactory loan is the one given to the North Somerset Co. of £25,000, which is being used for a much-needed extension of mains through that rural area. The Lytham and St. Annes Co. has a loan of £50,000 for new generating plant and distributing mains; the Oxford Co. has a loan of £25,000, the Kent Power Co. £15,000, and finally the Minehead Co. (one of the infants in the industry) a loan of £4,500. These loans added to the lion's share taken by the railway companies result in the bulk of the loan falling under public utility services.

Last week, in connection with its proposals to relieve unemployment, the Government announced its intention to renew the Trade Facilities Act and to increase the maximum amount of capital in respect of which guarantees of interest may be given to £50,000,000; part of this credit will no doubt be allocated to the electrification of railways, but presumably the electricity supply industry will also receive assistance from it.

The foregoing measures relate to the support of private enterprise; in addition, the Unemployment Grants Committee of the late Government was authorised to assist local authorities' loan schemes up to a total of £30,000,000, of which about £23,000,000 has been allocated, and plans for the utilisation of the remainder are being considered, a large number of additional applications having been received, but we do not know to what extent electricity supply has benefited under this arrangement. Sir M. Barlow (Minister of Labour), in explaining the Government's proposals, stated that the railway companies would undertake their programmes of work, including electrification, without any Government assistance, except in the case of the South-Eastern Railway; he said also that electricity supply schemes involving an outlay of about £10,000,000 were being undertaken.

In connection with all these plans for the relief of unemployment, there is one point which, though of the utmost importance, may nevertheless be overlooked until the time for action has passed—namely, that the object in view is to employ *British* workmen. It is essential, therefore, that the condition should be attached to every Government guarantee that all material employed in carrying out the works shall be of British manufacture, and all labour of British nationality. It may seem absurd thus to lay stress on the obvious, but we are certain that the precaution here outlined is indispensable to the fulfilment of the purpose aimed at. We see how, at this very time, the management of the British Empire Exhibition has been arraigned at the bar of public opinion on the charge of having failed to safeguard the all-British and only-British character of that Exhibition; let us make it very certain that there shall be no basis for a similar accusation in respect of the application of British State-guaranteed loans.

Unemployment Insurance and the Electric Supply Industry.

The much-discussed question of replacing the present unemployed insurance by some system of insurance by industry seems now likely to be fully thrashed out. Some little time ago the Ministry of Labour tried to get the views of industries on this question, but nothing concrete resulted. There is, of course, at present a way of doing this to an extent by contracting out. The new Government, however, is apparently taking the matter up in earnest, and Sir Montague Barlow, the Minister of Labour, has sent a Memorandum on the subject to both employers and employed, namely, the National Confederation of Employers' Organisations and the Trade Union Congress General Council. It is explained that the Ministry has quite an open mind on the subject, and is solely inviting suggestions. It is obvious that the proposal would bear very differently on different industries. So far as the electricity supply industry is concerned, it would probably have as small a margin of unemployment almost as any industry. The ordinary staff is, of course, a permanent one. The intermittent labour is practically confined to the distribution side, and even here it is modified by the fact that a good deal of mains laying is done by contract.

Exact figures are not forthcoming, but for purposes of comparison with other trades one might take the figures given in the *Labour Gazette*. The figures given for the public utility undertakings for unemployment come to about 7 per cent., which it will be seen is very low when compared with shipbuilding, which often runs over 30 per cent., and the engineering and iron trades, which run well over 20. Further, this 7 per cent. is probably much higher than if the electricity supply industry were taken singly and especially if it were organised with a view to specifically equalising labour so as to reduce unemployment to a minimum. A revised insurance of this kind would probably necessitate some new representative body to deal with it. The only bodies which at present might do it would be the National and District Councils, but here the organisation on the trade union side is hardly adapted to the special requirements.

Industrial Relations.

Since the new Parliament has been in session we think we have detected a change in the discussions respecting industrial relations. It has become perfectly clear that we are up against a situation which calls for more action and less talk. We suggested a week or two ago that the men representing industry at Westminster should put heads and hearts together to settle the industrial problem. Schemes are developing for making employment; and industrial insurance matters have taken a definite turn so that we may soon see whether it is practicable for the industries of the nation to share their individual burden without restricting progress and hampering us in international competition; but the hard fact of unemployment has taught one thing very definitely, namely, that discussions and conferences of the usual order will not bring work to hungry households. The Prime Minister has been asked whether he will call a joint conference of employers and employed with a view to arriving at an agreed basis for the establishment of a permanent industrial Parliament. In our view such a conference or such a Parliament would be of little immediate use, and we agree with Mr. Bonar Law when he says that the Industrial Councils have demonstrated their value, and that any such action as was indicated by the question could only succeed if it were undertaken on the joint initiative of employers and workmen. Surely more than ever before we have these two classes now represented at St. Stephens's!

Among the signs of the course of the wind is a communication just to hand from the Industrial League and Council. As our readers know, we have again and again urged this organisation and the Alliance of Employers and Employed to join forces. For reasons of their own they have not done so, but we are pleased to note that in the present atmosphere definite steps in that direction are now being taken. A joint committee, consisting of four representatives of each body, has discussed the question of amalgamation and its recommendations are that amalgamation is desirable, that a provisional Executive Committee of 48 (50 per cent. employer and 50 per cent. employed representatives) be appointed to prepare a draft constitution, that all officials shall retire and new ones be appointed by the new body, and that amalgamation shall take place on January 1st, 1923, or as soon thereafter as possible. These recommendations were to be discussed at the annual meeting of the Industrial League and Council on Wednesday, but as we go to press with these pages before the result can be known we must be content now to hope that the right thing will be done and an amalgamated body, the "Industrial Alliance," will emerge, which will enjoy the confidence, and be free from the suspicion, with which the separate parts have been regarded.

What we ought all to be doing just now is to contribute each his little bit towards promoting useful work and trade. If we do that instead of haggling about pet theories and ideals that cannot possibly be realised at present, we shall add to the spirit of confidence which seems to be returning. If we are going to wait for the European situation to improve in order to revive our industries we shall need to pray to be forgiven. Let every British engineer and purchaser think many times before he allows his orders for manufactured articles to go past the British manufacturer. That will be an immediate contribution to the improvement of industrial relations.

D

HYDRO-ELECTRIC DEVELOPMENT IN TASMANIA.

A Comprehensive Scheme for the Generation of 350,000 Horse-power from Water-power, of which the Initial 58,000 Horse-power has been brought into Service.

By FRED. A. TALBOT.

In the popular sense Tasmania has always been regarded as being pre-eminent in the mining, fruit-growing, and lumbering industries, while, owing to its temperate climate and magnificent scenery, it is generally regarded as one of the beauty spots of the world, being extensively favoured by tourists from the Island Continent. Its position, due south of Victoria, whence it is but a few hours distant, renders it readily accessible.

Since 1916, however, the island state of the Australian Commonwealth has commanded greater attention as a manufacturing centre, and this is directly attributable to the remarkable enterprise which has been displayed by the Government in the exploitation of the island's immense hydraulic resources for the generation of electrical energy, the full extent of which has not yet been conclusively ascertained. Although this



Fig. 1.—The Great Lake.

activity is relatively of recent date, Tasmania has already achieved the distinction of possessing the largest hydro-electric installation in the Southern hemisphere.

The topographical conditions of the island, which has an area of only 26,215 square miles—less than one-fourth that of England—are conspicuously favourable, the country being very mountainous. This advantageous feature is magnificently seconded by the meteorological conditions, the rainfall averaging from 29 to 120 inches per annum. This precipitation is well distributed throughout the year, thus simplifying the conservation problem to a very pronounced degree.

From the hydro-electric engineer's point of view, few countries possess such attractive features, the extremely broken character of the island being favourable for the economical construction of dams for the formation of storage lakes and lagoons. The physical conditions are somewhat reminiscent of those of Norway, the table-land [illegible] area being situate at an altitude ranging from 2,000 to 4,000 ft. above sea level, thus assuring [illegible] static head. Indeed, generally considered, the conditions are almost ideal for the development of hydro-electric energy upon an extensive scale at an attractively low cost.

In the first instance, the exploitation of this remarkable power reserve was essayed by private enterprise, work being commenced upon what is known as the Great Lake Scheme some years ago. With the universal awakening to the possibilities of hydro-electricity, the Tasmanian Government, in the knowledge that the industrial prosperity of the country was essentially dependent upon cheap power, acquired control of the undertaking in 1914 to develop it as a national enterprise.

The catchment area of the Great Lake project is approximately 300 square miles, while the elevation ranges from 3,050 to 4,000 ft. above the sea. The annual rainfall on this plateau averages from 30 to 60 in., and the whole basin drains into the Great Lake by natural watercourses and by two channels from adjacent watersheds. Thus the Great Lake acts as the head reservoir providing the necessary storage to equalise the run-off from the catchment. This storage has a capacity of 50,000,000,000 cu. ft., 312,500,000,000 gallons, or 1,150,000 acre-feet.

This storage is one of the largest in the world, as may be realised by comparison with other large reservoirs:—

La Loutre, Quebec ...	3,662,000	acre-feet capacity.
Elephant Butte, U.S.A.	2,600,000	,, ,,
Assouan, Egypt ...	1,865,000	,, ,,
Roosevelt, U.S.A. ...	1,279,362	,, ,,
Great Lake, Tasmania	1,150,000	,, ,,
Burrinjuck, N.S.W. ...	771,641	,, ,,

When it was first decided to exploit this storage facility, a dam of the gravity type was thrown across the outlet, but this has been superseded by a reinforced concrete barrage of the multiple arch type, with the sill 3,333 ft. above sea-level. The theoretical potential horse-power thus forthcoming is nearly 250,000, but it is probable that only one-half of this total will ever be commercially utilised. The initial contribution, known as the Waddamana Power Scheme, which has been completed, and is now in operation, utilises 1,190 ft. of the available fall, the energy generated at the turbine shaft at the power-house continuously being 58,000 b.h.p. A portion of the balance of the commercially-contemplated aggregate is now being investigated, the proposal being to carry development up to 127,000 h.p.

From the Great Lake the water flows down the River Shannon for about five miles, when it is diverted by a low weir into a canal. This conduit, 3½ miles in length, has a bottom width varying from 33 to 60 ft., while the

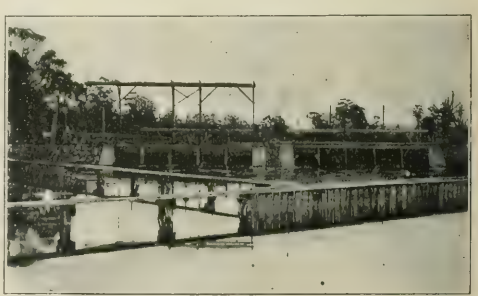


Fig. 2.—The Penstock Chambers.

maximum depth of excavation is about 16 ft. The water depth ranges from 3.5 to 4.5 ft., and as the grade of the canal is less than the natural fall of the country, differences in level are overcome by drops or falls in the bed of the canal.

The canal discharges into a large depression measuring about a mile in length by about half-a-mile wide, covering 360 acres, known as the Lagoon. Confinement of the water in this basin is assured by three long earthen embankments, pitched with rock on the water face, sealing the natural vents. The top of these banks is at an elevation of 3,009 ft. above sea-level, while the

banks have a total linear measurement of 3,500 ft. The difference in level, sill to sill, of Great Lake and the Lagoon is thus about 328 ft., which is overcome by natural waterway and canal in 8½ miles. The Lagoon is thus an extensive lake, the depth of water in which is about 6 ft. maximum, with an average varying between 3 and 4 ft. It constitutes an important feature of the scheme, acting as it does in the capacity of a subsidiary or balancing reservoir, capable of meeting large fluctuations in the load with a constant discharge down the canal from the Great Lake, while, if the occasion arises, it also permits the canal to be shut down for a short period to permit inspection, repair, or any other work which may become necessary.

At the lower end of the Lagoon are the penstock chambers regulating the flow of the water through the pipe lines to the power-house. The penstock chambers (fig. 2) are duplicate reinforced concrete box structures with coarse and fine screens, sluice gates, and valves. The pipe line is an interesting feature of the hydraulic installation for the reason that for the most part it is of wood construction. The original line was 48 in. in diameter, but at a later date three additional lines, each of 60 in. diameter, were laid down (fig. 3). The lines, erected by the Australian Wood Pipe Co., are constructed from wood staves, approximately 6 in. in width, planed to the shape of a segment of a circle, and held together to the designed section of the pipe in the usual manner by circular steel bands and a shoe for cinching.

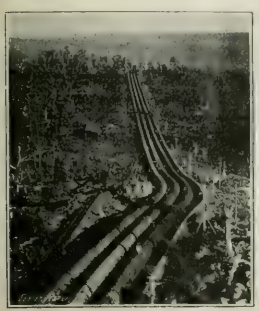


Fig. 3.—Wood Pipe Lines.



Fig. 4.—Steel Pipes and Power House.

By recourse to wood, pipe-line construction was rendered simple and inexpensive, while the material has proved highly effective in service; repair and maintenance are also easy. Actual construction was carried out expeditiously owing to the simplicity of the foundations. These comprise merely logs cut in the adjacent bush, adzed to the shape of the pipe, and laid upon the surface of the ground, with stone packing to preserve the grade. There was no elaborate excavation to maintain the grade, while construction round curves was also found to be a simple operation.

Each of these wood-stave pipes is a mile in length, and carries the water down to 150 ft. head. The 48-in. wood pipe then branches into two welded steel pipes, while the 60-in. stave pipes are reduced in diameter. Two are reduced to 54 in., which diameter is continued for 630 ft., where junction is effected with 54-in. steel riveted pipes, each 1,670 ft. in length. The third wood pipe is reduced in diameter from 60 to 49 in., and the latter diameter is continued for a distance of 2,300 ft., carrying the water down to 400 ft. head. This is probably the largest wood-stave pipe in the world, with water pressure at 400 ft. head, and was built during the war for the simple reason that steel plates could not be obtained.

The balance of the pipe lines leading the water to the turbines comprises two 950 x 750 mm., and two 50/46-in. welded steel pipes, one 50-in. and two 36-in. lock-bar pipes, respectively. These all connect with a common distribution pipe, 36 in. in diameter, outside the power station. Through valve sectionalisation, any one pipe can be shut off. The static pressure in the pipe is due to 1,120-ft. head, the steel of the 46-in. pipes just outside the station being 15/16 in. thick. All the steel pipes are supported on concrete and masonry piers; all bends are encased in massive concrete anchors to overcome thrust due to change of direction, while expansion joints are spaced not more than 100 ft. apart.

The distribution pipe has nine branches, each feeding a Pelton water wheel. The wheels run at 375 r.p.m. The water leaves the nozzle to strike the buckets at a velocity of 250 ft. per second—170 miles an hour—and after impinging upon the buckets drops into the pit to flow through the tail race, discharging into the River Ouse.

The power-house is at Waddamana, where a convenient site in a dip and beside the River Ouse was staked out for the building and the village which has sprung up, the housing accommodation for the staff and others being laid out on garden city lines. The power station, 272 ft. in length, carries seven 8,000-h.p. and two 4,900-h.p. Pelton wheels directly connected to horizontal alternators (fig. 5). There are also two exciter sets, each of 180 h.p., and two 440-h.p. motor-generator sets. The turbines are governed by oil-pressure governors driven by belts off the main shaft. Current is generated at 6,600 volts, 3-phase, 50 cycles. The alternators are air-cooled and enclosed, inlet and outlet air conduits being provided in the foundations.

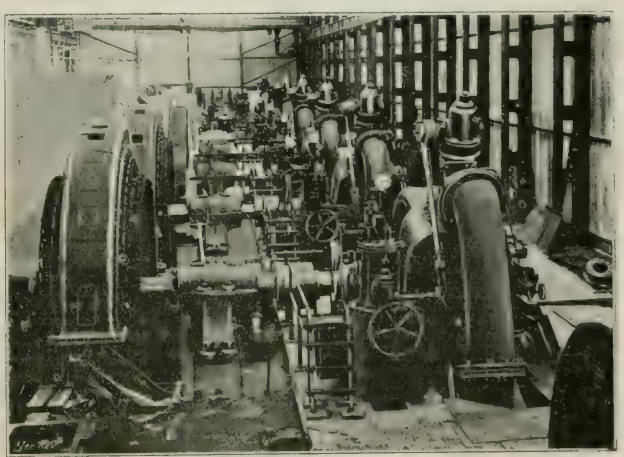


Fig. 5. Interior of Power House

A double bus-bar system is adopted, which, with 22 of the latest type, remote controlled 6,600-volt oil switches, reactances, &c., is situate in the switch gallery along the east side of the turbine room and under the same roof. Reactances are in the basement, bus-bars on the ground floor, and switches on the gallery floor, which is open to the turbine room. The control bench-

board is at the south end of the switch gallery and approximately in the centre of the station. From this point the whole generator and transformer station is controlled. Between the control benchboard and the operating valves of each turbine electric signalling is installed, while the electric control of the governors is placed on the benchboard. Opposite the last-named is a vertical switchboard controlling the battery, d.c. power, and all lighting. On this board is also mounted the temperature-indicating equipment for the generators and transformers. At right angles to this board is a four-panel vertical board controlling the a.c. auxiliary and the light and power supply for the village.

The battery and motor-generator sets are situate on the turbine floor level. The station auxiliaries are supplied from 6,600/415 and 240-volt transformers. There is a 300-ampere-hour (10-hour rate) battery supplying direct current for the operating mechanism of the oil switches and for emergency lighting. On this same level and under the one roof is the station workshop.

The transformer equipment comprises seven banks of 7,000-kVA step-up transformers of the outdoor type, transforming from 6,600 to 88,000 volts for supply into the main transmission system. The supply to the line is through disconnecting link switches to the 88,000-volt bus-bars, the take-off by the transmission line being through oil circuit breakers and disconnecting switches. Electrolytic lightning arresters protect the station at this bus.

The transmission system extends from Waddamana to the step-down transformer station about three miles from the centre of Hobart, the distance being 63 miles, and the power is transmitted at a pressure of 88,000 volts over four circuits carried on two steel tower lines. Two circuits are each of 10,000 h.p. capacity, while the other two are each of 20,000 h.p. The 10,000-h.p. circuits consist of three 7/.097 (.05 sq. in.) stranded bare copper conductors attached to the tower cross-arms by string disk-type insulators. Those for suspension comprise four or five disks, while the strain insulators are of five and six disks, the number varying according to the type of disk insulator used. The second two circuits are of similar construction, but are 19/.083 conductors.

(To be concluded.)

SALESMANSHIP IN ENGINEERING.

(Communicated.)

Modern salesmanship is a science and an art. In its application to engineering this appears with much persistency, and only a salesman thoroughly conversant with the laws and principles of selling can hope to achieve success.

In selling engineering products the salesman has many things to contend with; the chief are keen competition, a lack of technical knowledge on the part of some buyers, reputation on the one hand and pure conservatism on the other. Many buyers rely upon the reputation and standing of a manufacturer as a guide to their purchasing—a sound policy, no doubt, but not always an economical one. Keen competition has forced more modern manufacturers to produce articles that can and do compete with the productions of firms with bigger reputations, and experience has proved that their productions are as efficient and reliable, and sometimes more so. However, this does not lighten the task of the salesman selling for little-known manufacturers. For that reason in particular the representative of such a manufacturer must be well versed in the art of salesmanship if he is to overcome the prejudices of a buyer.

There are two branches of selling—the selling of staples and the selling of luxuries. Staples comprise foodstuffs and the like and come under the heading of necessities. Very often they are extensively advertised, a fact which often determines the policy of the buyer; consequently the disposal of such articles does not call for much studied effort on the part of the salesman. Luxuries, however, call for different treatment. The term "luxury" should be taken broadly, for under that head are classed all manufactures not generally recognised as every-day necessities. Yet a luxury may be also a necessity. To many motor-cars are luxuries, but the doctor and the business man, finding their cars indispensable, will say without hesitation that they are necessities. Most engineering articles, while not actual necessities, are indirectly of vital necessity in modern life. This is best understood when one realises that all commercial and artistic progress is due entirely to the unceasing labours of the world's engineers, and all commercial developments are based on engineering enterprise. There is no trade or profession that does not owe something to the engineer, and, similarly, there is no new industry that does not call for engineering help. In short, engineering, in some form or another, is at the back of every commercial enterprise. From such a statement one would be justly excused for thinking that the engineering salesman has a unique field for his operations. He has; but that field is by no means an easy one. Most engineering salesmen are concerned with new *developments*, and a conservative world is very slow to adopt them. When Stephenson invented the steam engine he was laughed at, but to-day, as a result of the perseverance and energy of the engineers who followed him, there are huge steam locomotives hauling trains of over 1,500 tons.

The engineering salesman is faced with a big problem, and it is therefore worth considering the qualities that he must possess. Broadly, he must be a competent engineer as well as a capable salesman, for not only must he be able to sell his articles, but he must be able to expound them and demonstrate their suitability to requirements.

First of all, then, the salesman must have an intimate knowledge of the article he wishes to sell, the process by which it is manufactured, or, alternatively, its construction and its selling points. He will also find it advantageous to be familiar with the selling points of competitive articles. He must have confidence in his goods, in the business he represents, and in himself. He must possess unbounded energy, enthusiasm and optimism, courage, tact, and perseverance. He must also possess the sense of perception and judgment. In appearance he must be neat and well-dressed. Vulgarity in dress creates a bad impression, and the first impression is all important. It is invariably fatal for the salesman to present himself in any but a favourable manner. Then he must be able to talk convincingly on specialised subjects, as well as pleasingly on matters in general. These are the essential qualities of a good salesman.

Broadly speaking, there are three types of people the salesman will encounter—the stolid, the nervous, and the self-confident. The first is recognisable by a certain deliberateness in appearance and manner. He talks little, and it is not easy to gather what impressions are being made upon him. Full details should be given him, as he is not usually capable of forming intensive mind pictures of the article under discussion. The second, the nervous man, is the antithesis of the first. Usually of slight physique, of uncertain and abrupt manner, he invariably forms his own conclusions before the salesman has given much information. The condensing of facts is necessary with this type, a mere outline of the article being all he requires. Intuitively,

he will visualise the details. First interest him. The third, the self-confident man, comes between the stolid and the nervous. It is difficult to describe him accurately, as his type varies so much between the wide limits of the stolid and the nervous. It is generally safe to be prepared for this type, if it is not obvious from the first that he belongs to one of the extremes, by treating him to facts and by getting to business at the start. From his subsequent conversation it will generally be possible to learn what course to pursue—whether to expand or condense one's information. Very often the self-confident man is inclined to be cynical. The salesman should not overlook this fact, but he must not be influenced by it, and he should remember that straight talking and a clear presentation of facts appeal more to this type than any tricks of salesmanship.

The next important thing the salesman must understand is the manner of approach. Experience counts for much in this, as no two cases call for the same treatment and no two human natures respond alike to the same suggestions. In all cases it is necessary that interest be created at the start, for interest is vital to the satisfactory conclusion of any sale. When an inquiry comes direct from a prospective buyer, interest has been created by advertisement or some other means. Where no inquiry is received the salesman must create the interest. For example, I have in mind the case of an indifferent salesman who, some years ago now, called upon a much-harassed business man with the object of selling him a typewriter, but so befogged him with illustrations, pamphlets, and a lengthy explanation that the sale was never concluded. Later, an enthusiastic and enterprising salesman called on the same business man for the same purpose. While engaging his attention, the salesman set up a typewriter and then asked the prospective buyer to dictate any matter he wished. He complied, and watched with interest the salesman type out the message as it was given. Handing the neat typewritten sheet to the gentleman, the salesman said, "That's what it can do, and the speed at which it can do it." The sale was effected. This is an example of correct approach, the creation of interest and thorough familiarity with the article offered.

It is not always practicable, however, to place the article before the prospective customer. The salesman cannot set up an engine in the other man's office, neither can he expect him to go and see an engine working at some other place. He must find other means, by the power of suggestion, of creating interest, and this is often done by arousing curiosity in prospective buyers' minds and a feeling of something to be desired. The salesman's opening remark should, therefore, be one likely to command the person's quick attention. As an illustration: A salesman travelling in the South of England came across a flour mill driven by an old wooden water-wheel. Sensing the possibility for the sale of an oil engine, he proceeded up stream and measured the flow of water, calculating therefrom the probable horse-power developed by the wheel. He also made a few inquiries as to the amount of business done by the miller. Finally, obtaining an interview with the miller, he said, "I would like to put you in the way of doubling your turnover and more than doubling your profit." And he compared the work obtained from the water-wheel with the work the miller could do with an oil engine and a slight increase in plant. The miller was interested, and subsequently made the conversion.

But the salesman cannot always expect success from these methods. Sometimes his man will not be interested. A conservatively-minded person is the most difficult to interest, but even here continued perseverance and tact will often meet with success. Here is an actual instance: The sales manager of a large electrical undertaking had tried repeatedly to interest the very conservatively-minded owner of a steam-driven engineering works in the advantages of electric power, but without success. Time after time he called, but always received the same answer: the engine had served the owner's father and would serve him, and no argument would convince him to the contrary. One day when the salesman called he found the works shut down. The steam plant had given out. Without waiting to be invited, he examined the engine, located the trouble, rectified it, and got the engine running again, much to the astonishment of the owner. A few days later he received an invitation to call, and then learnt that he had so impressed the owner by the kindness of his assistance when he might have used the occasion as an argument in favour of electric power that the owner intended to install electric motors right away.

Much more might be said on the methods and details of a salesman's equipment and campaign, but such things are largely matters of experience and occasion.

However, the principle is this—and the buyer must realise this fact: The modern salesman is not a tout, but a thoroughly capable and live member of the business community, seeking, by his efforts and specialised knowledge, to introduce the most efficient article to the buyer, to the benefit of buyer and seller alike. That salesmanship is being recognised as a specialised art is proved by the increasing number of firms which have instituted their own organisations for the training of their salesmen.

THE APPLICATION OF ELECTRICITY TO AGRICULTURE.

By R. BORLASE MATTHEWS, M.I.E.E.

In connection with the Engineering Exhibition that was recently held at Cardiff under the auspices of the South Wales Institute of Engineers, a conference was held at the Institute, at which several papers were read and discussed, amongst them being one on the above subject, in the course of which the author said, *inter alia*:—

Undoubtedly one of the main factors essential in economical farming is the reduction of the power cost (be it of man, horse, or other agent) to the lowest possible figure. It is not generally realised that the total amount of power employed on the farms, even of this country, far outweighs in the aggregate that required in any other industry. Nearly 200 British farms are now making some use of electricity, and their practice is supported by many thousands of farms on the Continent, in the Colonies, and America. In point of fact the encouragement of the use of electricity is one of the avowed objects of the agricultural policy of several countries. The British farmer is in a very sad plight, hence it is necessary for the engineer to come to his assistance, and this he can only do by a careful study of the farmer's requirements.

On the list of the present applications of electricity to farming the items already reach the respectable total of 165, and doubtless there are a considerable number more. Even at the very high rate of 10d. per kWh the cost of producing a given effort on a farm is cheapest by electrical means, tractor effort costs 2.3 times, horse effort from 5 to 6 times, and man-power at least 17 times as much to perform a given task. By these facts it is not intended to demonstrate that the horse should be entirely superseded on a farm, as there is often some special work that is not easily carried out by machinery. However, on the electrically-equipped farm one horse should suffice for a small holding, and two for those of 300 acres or over.

Steam-generated electric power is sold more cheaply at Newcastle than hydraulically generated power at Niagara. Owing to the high cost of water-power development the annual interest is often higher than that of a steam station plus the cost of the coal it consumes. It is much cheaper to obtain power from a public supply, but the average farmer can very profitably generate his own electric power.

Cost of Equipping a Farm.—On the basis of credit for using some of the unsuitable existing plant the average 300-acre farm could be electrically equipped for about £900 and a 600-acre farm for about £1,100. A small farm of under 150 acres without an electric plough would require about £1

capital per acre. To modernise an existing equipment is always very different from starting out with an entirely new installation. The net result of expending this new capital would mean an increased annual profit of about £300 per annum on a 300-acre farm; on a farm of under 150 acres a return of about three-fourths of the capital invested per annum, and on a 600-acre farm a return of about £650. If weather were to adversely affect neighbouring farmers these profits might easily increase by 50 per cent., due to hay making, corn-sheaf drying, ploughing, &c., being carried on by electrical means regardless of weather conditions, *i.e.*, what would otherwise be losses are turned into gains. The above figures indicate an enormous return on the extra capital expended, and in a bad year would make all the difference to the balance sheet of the farm. Most farms are so badly engineered that in many cases a new farm could be electrically equipped by an experienced engineer at very little more than the cost of the existing equipments on other farms; and certainly there would be a great reduction in the running and labour costs of the electrically-equipped farm.

Energy Consumption.—Continental experience shows that the annual consumption of electricity in farm buildings alone is proportional to the size of the whole farm, and averages 10 kWh per acre. The consumption in the farm-house would average 7 kWh per 33-watt lamp per annum, or an average of 210 kWh. To this must be added 800 kWh for heating, cooking, and domestic power. If the farm were very modern there would be, in addition, a consumption of 33 kWh per acre of arable land for ploughing, plus one-third of this for cultivation, electro-culture, electric silage, harvesting, &c., or a total of 44 kWh per acre.

TABLE I.—ENERGY CONSUMPTION

Area of farm acres.	Usual farm buildings, max. demand, h.p.	Farm buildings, kWh per ann.	Farm land, kWh per ann.
1		10	44
150	3	1,500	6,600
300	5	3,000	13,200
600	15	6,000	26,400

Load Factor.—On an intelligently equipped farm a load factor of 33 per cent. may be anticipated. Table II. gives some idea of the approximate load factors of some electrically equipped farms.*

TABLE II. LOAD FACTORS.

Type of farm	Farm only, per cent.	With addition of farmhouse lighting, cooking, and part heating, per cent.
Dairy	13	24
Mixed	15	25
Arable	31	33
Poultry	40	45

Since the size of farms varies considerably, it is useless to assume that, if a 600-acre farm has a demand of 25 kW, the generating station demand will be 25 kW per square mile. In any event, the supply undertaking would run its lines along the route of the maximum demand, and Continental experience shows this practice to be advantageous in units of 50 kW. Further, farms cannot be considered apart from rural industries and the varied demands of even small villages in the same neighbourhood.

Distribution.—This is not so troublesome as might at first be anticipated, since each stationary ploughing gear has to be brought into only one corner of the field it has to plough, it is merely necessary to bring the distribution lines within reach of the plough flexible electric cable, which is usually over 100 yards in length. Permanent lines are justifiable if other operations than ploughing are undertaken. However, on the Continent, to economise in copper, posts and insulators are installed permanently and the copper lines are moved about as required. The author has one transmission line crossing his farm, and has planned one other line at right angles to it. He hopes that this simple arrangement will be sufficient for all the farm field requirements. The author employs a bare-wire overhead ring main encircling the farm buildings, and taps off this at convenient points, with insulated conductors attached to the line by a special fitting of his own design.

On the Continent it has proved most useful and economical to employ electricity on small holdings of a few acres. Electricity costs so very much less than human labour that it is most important to let it do all that it conveniently can. The capital investment is low, for the power required rarely exceeds two or three horse-power. As regards the use of electric power in the farm buildings, the methods employed are more or less on conventional lines. The author's experience is that direct drives (with either fixed or portable motors) are most suitable.

*The load factor of [illegible] cooking factories is 5 per cent., and that of engineering works 6 per cent. Printing works have a load factor of [illegible] per cent., while cloth factories have a load factor of from 15 to 25 per cent.

Table III is illustrative of typical farm electric drives and the economies that are effected thereby:—

TABLE III.—ELECTRIC DRIVES.

Machine.	Work done per hour.	Speed of machine pulley.	Size of motor.	Work done per kWh. consumed.
		R.P.M.	H.P.	
Cake-breaker ...	13 cwt.	140	1	1¼ tons
Chaffing	3 tons	300	10	0·5 ton
Churn (with butter worker)	170 lb.	30	2	165 lb.
Clipper (horse) ...	1-2 horses	1,300	¼	3-4 horses
Cream separator ...	135 gallons	650 (bowl 6,000)	½	260 gallons
Ensilage cutter (rye)	5·5 tons	300	10	0·66 ton
Feed grinder ...	40 bushels	1,800	25	3·3 bushels
Groomer	6-7 horses	1,300	1	9 horses
Harvester and binder	2 acres	360	*1½	1·5 acres
Milking	90 cows	42 pulsations, central pump, 390 r.p.m.	3	52 cows
Oat crusher	50 bushels	500	2	22 bushels
Root cutters ...	6 tons	150	2	6 tons
Thresher	150 bushels	1,200	15	7·7 bushels

Ploughing.—Extensive practical work in Germany, Sweden, Italy, and France has shown conclusively that electric ploughing offers all-round advantages over any other method. Much progress has recently been made in the construction of electric ploughing sets. For work on the average farm the single rope, double-drum method (similar to the Howard steam round-about system), appears to be the most suitable.

The electric system differs from its steam predecessor in that the haulage gear is very much lighter and the anchorages are much improved, and have not to withstand such great strains. The system is well adapted to small fields, as the haulage set only enters one corner of the field. (Very large fields would be ploughed in several sections.) Once set up in a field two comparatively unskilled men only are required. The effort required to plough is practically directly proportional to the total area of the furrow slices being cut at a time. Two speeds are usually provided, namely, 3 ft. per second (2 m.p.h.), and 5 ft. per second (3.6 m.p.h.). While the maximum furrow length with horse ploughing is about 250 yards (and from 15 to 20 per cent. of the day is spent in turning, exclusive of resting), the electric plough will travel any distance desired, the limit being set only by the difficulty in signalling, which is experienced where the furrow exceeds a quarter of a mile in length. Turning time is only from 15 to 30 seconds per furrow, and no resting periods are required. Table IV. gives actual results obtained with electric ploughing equipment:—

TABLE IV.—ELECTRIC PLOUGHING.†

(Average land in good heart.)

Depth of furrow, in.	Acres ploughed per hour.	Consumption, kWh per acre.
6	2.5-3	14
8-8.75	1.8-2	17
10	1.8	18
12-12.75	1-1.25	24‡
12-14	1-1.25	33
10, plus 6 subsoiling.	1.25-1.4	36-40

TABLE V.—COST OF PLOUGHING.

(Assuming a net effort corresponding to 15 h.p.-hours per acre.)

Methods of haulage.	Cost per unit, pence.	Cost per acre for equal conditions.
Horses	48	£2 0 0
Oil-tractor	23	£1 0 0
Electric	5	£0 6 8

In the above comparison no allowance has been made for interest, depreciation, repairs, &c., for the plough or for the ploughman's wages; management and overhead expenses are not included. With the improvements which will undoubtedly be made in electric ploughing sets the economy of using electricity will eventually be much greater than is indicated in Table V.

Electro-Culture.—By the stimulating effect of the influence of electricity on plants a definite minimum increase in the harvest yield can be obtained. The author is satisfied that an electrically-treated crop may be reckoned upon to produce at least 10 per cent. more grain and a proportionate increase in straw.

Haymaking.—The farmer need not, in future, wait for the weather, for the aid of electricity provides an artificial

*For knife and binding mechanism.

†Figures for "acres ploughed per hour" depend on the capacity of the ploughing set. The consumption is independent of the actual time taken to plough an acre.

‡This result was obtained when ploughing 3-year lucerne on sun-baked land.

means of producing hay as good as, if not better than, good natural hay, and certainly much better than can be made under normal bad conditions. To obtain properly cured hay as distinguished from merely dried grass (since the latter has no fodder value for animals) temperature control must be employed which allows certain bacteriological and chemical changes to take place. The results obtained in this country should go far to revolutionise haymaking and save the farmer very considerable sums of money.

Table VI.—Haymaking.

	Sun-made. s. d.	Electric fan-made. s. d.
Cutting	10 0 ...	... 10 0
*Turning (twice) ...	6 0	... Nil
*Raking (once)	3 0	... Nil
Windrowing	3 0 . .	3 0
Carting and stacking	18 0	. 18 0
Cost of electrical power	Nil	1 3
Interest and depreciation of blowing plant costing £60	Nil	... 1 0
Total costs per acre	£2 0 0 ...	... £1 13 3

Harvesting.—The author has proved that an electric motor driven binder (obtaining its power from a dynamo mounted on the tractor that hauls the whole outfit) will cut one-third more acres of corn per day. Also it cuts the straw closer to the ground—a matter of considerable importance when the straw is short as happened in some parts of the country this year. Actual results in this country show that advantages are actually gained. Immediately after cutting the corn can be stacked and dried, in a similar fashion to that described above for hay.

Electro-Silage.—The method of conserving green fodder in silos for the winter has lately come into extended use. It is claimed that by electrical silage, of which there are already nearly 100 examples in Germany, fodder is better preserved, as objectional bacterial action is arrested before it has time to do any damage. The power required is up to 10 kVA for a silo of about 20 ft. in height and 14 ft. in diameter; the time required is from 24 to 48 hours and ten tons of fodder require between 130 and 200 kWh.

Threshing.—In order to reduce the power and also the number of hands required it is now found advantageous to carry out the work in two stages. In the first machine the corn is threshed and cleaned sufficiently for the farmer's own needs. In the second stage only that portion of the corn (from the thresher) that is intended for market is finally dressed, cleaned and graded. Either machine can be driven by a 5-h.p. electric motor.

Table VI gives particulars of tests carried out on Dutch farms with threshing machinery of the type described above. Similar equipment has been installed at the author's farm.

Table VI.—Cost of Power for Electric Threshing.

(Commercial tests with electrically-equipped machinery).

Crop	Bushels	Time, minutes.	kWh consumed.	Cost of power at 5d. per kWh.
Barley†	50	60	5.98	2s. 6d.
Oats	50	60	5.24	2s. 2d.
Rye‡	52	150	12.3	5s. 2d.
Wheat	98	140	11.0	4s. 7d.
Stacking straw§	1,100 lb.	11.3	0.72	3½d.

When a trusser is used for binding the straw the power consumption is increased by one-eighth kWh per hour, but three or four workers can be dispensed with. The cost of running the trusser is only 9d. per hour with energy at 5d. per kWh. In contrast with the above power cost of less than 5d. per quarter, a prolonged test on an oil tractor-driven thresher at a farm in Kent recently gave a power cost (inclusive of interest and depreciation, but not including tractor driver's wages or management expenses) of 28d. per quarter on 850 quarters.

Conclusion.—In this paper an attempt has been made to collate, in a brief summary, some of the more important aspects of electro-farming. It has dealt with the practical present, without attempting to look into the future. The solution is most satisfactory to the business-like farmer, for it is far removed from being merely a rich man's hobby, or the idea of an eccentric. After all it is but the application of the principles of other industries to agriculture. The work described has either been carried out on commercial lines at the author's 600-acre farm, or else has come to his personal notice when carrying out trials on, [illegible] or inspecting Continental farms.

Discussion.

There was a large attendance, and many of the South farmers showed a keen interest in the lantern slides and kinematograph pictures illustrating the applications of electricity to farming. Mr Richard Stratton, a Midland farmer, opened the discussion by saying that electricity appeared to have an adaptability which few of [illegible] and there must be a great future for its use in farming. A young man, before he started farming, should undergo training for a year or two in agriculture, and even in electrical engineering. He understood that electricity had a very important effect on vegetation, and the question arose whether it should not be generally applied by farmers.

With regard to the hay-drying system he [illegible] thinking that those who advocated the use of electricity were right.

Mr. W. W. Hood expressed the opinion that they were on the eve of a revolution in agriculture [illegible] through the utilisation of electricity, and he went on to explain the experiments which he had conducted upon [illegible] which he had cultivated. He had found his knowledge as a mining engineer, he said, of real use to him in carrying out his experiments with regard to hay-making under varying climatic conditions.

Mr Illtyd Thomas, Cardiff, had come to the conclusion that electricity, as applied to farming, was becoming a very practical question. Farmers were as a rule very conservative, and it took a long time to get them to adopt new principles, but he sincerely hoped that the agricultural community would adopt the use of electricity.

The Chairman (Mr. David E. Roberts) commented upon the use of electricity on even small farms and small buildings, and referred to the great development which had been made in Canada through the utilisation of electricity on farms. When there he was very much impressed by the progress made in this direction.

ELECTRICAL POSSIBILITIES IN IRELAND.

Lecture and Discussion at I.E.E. Centre.

An interesting address on the development of electrical industries in Ireland was delivered at Dublin on November 24th by Prof. W. J. Lyons, Head Master of the City Technical Institute, under the auspices of the Institution of Electrical Engineers, Irish Centre. Mr. E. C. Handcock, M.I.E.E., chairman of the Centre, presided.

Prof. Lyons said, *inter alia*, that the time was opportune for the consideration of the important developments which the utilisation of electricity suggested, and went on to urge that in Ireland such developments were likely to be best effected by one general Irish company, sufficiently capitalised by Irish capital, working on satisfactory bases, as required, with other countries. There had been a transfer of important powers to the Free State Government, and in this connection he dealt in some detail with the problems as to limit and scope of manufacturing, assembling, repair work, possibilities in the matter of radio telegraphy, the position of things in relation to patents in the new State, and the respective aspects of capital, labour, and organisation. A recent comprehensive Continental tour had enabled the lecturer to submit valuable analyses for the information of the Centre. It was most desirable, he contended, that they should do all they could to promote and foster electrical industries in their midst and, to that end, to provide gear and equipment.

Alluding to a direct radio telegraphic service, he remarked that France, Belgium, and other countries were watching the technical and commercial aspect of the question, and they should do the same in Ireland, where they should have a direct service established in the Post Office system, for, he added, the importance of a terminal in Ireland appeared to be more clearly realised abroad than it was at home. There was no reason why they should not be able in that country to assemble the various complex and component parts. He thought the question of skilled labour should not be emphasised too much. Until recently, when anything went wrong with electrical gear, they had to send across the Channel to have it made right. That was not as it should be. There were no people more capable than the Irish of acquiring and making the most of technical instruction, or of taking advantage of organisations set up on their behalf and of the necessary capital invested. He did not consider that the Government should have control, and did not favour monopoly, but the Government might be induced in very exceptional cases to favour protective tariffs, and in [illegible] the best terms might be made with other countries.

Discussion

Mr. G. M. Harriss agreed with the lecturer's proposal, stating that from a small start they could build up large industries. They were all aware of what had been done in

*These operations would be repeated in unfavourable seasons and the cost would consequently be greater. The fan-made hay cost is independent of weather conditions. It must not be forgotten that the present method of cutting and carting can be simplified and changed where field drying is not required. This will reduce the cost of fan-made hay still further

†Thresher equipped with treble cleansing apparatus.

‡6,300 lb. of straw.

§The straw was unloaded from cart and blown on top of a stack 33 ft. high.

Ireland during the war, when they had to fend for themselves in the matter of repairs and in other respects.

Mr. Porte observed that the Irish were as keen and quick as any other people in picking up details of electrical affairs. He advocated small undertakings, which should be built up on their merits.

Mr. Darrell Figgis said it might be that they would have to pay more for materials at home, but they would, in the long run, find it perhaps cheaper to use home materials than to get those of foreign manufacture.

Prof. Clarke endorsed views expressed as to the value of small undertakings.

Mr. J. J. Symington said he had often felt the disadvantage accruing from the fact that almost every penny spent on electrification works was leaving Dublin and leaving Ireland, and he hoped the lecturer's address would help to stimulate native energy and enterprise.

SALESMANSHIP IN THE ELECTRICAL INDUSTRY.

Mr Wallace Attwood, the expert trainer of salesmen, delivered the second of his series of three lectures on "Theory and Practice of Salesmanship in Relation to the Electrical Industry," under the auspices of the Electrical Development Association, on December 1st. In the absence of Mr. Hugo Hirst, Mr. L. L. Robinson, of Hackney, presided.

Mr. Attwood first dealt with the question of what was meant by the term "value" in selling. He said that in every instance, value lay in the service, satisfaction and pleasure an article gave the buyer, rather than in its intrinsic worth. In general, the value of an article was the degree in which it could supply the needs of the customer or contribute to his personal satisfaction and pleasure. In all cases, the value of an article could be greatly enhanced by the way it was presented and the personal service surrounding it. Sometimes value was expressed as the price the commodity would bring in the open market; in other words, "supply and demand." The difficulty, therefore, was to measure value, and there was no one standard method of doing it. By the aid of charts, the lecturer explained intrinsic value, distribution value, and usage value, passing on to production charges, distribution charges and sale charges, and demonstrated how these all contributed to a true approximation of value and selling price. At the same time, he emphasised the point that there was a big difference between value and price, and repeated what he said in his first lecture that the good salesman would put price on one side and deal in his commodity on the basis of the service the article would render the purchaser.

Comparing the relative values of a large diamond, a bottle of medicine and an electric radiator, he pointed out that the diamond would always retain the value denoted by the price, and the value lay almost entirely in its intrinsic worth. In the case of the bottle of medicine, the intrinsic value was negligible compared with the service. On the other hand, in the case of the radiator, this had an intrinsic worth and an added value by reason of the use to which it could be put. Hence the radiator was justified both by its intrinsic value and by its use or service.

Another point emphasised was that the salesman was the last link in the chain between the manufacturer and the customer, and he repeated the maxim that "Sales always precede profits." In order that the salesman should be as efficient as possible, a general plan was outlined dealing with the analysis of the product; this would be modified, more or less, according to the particular product, and after the analysis had been assimilated by the salesman, it was recommended that he and his firm should undertake an analysis of the range of possible purchasers. It was remarkable, said the lecturer, to find the large number of firms that adopted "hit or miss" methods in assessing the complete field of demand which existed for their products. He believed that it was safe to assert that the full possibilities for any product had never been fully exploited. Even where there was a near approach to this ideal, the gradual march of time, cycles of trade, altered circumstances, and the evolution of the habits of the consuming public, continually presented new opportunities to the sales manager who used correct methods of analysis for enabling him to keep his finger on the pulse of the buying public. An "Analysis of the Market" was then shown in detail.

The next branch of the lecture dealt with getting more business and indicated the various more or less well-known methods, such as direct approach and impersonal approach, through the medium of publicity, window display, and the post. The lecture gave [illegible] advice to the young man just commencing [illegible] salesman.

There was not [illegible] One point made by the lecturer both in the first and the present lecture was that the price should not be cut but that sales should be on quality and service. [illegible] Mr. Ford asked how it was that Mr. Henry Ford was able to cut his price and yet sell. Mr. Attwood replied that Mr. Ford did not cut prices on the road, but had concentrated on production methods and so was able to sell at a very low figure and at the same time pay high wages.

Mr. Gillott asked whether a manufacturer should have a higher percentage of profit when he sold directly than when he sold through a retailer, or if he advertised in such a way that the public were induced to go to the wholesaler or the retailer.

Mr. Attwood said that a manufacturer always allocated a certain proportion to advertising, and the selling price took that into consideration. It followed, therefore, that if the sales were direct to the public and the manufacturer charged the same price as the retailer, then the manufacturer would get a higher rate of profit but the public would pay the same. On the other hand, the fact that the manufacturer advertised largely, enabled the retailer to sell more of the article than he otherwise would do.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Annual Festival Dinner.

On Wednesday last week the Festival Dinner of the Electrical Trades Benevolent Institution was held at the Trocadero Restaurant. The President of the Festival was Sir James Kemnal, the vice-presidents being Mr. J. S. Highfield and Mr. E. S. Barralet, and there were some 120 guests, including Sir George and Lady Sutton, Sir Wm. Noble, Mr. Dane Sinclair, and many other well-known supporters of the Institution.

After the loyal toasts the president said the present was a bad time to appeal for subscriptions, but most of them could give something. The electrical industry had grown enormously since the days when he worked on the first installation of electric lighting on Holborn Viaduct; then there were few electrical men—now there were as many thousands. The subscriptions already received in connection with the Festival amounted to £725 16s. 9d.; the fund, without this addition, stood at £18,780, and they wanted to make it £20,000. The benefits were chiefly extended to those who fell on evil days and were not provided for in other ways; pensions could only be given out of the interest on the main fund, which, therefore, should be much larger.

Mr. Highfield, supporting the appeal, said that they must endeavour to make the Institution a really strong body; its success depended mainly on gaining new contributors—otherwise it would remain merely a "fund." It was conducted in harmony with the Benevolent Fund of the Institution of Electrical Engineers, and there was no overlapping. He heartily supported all that the President had said, and hoped that the funds—and particularly the membership—would continue to grow.

Mr. Barralet also supporting the appeal, made a humorous speech, touching upon many topics, and urged his hearers not to wait till they were old before they were benevolent; now was the time—there was always a proportion that one could spare.

The President then proposed the toast of "The Electrical Trades Benevolent Institution," which was duly honoured. The collection at the tables realised £101 11s. 6d., making, with the sums previously received, a total of £827 8s. 3d.

Mr. J. Y. Fletcher proposed the health of the chairman, thanking him for his help in the threefold capacity of president, donor, and employer of labour—the last being one of the best ways of helping the respectable poor of the electrical industry, who were particularly reluctant to come forward with appeals for assistance. The committee was anxious not to reject any application, and none had been refused during the past year. The fund had now arrived practically at £20,000, but they must not stop at that sum, which was not sufficient to provide for pensions—the primary object of the fund; it should be more like £50,000. There was ample money in the industry to increase the fund by four or five thousand pounds a year.

Sir James Kemnal briefly acknowledged the toast, and endorsing Mr. Fletcher's remarks, said the industry was able to find £50,000, but the fund still fell short of £20,000.

During the evening a programme of music and song was performed by Mr. Barrington Hooper, Mr. Sterndale Bennett, and Mr. Bernard Flanders.

Eagle Causes Failure of Power.—The *Daily Mail*, in a recent note, adds another to the list of birds and beasts who have become entangled in electricity supply systems with adverse results both to the systems and themselves. Grenoble (Isère) was plunged into darkness for several hours on November 21st by the descent of an eagle upon the overhead supply mains, and it was found impossible to restore the supply until the bird's body had been completely burnt.

LEGAL.

H.M. Postmaster-General *v.* William Henry Pearce, Ernest Pearce, and William Robert Moon.

An application in respect of telephone cables was brought before the Railway and Canal Commissioners Court on November 29th, by the Postmaster-General against the three defendants. The Postmaster-General asked for an order, equivalent to a consent by the landlord, to retain, in Moss-hall Mansions, Maida Vale, telephone wires which ran through the storerooms of the flats, which the landlord had given the Postmaster-General notice to remove.

Counsel for the Postmaster-General said he made his application under Section 1 of the Telegraph Construction Act, 1916, a section the Court lately considered in the important case of the Postmaster-General *v.* Brooks. Thirteen of 104 tenants had used the telephone; others objected to the visits of workpeople to the wires, which were in all the store-rooms. Some of them appeared to store china there and others coal, and the coalmen with their bags dragged the wires adrift. The wires were laid with the consent of the owners, and it was said that one of the Mr. Pearces indicated where he preferred they should go. The Postmaster-General had been before Mr. Lester (the Stipendiary Magistrate), but the magistrate, after the recent judgment, sent him here. Mr. Pearce suggested that the cables should be led down the street, and not through the cellars, and connections taken off at house doors as they were needed; but that would be expensive to the public.

Mr. Dollar, for the defence, explained that the cable passed through 25 storerooms, the majority occupied by non-subscribers, and junction boxes were in some of these store-rooms.

Mr. Justice Lush said it was understood that the defend-ant had the right to give three months' notice to remove the wires. Only a small number of the tenants in his flats had the telephone, and the other tenants complained of the inconvenience of workmen going into their storerooms to repair the wires. The Court was satisfied that there was a serious nuisance created with regard to those particular tenants, who had a perfectly just cause of complaint. Mr. Pearce, in 1913, called on the Postmaster-General to remove the wires, withdrew his request, and on the renewal of complaints again gave notice. The Postmaster-General asked the Court for an order, which amounted to a request, that these wires should be continued through the flats. It seemed to his Lordship that the only possible condition on which such an application could be granted would be that it was shown to be necessary in the public interest, as in the case of the Postmaster-General's desiring to carry his wires over privately-occupied land. It seemed to his Lordship that the Postmaster-General here only desired to utilise the property of those residents because it would be more easy and convenient to him, and that was very far removed from cases in which the public interest was concerned. What it really amounted to was that the Postmaster-General was seeking to carry on this business of laying telephone wires on more advantageous terms than in the ordinary course, and at the expense of the private owner. In his Lordship's opinion the private owner had a right to be protected, and it seemed to him that the continuance of these grievances of the tenant must tend to react against the interest of the owner of the property. On all these grounds the application must be dismissed, with costs.

Electricity Charges Disputed.

On November 29th, at the Chichester County Court, the Bognor Gas Company sued Charles Knowles, Furnishers, Ltd., to recover £2 7s. 7d. for electricity supplied. Mr. Jackson, for plaintiffs, said that the defendants had several separate pre-mises in Bognor, and an agreement for the supply of electri-city was entered into in each case. Charges were based on a sliding scale, there being a fixed charge for the first 50 kWh and gradually falling charges for larger quantities. The defen-dants maintained that they were entitled to be considered as one consumer, to be charged for their electricity as a whole. To this the plaintiffs would not agree, stating that each set of premises would be considered separately, and charges were made accordingly.

His Honour Judge Cann decided in plaintiffs' favour, award-ing them costs on Scale B.

Electric Pumping in South Africa.—The barrage on the Vaal River in South Africa—which ranks as one of the world's great engineering schemes of its kind, and was begun in October, 1916—is now to all intents and purposes completed. It will enable Johannesburg to have a large and pure water supply. The river pumping station is practically completed. The plant consists of electrically-driven vertical-spindle cen-trifugal pumps, the motor itself being installed 9 ft. above the highest known flood level. The pumps are each capable of raising 6,000,000 gallons per day against a head of about 80 ft.—*Daily Mail.*

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Shift Engineers' Salaries.

High and low in the electrical profession look upon the Electrical Review as the forum of justice in all electrical matters, even to such a point as to be a source of joy to the electricity supply industry—" shift engineers, so please Mr. " P. G. H." cancel out your eye-wash, the poor substitute of sending to the E.P.E.A. journal, even if we could at last get publication.

I can assure the above gentleman that there is considerable amount of dissatisfaction among the shift engineers upon the schedule and conditions as presented by the E.P.E.A., and they would like the following questions answered, through your columns, by some reliable E.P.E.A. official:—

Had shift engineers representation on the N.E.C. in pre-schedule days?

If any, what proportion?

Why a gross injustice of difference in salaries between the chief and works super in pre-schedule days should be trans-ferred to between Grade 3 and Grade 8 at present? Why the word highest should be affixed to Grade 8 only? Why a lower maximum salary for Grade 8 was decided upon than was being paid in some municipal and company undertakings at the time?

Are they aware that even less hours were being worked by some shift engineers than was fixed by schedule? Why should Grade 8 be taken as a fixed and tied basis? Why was not a fair and just relative difference made all the way through the staff in grading?

Why should large, medium, and small undertakings be governed by a schedule so obviously drawn out to suit the few extra-large undertakings?

Why should *bona-fide* electrical, steam, and mechanically-trained men be expected to jump more grades as the next step in promotion than the purely electrically-trained man?

I feel sure, Mr. Editor, that an answer to the above will undoubtedly tend to educate the shift men in the manner their case was handled by those they at one time trusted.

One Out For Information.

December 3rd, 1922.

Although reluctant to take up any part of your valuable space in further discussion of a subject which by now must be in process of becoming tiresome, perhaps you will allow me to make a few observations.

In the first place, exactly what definite benefit do your correspondents expect to gain by persistently grousing in your long-suffering columns? Were there even a suggestion of constructiveness in any of the letters published to date, some good might conceivably result, but this ingredient has been conspicuously absent and analysis has so far revealed one hundred per cent. of hot air. Possibly the gentlemen who are thus laying bare the travail of their souls have in mind some such adage as: "Constant dropping wears away stones," or its companion: "Little strokes fell great oaks. They will probably find, however, that the "wear" will most affect the patience of the Editors of the Electrical Review, who will themselves eventually deliver, not a "little" but a sufficiently heavy stroke in the shape of: "This correspondence is now closed."

That shift engineers have a legitimate grievance in their grading under the E.P.E.A. Schedule is true enough, but the method whereby some of them are attempting to remedy the situation is predestined to futility. Let them apply pressure in the quarter where it can alone be effective, that is, in the councils of the E.P.E.A. Let them make their voice heard at their general meetings, and, if they wish for greater emphasis, to invoke the aid of the Fourth Estate, in the correspondence columns of the *Electrical Power En-gineer*, which are at their service.

The washing of dirty linen is really a domestic matter, and as a shift engineer and a fellow-member of the Association, I would urge those of my colleagues who feel aggrieved to refrain from this ineffective public parade of their disabili-ties. It can do no possible good; it may, by acting as an irritant and in other respects also, prejudice the very cause they have at heart.

W. H. S.

December 3rd, 1922.

The "Standard" Brush-holder.

The letter from Messrs. Bates and Windibank, published in your issue of November 3rd, 1922, calls for some comment on our part, particularly in view of the further letter from Messrs. Flather & Co., Ltd., published in your last issue.

We are surprised that a firm of Messrs. Bates & Windibank's experience can fail to notice the important differences between Messrs. Flather & Co.'s brush gear and our own. It is true

that the brush gear is similar in the method of fixing the brush spindles in the sets of the rocker arm in using packing pieces to compensate for commutator wear, but this method has been used by many of the members of the Standard Carbon Brush Holder Co., Ltd., for nearly 20 years.

With regard to the numerous other special features of the Standard [illegible] brush holder, there is no resemblance between the two types of brush gear.

These special points are :—

1. The shape of the brush holder and of the supporting carrier is such that the position of the brush holder is absolutely definite in relation to the commutator. In the "Flather" arrangement the brush holder is clamped to a circular spindle, and therefore capable of circumferential movement round the spindle.
2. The "Standard" brush holders are pulled up against an accurate face on the carrier, which definitely ensures the alignment of the holders and brushes. This feature is not shared by the "Flather" holder, with which alignment is a matter of hand adjustment.
3. The "Standard" brush holder is so formed as to encase the clock spring, which is thus fully protected against "flash over." This arrangement has been standard for over fifteen years with several of the firms who have now adopted the "Standard" brush holder, but the "Flather" holder has not this feature.
4. The method of adjusting the clock spring tension is quite different in the two holders. It is impossible to ensure uniform tension when adjustment is effected by turning a screw, as is the case with the "Flather" holder. With the "Standard" brush holder the adjustment is effected by means of a short lever, which is very accessible, easily operated with the fingers of one hand, and so arranged as to ensure uniformity of tension.
5. Each "Standard" brush holder can be moved and replaced as a single unit without disturbing the adjoining brush holders and, due to the method of attachment, can only be replaced in the identical position from which it was removed. The "Flather" brush holder in general cannot be moved without disturbing the adjacent holders, while in certain cases it is even necessary to remove the supporting spindle also.
6. The method of assembly which enables the "Standard" holder to be quickly separated into its component parts, also permits the fitting of a new part, such as a spring, in an exceedingly short time. The "Flather" gear is different in this respect also.

We do not wish to imply that Messrs. Flather's brush gear is badly designed. There are very many makers of electrical machines who have designed satisfactory brush gear, and we do not consider Messrs. Flather's design to be any better or any worse than a dozen other accepted types. The claim we make for the "Standard" brush gear is that it combines all the best points of existing designs, together with several quite distinctive features of its own. We have endeavoured to produce a brush holder "better than the best," and we feel that this object has been achieved.

Apart from the general features of design, which are common property, it is clear that improvements can only be the result of experience, and more experience has been available in this connection than has ever before been brought to bear upon the problem of brush gear. The fact that manufacturers with such experience and with existing designs of brush holders at least as satisfactory as any other on the market, have decided to substitute the new "Standard" brush holder for their previous designs—after many severe trials—is, we think, fairly conclusive evidence that the result of this collaboration is a brush holder superior to any other on the market.

The Standard Carbon Brush Holder Co., Ltd.

London,
[illegible] 22nd, 1922.

Estimating for Internal Wiring Contracts.

In [illegible] of the 1st instant, Messrs. Lowdon Bros. and Co., and Mr. Basil A. Pilkington take exception to my criticism of the "price per point" method of estimating for internal wiring contracts.

Messrs. Lowdon Bros. confine their remarks to a statement that for [illegible] years they have made use of this method and the results carried out by them; but such a statement is [illegible] because their two contracts for the internal wiring of Bedford Lawn's and Ingram Lane's [illegible] although [illegible] supervision [illegible] neither scheduled nor measured [illegible] price per point rate.

Mr. Pilkington in a weak attempt to defend an indefensible system, confuses [illegible] an extreme case as an illustration, but surely he will agree that the strength of a [illegible] lies in its weakest [illegible] Mr. Pilkington's attempted analogy of "rate per point" [illegible] a good post is deplorable, if only he could [illegible] the I.E.E. to adopt a "rate per package" irrespective of magnitude and weight the analogy would be perfect.

Mr. Pilkington, referring to "The Scottish Mode for the Measurement of Electrical Work," says, "the code was designed to be applied for work of any voltage"; will he now say why it was necessary to obscure the issue by bringing in the question of voltage? In what way does a varying voltage affect the measurement of definite lengths of wire?

In the preliminary rules of the Scottish Mode it is laid down that the "Schedules of Quantities shall fully, completely, and accurately represent the work to be contracted for"; can it possibly be contended that a "rate per point" falls within that rule?

Apart from certain anomalies, the Scottish Mode for the Measurement of Electrical Work, with Specific Rules Nos. 2 and 3 deleted, would be excellent and found capable of dealing with all internal wiring contracts for all voltages.

It would be interesting to know why "lighting points should be scheduled at a rate per point when "power points" are to be measured in detail under the Scottish Mode.

Alan Kirk.

London, *December 4th*, 1922.

Electric Lighting, Heating, and Cooking.

There are many letters, articles, and discussions reported in the electrical Press from time to time, almost all of which naturally emanate from those who are interested in the electrical business.

We showed a very nice range of electric irons, kettles and others of our manufactures at the recent Marine and Small Craft Exhibition held at the Agricultural Hall, and from the many conversations held with visitors we early realised that there was an opportunity to obtain the views of all kinds of people, as to why electrical appliances were not in more general use.

Careful notes were kept, and we found that :—

Seven per hundred had electric light.
Four per hundred had electric light and an oven.
Three per two hundred had electric light and a kettle.
Five per two hundred had electric light and a fire.
Only one had an electric cooker.

Almost unanimously the visitors would very much like to have electricity in their homes, but had heard that it was very expensive to obtain an installation. Those who had gone to the trouble to inquire the cost declared that they simply could not afford to pay the prices quoted.

When informed of what Poplar, Hackney, and Ilford were doing they were keenly interested, and there is very little doubt in our opinion, that the method being followed in these progressive boroughs, is the only way in which the boom in the electrical trade (which we all desire) will be achieved.

There are, no doubt, many local difficulties to contend with by those engineers whose duty it is to sell current and service, but the sooner they realise that a free wiring and rental scheme, organised in conjunction with their local contractors, is the only method by which they can interest all householders, the better for themselves and the trade generally. Obvious facts must be faced; the mass of the public cannot possibly bear the initial cost, but they want electricity, therefore it must be provided for them in a manner which appeals to them and which they can afford.

His Majesty the King paid a private visit to the Exhibition, and it was very noticeable what a really keen interest he took in everything; it brought vividly to our minds in relation to the foregoing remarks, what His Majesty said a few years ago: "Wake up, England!"

The Electric Heating Co.

Croydon, *November 27th*, 1922.

[Our correspondents made excellent use of their opportunity of collecting useful data, and we should be glad to receive further information of this kind.—Eds., Elec Rev.]

The Hastings Electricity Undertaking.

In your description of the Hastings undertaking at p. 777 of the Electrical Review of November 24th there are two statements not quite historically accurate. The Hastings company commenced supply in 1883, not 1882. I was the Eastbourne Co.'s first engineer. That company commenced supply in September, 1882, and I know that the Hastings company was several months later.

The incandescent lamps supplied from Brush arc circuits in Hastings—as in Brighton and Eastbourne—were not in series of 20 across the 2,000 volts (the 100-volt lamp was not in commercial existence then), but in groups of lamps in parallel, the groups in series on the arc circuit, each group taking the arc circuit current. Arcs and lamp groups were on the same series circuits. This is obviously the only way to run incandescent lamps on a circuit, the characteristic of which is constant current and variable voltage. At Eastbourne we commenced with groups of eight 50-volt 16-c.p. lamps, each group taking the arc current of about 9.6 amperes. It was necessary to sort the lamps for equality of brightness and current. Eight lamps made an inconveniently large

group in many cases, and some lamps were specially made for us by Mr. Swinburne at the Hammond Co.'s lamp works to take about 3.2 amperes each, so that groups of three could be used. These lamps were of about 10 c.p., 12 to 15 volts. They were more convenient and economical. The switches short-circuited the groups. Meters were electrolytic, shunting the consumers' leads, so that they integrated volt-hours. They were "read" by weighing the cathodes.

The meters, switches, lamp-holders, and the cut-outs used to prevent the failure of one lamp in a group resulting in fireworks, were all home-made. Mr. Arthur Wright, at Brighton, was the pioneer in developing the fittings and devices used in this group-series system, but each of these three stations devised variations of its own.

The system was used shortly afterwards at some other places, *e.g.*, Cardiff, Windermere, and—if I remember aright—Chesterfield. I think it gave the idea for the "King-Beeman" system used at Colchester, subsequently developed into the so-called "Oxford" system, used also at Chelsea and Wolverhampton, where batteries were charged in series in sub-stations on a high-pressure constant-current circuit. But I did this in one of the Eastbourne hotels in the summer of 1883, charging the battery in the small hours of the morning from a Brush arc circuit, which I contrived to feed with about 25 amperes from a nominally 10-ampere machine, using automatic switches to cut out the arcs, and incandescent groups when the increased current started.

The Thury system is the highest development of this constant-current, variable-voltage, high-pressure system, and it is interesting to know that it is recognised as having possibilities even yet.

It will be remembered that this work was done before the a.c. system was available, and there was then no other commercially practicable way in which we could have supplied incandescent lighting three miles away from the station. But as soon as a.c. plant was available it put an end to progress with high-pressure direct current.

Nevertheless, there is still a surviving example derived from the early work above described in the Midland Railway stations and yards from Kentish Town to St. Pancras. It is not a series system, however. The dynamos at Kentish Town supply, at 2,000 volts, motor-generators in parallel in various sub-stations. It is not very long since that the Walsall undertaking was still using high-pressure direct current with battery and motor-generator sub-stations.

I can say that the familiarity with high pressures gained while working this series system proved very useful when the a.c. plant had to be handled; the engineers who had been brought up on it knew more about insulation than those who had only known 100 volts from earth.

Board of Trade regulations for the public safety were still in the future. The first time that Major Cardew inspected one of these series systems he was deeply grieved, and ordered it to be shut down. Yet we supplied shops, hotels, and some private houses in this way without catastrophe. The fire insurance people were a little puzzled by it. They could not understand why we put in no fuses; but after I had demonstrated to one inspector that a short circuit on the station switchboard resulted in an instantaneous cessation of current I had no further trouble, though I do not say that he understood. The arc machines had automatic regulators, which kept the current nearly constant, and if the circuit conditions led to a quite small increase in the current the machine flashed over and lost voltage.

Such were some of the beginnings, forty years ago, brought to mind by your Hastings article, when the Electrical Review was still young, but already the valued weekly instructor of,

Henry M. Sayers.

London, *November 29th*, 1922.

Steam Condensing Plant.

In Messrs. Fothergill's last letter appearing in your issue of December 1st, I am glad to see that they do not now insist on a test being carried out on a commercial plant, and no doubt they have realised that this would be useless as a reliable guide to ascertain the high efficiency of the Delas air extractor.

I feel sure that these gentlemen cannot have been so ill-informed as not to have thought of a much more simple test of an extractor alone without its condenser, but no doubt, and very judiciously, they considered they could not well ask for such a test; and I very much doubt if they could persuade any British manufacturer to deliver a jet to them for testing purposes, as it is a very exclusive trade, and results have been obtained only at the expense of much time and money in experimental work, but again I must inform Messrs. Fothergill, that I have no authority to speak or sell in the name of La Société des Condenseurs Delas, and I believe that this firm cannot even sell its own apparatus in England.

In reply to the final part of Messrs. Fothergill's letter, I should like to make it clear that Mr. Delas actually invented the jacketing of the extractors, and when he made the discovery had not even heard of the old fireman who put his wet rag on the boiler injector.

In conclusion, I should like to say that I feel we have already taken up rather more of your space than the case merits, and that nothing can be gained by continuing this correspondence. I must, however, repeat that the steam consumption figures were based on tests carried out by an eminent consulting engineer who has had exceptional opportunities of testing the leading steam-jet air extractors, and when all is said and done, although important, it is not only economy that counts. The engineer in charge is much more concerned about the stability and all-round efficiency of his apparatus, and those of the Delas air extractor are well shown by the way that modern power stations and leading firms have adopted it, not only in France, in stations such as Commentry, but all over the world.

R. Velut.

Wembley, *December 4th*, 1922.

[This correspondence is now closed.—Eds. Elec. Rev.]

The Improvement of Power Factor.

In perusing your valuable journal of November 24th, I notice during the discussion on the late Dr. Kapp's paper on the above subject, that Mr. W. E. Rogers considers that the use of static condensers is not a commercial proposition at a lower pressure than 600 volts. The writer previously to installing this method of power-factor improvement inspected several installations working at from 400 to 550 volts, all of which had given perfect satisfaction from the point of view of reliability, and the resultant saving effected by their installation for the improvement of the power-factor of the system in question.

C. Jones.

Applications to Box Numbers.

On reading the letter written by "Practical Engineer," I felt I should like to send you a few lines to say that, with regard to obtaining situations in reply to box numbers, my experience has been just the reverse of "Practical Engineer's." For instance, a few years back I desired a change and improvement in my position, and replied to two advertisements which appeared over box numbers in two consecutive issues. I heard nothing from the first, but received a reply to the second and got the job; efficiency therefore 50 per cent. Again, this year, I desired another change and step up, and replied to three advertisements, which appeared over box numbers in issues close together; result, no reply to the first (for which I was unsuited, and which was a job beyond me); replies to the other two asking for an interview; lost the second job and got the third; efficiency 66⅔ per cent.

I have occasionally in the interval "had a shot" for a job asking for a salary higher than I expected to get, just to see if anything did come of it, without receiving any reply, but what I am trying to point out is that on two occasions when I have definitely desired a fresh job I've been fortunate enough to obtain it soon through the advertisements in the Electrical Review. Further, in the cases when I've received no reply, I've never had my confidence broken.

I would like to suggest to "Practical Engineer" that men advertise for positions as well as employers for men, and I'm quite sure that very few men in jobs with which they are not satisfied would like to advertise for another job without using a box number. Conversely, in the case of an employer who has an important man with whom he is not satisfied, he can hardly be expected to advertise the fact that he intends to make a change without first ascertaining whether a more suitable man can be found.

Fortunate.

December 2nd, 1922.

"Practical Engineer" has brought up an old grievance which has the writer's sympathy, but one which I am afraid will not be remedied till labour is at a premium. Why can't would-be employers take a tip from our esteemed journal, the Electrical Review, and assume a sense of fairness? Having had similar experiences to your correspondent, I have long since ignored box numbers, and also the gentlemen who add the nauseating words to their advertisements: "state salary required." Like "Practical Engineer," I feel sure that if employers would come out into the open they would get many more replies to their advertisements, and the results would be much more satisfactory to the employers themselves, besides giving the applicant more confidence.

Another Engineer.

December 2nd, 1922.

[We think no useful purpose will be served by prolonging this discussion.—Eds. Elec. Rev.]

International Electro-Technical Commission.—Correction.—Owing to a printers' error the note bearing the above heading in our last issue was made to read "to consider the acceptance of the 40 per cent. rating with overload." The reference was, of course, to temperature rating, and the wording should have been "40 degrees."

BUSINESS NOTES.

The "Electrical Review" Issue for December 22nd.—The attention of advertisers and readers is directed to an announcement appearing on another advertisement pages to-day respecting the dates for sending in copy for our issues of December 22nd and 29th. We correspondents and other contributors take note that for the issue of December 22nd all editorial matter for publication must reach us a day earlier in the week than usual.

Bankruptcy Proceedings.—Francis Leopold Perrin, electrical engineer, Northampton. The first meeting of creditors was held at Northampton last week. The statement of affairs, showing a deficiency of £2,129, appeared in last week's Review. The Official Receiver (Mr. J. Osborne Morris), who presided, said that whether the assets would realise as much as the debtor estimated, was problematical. He had frequently found that debtors under-estimated their liabilities and over-estimated their assets. There were several claims by money-lenders, and there was no doubt that debtor ought to have filed his petition long before he did. It was decided that debtor should be adjudged a bankrupt, and Mr. H. C. Palmer, Kingham Chambers, Abingdon Street, Northampton, was appointed trustee, with Messrs. W. J. Barnes, F. S. Day, and H. Adams (General Electric Co.) as a committee of inspection. The larger trade creditors were :—

	£		£
[illegible] Engineering Co.	31	[illegible] Engineering Co.	78
Ace Advertising Co.	27	Napier Kinnear	94
B.T.H. Lamp Co.	99	A. R. Reeve	100
L. S. Dick	46	Ruston & Hornsby ...	18
Downing & Muir	17	Rowell Lorraine	84
[illegible] Electric & Siemens Supplies ...	120	Roberts & Co. ...	12
Electric Supplies	80	Siemens Bros. ...	19
General Electric Co.	276	Smith & Co. ...	26
B. Harris	200	Sun Electrical Co. ...	20
Hobbs, Ltd. ...	48	Tudor Association ...	146
Hoover Precision Co. ...	19	Varley ...	241
Johnson & Wright, Ltd.	73	Warner ...	57
Jones Electrical Co. ...	65	Wood & Son ...	32
Johnson & Phillips	38		18

H. Busfield and J. J. Whittaker (Busfield & Co.), electrical engineers, 6, Wilfield Street, and late of 215, Padiham Road, Burnley.—First-meeting December 9th, at the Official Receiver's offices, Preston. Public examination December 12th at the County Court House, Burnley.

S. Beckett, Junr., electrician, 50, Deane Road, Bolton.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released November 24th.

W. Shaw, The Younger, electrical engineer, 26, Westcliffe Road, Shipley.—Last day for proofs for dividend December 16th. Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford.

J. Owen (J. Owen & Sons), electrical engineer, 186, Westcombe Hill, and 3, The Grove, Greenwich.—Second and final dividend of 1½d. in the £ payable December 18th at 29, Russell Square, W.C.

Company Liquidations.—Varley Magnet Co., Ltd.—Winding up voluntarily, the company having disposed of its business to Oliver Pell Control, Ltd. Liquidator, Mr. R. Crane, 46-47, London Wall, E.C. Meeting of creditors, December 15th. Particulars of claims to be sent to the liquidator forthwith.

Oliver Pell Electric and Manufacturing Co., Ltd.—Winding up voluntarily, the company having disposed of its business to Oliver Pell Control, Ltd. Liquidator, Mr. R. Crane, 46-47, London Wall, E.C. Meeting of creditors, December 15th. Particulars of claims to be sent to the liquidator forthwith.

With reference to the above notices, Messrs. Oliver Pell Control, Ltd., write stating that these liquidations "are merely formal and occasioned by the fact that an amalgamation of the two companies was made some time ago under the title of Oliver Pell Control, Ltd., for greater convenience and economy in working, the two companies having been so intimately connected during the past 20 years. The management remains the same, and there will be no change of policy." The Varley Magnet Department is exceedingly busy in all classes of coil winding, including that for wireless broadcasting sets, while the Oliver Pell Department is actively engaged in executing orders for its distant control system of switching and other manufactures.

A.C. Sparking Plug Co., Ltd.—Meeting of creditors, December 9th. Particulars of claims to the liquidator, Mr. H. C. Fuller, The Hyde, Hendon, by January 5th.

Splitdorf Electrical Co., Ltd.—A meeting of members is called for January 8th at Messrs. Hickman & Randall's offices, Coventry House, South Place, E.C., to hear an account of the winding-up from the liquidator, Mr. H. J. Hinley.

Standard Cable Manufacturing Co., Ltd.—First and final dividend of £11 15s. 4½d. per share, payable at Carey Street, W.C.

Strachan, Oswell & Co., Ltd., exporters and importers, 45, Kingsway, London, W.C.2.—Voluntary liquidation. Messrs. W. W. Read and H. Kidson, joint liquidators.

Dissolution of Partnership.—Chas. Roberts & Co., automobile and electrical engineers, The Grange, New Scarborough, West Ardsley. Mr. C. Roberts and Mr. T. Bailey have dissolved partnership. Debts will be attended to by Mr. T. Bailey and Mr. H. Johnson, of The Crescent, Britannia Road, Morley, who will continue the business in co-partnership.

Trade Announcements.—The Enterprise Manufacturing Co., Ltd., has been appointed sole London and export agents for the Imperial Engineering Co., of Wolverhampton, manufacturers of "Imperial" fires, hotplates, toasters, and geysers. It is holding stocks at its premises in Grape Street, Shaftesbury Avenue, W.C.2.

Messrs. Corlett Bros. have commenced business as electrical engineers at 42, Tynwald Street, Douglas, Isle of Man.

The businesses of Trevelyan & Co. and C. H. Davies & Co., Ltd., have now been amalgamated, and will in future be carried on under the name and title of Trevelyans (Birmingham), Ltd. Messrs. T. Gladdy and T. Reynolds are directors of the new company, the registered offices and works of which are at 155, Bracebridge Street, Birmingham, where the company will continue the manufacture of "Treva" lampholders and accessories. A new catalogue is in the press. The company's London office is at 70, Newman Street, Oxford Street, W.

Messrs. Pettigrew & Merriman, Ltd., of Tooley Street, S.E.1, sole distributors for the Ashley Wireless Telephone Co., Ltd., and the Automatic Telephone Manufacturing Co., Ltd., of Liverpool, for London, Home Counties, and South Wales, announce that they are opening a retail store and demonstration room at 54, Gracechurch Street, E.C.3.

The business of Shand, Mason & Co., fire-engine makers, of Blackfriars, has been purchased by, and is now incorporated with Merryweathers, of Greenwich.

Messrs. Watson & Sons (Electro-Medical), Ltd., announce that the British Thomson-Houston Co., Ltd., and the General Electric Co., Ltd., are now associated with them. This connection is for the development of X-ray and electro-medical apparatus constructed on established electrical engineering lines, and, with the aid of the research laboratories of these companies, the incorporation of the most recent advances in physics. Mr. C. H. Holbeach, previously in charge of the Coolidge Tube Department of the British Thomson-Houston Co., Ltd., is joining the company's staff. The management of Watson & Sons will be unchanged.

Mr. E. Goldston, electrical and heating engineer, has removed to 58, Marefair, Northampton, and has taken his manager, Mr. Garratt, into partnership. The business will be known as Goldston & Co., and lists of electrical manufactures are desired.

The Calphos Electrical Co., Ltd., has moved into larger premises at No. 70, Victoria Street, Westminster, where it is demonstrating its specialities, including the Calphos flashing adapter and signs, of which it is the sole manufacturer.

Messrs. Berry's Electric, Ltd., are removing their Manchester branch from King Street to Touchbutton House, 5, Deansgate, where, when completed, they will have extensive showrooms on the lines of their House in Newman Street, London.

The London Electric Firm has purchased from Messrs. Henry Williams, Ltd., of Darlington, the branch of their business recently trading as the Arc Lamp Lowering Gear Co. (and formerly as the North-Western Appliances Co., of Cathcart, Glasgow), including the whole of the designs, patterns, entire stock, tools, jigs, drawings, patent rights, and goodwill.

Messrs. Barratt Bros., electrical engineers and contractors, 48a, Baxtergate, Whitby, Yorks., are opening showrooms, and they desire to receive catalogues and lists of domestic electric lighting and cooking appliances, wireless apparatus, &c.

The name of A.G.E. Electric Motors, Ltd., Stowmarket, has been changed to Bull Motors, Ltd.

Catalogues and Lists.—Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list (December) of d.c. motors ranging from 1 to 50 h.p.

The Electrical Alloy Co., 4, Regent Square, Gray's Inn Road, W.C.1.—A leaflet advertising "Calido" resistance wire for electric heating and cooking appliances.

The Peak Engineering and Supply Co., 17, Red Lion Passage, Red Lion Square, W.C.1.—A pamphlet illustrating and describing the "Castle" fine adjustment valve for the micrometric control of the flow of fluids.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—A comprehensive catalogue dealing with electrical equipment for ships. The list includes lighting fittings, switchgear, heating and cooking appliances, wireless equipment, electric tools, &c.

Recess Screws, Ltd., Gillingham, Kent.—An illustrated pamphlet advertising screws with recessed heads, and special screwdrivers for these.

Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—Progress sheet No. 58, dealing with "Revo" ceiling fans and reproducing a Faraday House report; also a folder advertising the "Revo" electric iron.

Messrs. Ferguson, Pailin, Ltd., Edward Street, Higher Openshaw, Manchester.—Catalogue Section 66/A1, an illus-

trated list of pole-operated isolating switches of various types for currents ranging from 200 A. to 2,500 A. up to 11,000 V pressure.

The Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, E.15, has circulated a small blotter bearing particulars of its business and manufactures.

Superlamp, Ltd., 197, Old Street, E.C.2.—A net trade price list of cables, wires, tumbler switches, wall plugs, conduits, &c.

Mr. M. W. Woods, 146, Bishopsgate, E.C.—An illustrated and priced pamphlet dealing with small rectifiers for battery charging.

Whitworth Electric Lamp Co., Ltd., 195, North End Road, West Kensington, W.14.—A net trade price list of electrical accessories, including lighting fittings, switches, bells, batteries, conduit cables, and wires.

Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street, S.W.1.—A well-produced brochure containing numerous views of installations of coal- and ash-handling plant in power stations, &c.

X-Rays, Ltd., 11, Torrington Place, Gower Street, W.C.1.—A circular letter announcing reductions in the price of "duplitised" photographic films.

Credenda Conduits Co., Ltd., Whitehouse Street, Aston, Birmingham.—A well-illustrated catalogue of "Creda" heating and cooking apparatus. Fully priced.

Messrs. W. T. Henley's Telegraph Works Co., Ltd. (Engineering Department), Blomfield Street, London Wall, E.C.2.—Publication W.L. 2a, a pamphlet illustrating and describing the "Isco D" loop-in cut-out.

Messrs. May & Padmore, Ltd., Wharfdale Road, Tyseley, Birmingham.—A priced catalogue of "Maymore" electric fires, irons, kettles, hotplates, &c., illustrated in colours.

The Cambridge & Paul Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A mailing card advertising the "Omega" insulation testing apparatus.

The Overseas Engineering Co., Ltd., 68-70, Great Eastern Street, E.C.2.—A number of pamphlets dealing respectively with automobile lamps; "Zenith" low-speed oil engines; "National" d.c. motors and dynamos; and the "Overseas" small lighting and power plant.

Electricians' Wage Reduction.—The members of the N.F.E.A. have been notified that the result of the ballot vote of the Electrical Trades Union was in favour of acceptance of the second 5 per cent. reduction on the April, 1921, rates. The reduction will take effect on the first pay-day following January 7th, 1923, for the period covered by that pay-day, when the rates per hour will be as follows:—Grade A, 1s. 8¼d. (this rate includes a travelling allowance); Grade B, 1s. 6¼d.; Grade C, 1s. 5d.; Grade D, 1s. 3¾d.

Correction.—The Metropolitan-Vickers Electrical Co., Ltd., asks us to correct an error which occurred in its advertisement on p. 15 (supplement) of our last issue. The price given as £5 should have read £4 10s.

The British Empire Exhibition.—We have already published a good deal of information regarding the arrangements that are being made for the great British Empire Exhibition at Wembley Park from April to October, 1924. We have concentrated more particularly on the electrical and engineering arrangements, and we emphasise the importance of these and the need for prompt action on the part of would-be exhibitors in our "Leader" pages to-day. Since our last extended reference to the Exhibition we have received a grey-covered booklet of 68 pages in which are set forth fully the names of vice-presidents, members of the Executive Council, and the officials, and particulars of the numerous groups in the general classification of exhibits. Copies of this booklet should be obtained (from the general offices at 16, Hobart Place, London, S.W.1), as readers may be interested in lines that presumably do not come in the Electrical and Engineering Hall. For instance, the additional groups include railways and tramways, postal, telephonic and telegraphic services, lighting, heating, and ventilation, photography, kinematography and radiography, and so on. In addition, we have received certain information respecting the work of the Scientific Instruments Committee, of which Sir W. Napier Shaw is chairman, and Sir Joseph Petavel deputy chairman. This is one of the many technical and scientific committees now at work on the organisation of exhibits.

With regard to the classification of exhibits, two methods have been suggested by the National Physical Laboratory:—(1) Under branches of science; (2) under types of instruments. It is possible that the exhibits coming within the scope of this committee will require between 10,000 and 20,000 sq. ft. of space, but the precise area cannot be ascertained just at present. The Committee is in touch with the various firms who are likely to be exhibiting. Special attention will be paid to the optical section of the trade, as well as to the magnetic, meteorological, and general sections. There is a possibility, we understand, that the Royal Society, as a measure of support for the Exhibition, may decide to form a committee to deal with pure science. For this work special funds would be needed to meet expenditure; but the activities of such a committee would in no way trench upon the work of the Scientific Instruments Committee.

On behalf of the Department of Scientific and Industrial Research, several nominations have been made to the Exhibition Committee on the application of Science to Industry. Other nominations have been made by the British Engineering Association for the [illegible] and by the Royal Institute of British Architects [illegible] Latest is [illegible] on the Committee.

In regard to the progress that is being made [illegible] Exhibition buildings [illegible] to the end of November the following quantities of [illegible] materials had been used:—

[illegible]

The number of men employed was 1,200.

An Executive Committee representing all the States has been appointed to deal with Australia's participation in the Exhibition. With regard to the erection of a pavilion, plans are being prepared by officers of the Public Works Department, who are going to London to supervise the arrangements. Sub-committees have also been appointed to deal with publicity, finance, and shipping matters.—*Reuter* (Melbourne).

Book Notices.—"Common Commodities and Industries: Incandescent Lighting," by S. I. Levy, B.A. (129 pp.; 23 plates). London: Sir Isaac Pitman & Sons, Ltd. Price 3s. net.—The greater part of the matter in this work is historical in nature, and gas illumination, probably on account of its greater age, receives more space than electric lighting. There is an interesting chapter upon the rare earths, followed by a description of the manufacture of incandescent gas mantles. Comparatively scanty treatment is afforded the electric incandescent lamp, the actual manufacture being confined to two plates showing, respectively, a filament sprairsing machine and a sealing-in machine. In Chapter V the author makes a comparison between modern methods of lighting. He frankly admits that his table of comparative costs is subject to many fluctuating considerations, but he has endeavoured to give fair and representative figures, although this is extremely difficult where the prices of gas and electricity cover such a wide range. Mr. Levy considers the hygienic superiority of electric over gas lighting "not proven" to any appreciable extent, and considers that the application should decide the choice of illuminant.

"Lubrication and Lubricants," by J. H. Hyde, A.M.Inst.C.E. (114 pp. 37 figs.). London: Sir Isaac Pitman and Sons, Ltd. Price 2s. 6d. net.—Commencing with the function, types, and applications of lubricants, the author gives a short study of the nature and manifestations of friction, including fluid friction and viscosity. He then briefly outlines the theory of lubrication, following this with descriptions of tests of lubricants—mechanical, physical, and chemical which occupy comparatively large space. The use of solid lubricants is confined to a brief chapter, but recent developments are treated at greater length. Concise but clear descriptions of the Michell thrust and journal bearings appear in the last section, together with illustrations and diagrams. The results of recent researches into the nature and properties of lubricants are reviewed, and the final chapter presents a number of every-day examples of lubrication, including descriptions of force-feed pumps and other mechanical lubricators.

"Railway Signalling: Automatic," by F. Raynar Wilson (116 pp.; 75 figs.). London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.—The author, who is assistant engineer of the Victorian Government Railways, in his opening chapter states the case for automatic signalling, pointing out that such a stage has now been reached that failures due to defective design are a negligible quantity, and other failures are extremely rare. Track-circuiting is dealt with in the two following chapters—both steam and electric railways being considered. Subsequent chapters deal with: Locating and spacing signals; electro-pneumatic, electro-gas, and low-pressure pneumatic signals; all-electric two- and three-position signals; and light signals. The numerous illustrations are successful in conveying to the reader's mind the nature and appearance of the apparatus dealt with, and a comprehensive bibliography and index appear at the end of the volume.

M. Albin Michel, 22, Rue Huyghens, Paris (14), has sent us two lists of technical and scientific works of which he is the publisher. One list covers electrical and mechanical engineering, mining and metallurgy, architecture, transport, &c., while the other describes the contents of the electrical and mechanical engineering works included in the first list.

From Messrs. S. Rentell & Co., Ltd., we have received a list of books dealing with all branches of electrical engineering. A number of books recommended by the City and Guilds examiners is the main feature.

The Stafford electrical engineer (Mr. R. H. Robins) has sent us a souvenir booklet containing a note of the proceedings at the recent official inauguration of the plant extensions by the Mayor. A photograph of these present forms a frontispiece.

"Bulletin Oerlikon," August, September, and October, 1922. London: Ateliers de Construction Oerlikon.—The first of these three numbers gives a brief illustrated description of the St. Lary (Pyrenees) power station, and an article on eddy current losses in the copper conductors of electrical machines and transformers. The September issue describes the Herlandsfossen (Norway) station, and gives full details of the design and construction of the generators and another article deals with the Lognè (Switzerland) hydro-electric station. In

the October number an electric overhead conveyor at a steel-works is described, and there is also an article upon main-line railway electrification in France.

"The *Journal* of the South African Institution of Engineers." November, 1922. Price 2s. The paper reproduced in this issue is "The Hanging and Guiding of Vertical Skips," by G. W. Sharp, together with discussion. A list of recent Union patents also appears.

"Industrial Applications of X-Rays," by P. H. S. Kempton. Pp. xiii+112. London: Sir Isaac Pitman & Sons. Price 2s 6d. net.

"Discoveries and Inventions of the Twentieth Century," by E. Cressy. Second edition. Pp. xxiii+458; figs. 342. London: G. Routledge & Sons. Price 12s. 6d. net.

"Experimental Electricity and Magnetism," by S. E. Brown. Pp. vii+221; 193 figs. Cambridge: University Press. Price 5s.

We understand that *La France*, a new paper introduced by Messrs. Evans Bros., Montague House, Russell Square, W.C., for readers who are learning the French language, and referred to here previously, has been so successful that the publishers are now issuing a new paper, *L'Echo de France* (Price 1d.), in much more simple language for beginners. Specimen copies of both publications will be sent to our readers on application to the foregoing address.

Armstrong, Whitworth and the B.T.H.—We hear that arrangements have been made by Sir W. G. Armstrong, Whitworth & Co., Ltd., and the British Thomson-Houston Co., Ltd., of Rugby, with the object of undertaking jointly the complete electrification of railways and the manufacture of all types of electric locomotives and rolling stock. These companies hope to receive an important share of the railway electrification schemes now under consideration, thus helping to provide much-needed work for a large number of men on Tyneside and at Rugby in the near future. The locomotives and rolling stock will be constructed at Messrs. Armstrong's Scotswood Works. The potential output of heavy main line steam locomotives from these works is stated to be 450 a year, and large numbers of engines for both home and foreign railways have been constructed there since the war. The British Thomson-Houston Co., Ltd., with its various factories, will, it is understood, be able to provide all the electrical equipment and machinery which will be required, not only for the locomotives and rolling stock, but for the power stations and sub-stations as well.

Social.—The annual whist drive and dance of the Blackpool Corporation Electricity and Tramways Employés' Institute was held recently. Over 1,200 people sat down to whist, whilst for dancing there were about 2,000 present.

The Rand Strike.—The Mining Industry Board, appointed after the strike of the Rand miners to investigate the state of the mining industry, has issued its report. This was reviewed recently in the *Financial Times*. After stating its conclusions with regard to the gold mines—the native labour question, efficiency, &c.—the Board deals with the coal-mining industry. It is of the opinion that the wage reduction proposed by the employers was justified, but the miners acted properly in giving a month's notice of stoppage, and the Board can understand their refusal to proceed to arbitration. With reference to the Victoria Falls Power Co. dispute, the Board declares that upon the whole the men were not justified in demanding an increase, and the company was right to reject it. The question of higher pay for Sunday work, however, was a matter for further negotiation, and the company was unwise to refuse to call a conference to discuss the matter. The report outlines conciliation boards for the various industries concerned, and expresses the opinion that trade unions should be registered, and that any vote of workmen which may result in a stoppage of work should be secret and held under the supervision of a Government department.

French Metallurgical Conditions.—The Société Electro-Metallurgique de Dives reports that the net profits declined from 4,397,000 fr. in 1920-21 to 2,765,000 fr. in 1921-22, although the dividend is maintained at the rate of 60 fr. per share. The directors state that the diminution in the profits was due not solely to a falling off in business, but also to general considerations. For instance, the wages paid to the workmen were now more than three times the amount of the profits distributed on the share capital, and they formed a greater part in the cost of production. The high increases in the cost of railway transport also brought about a notable decrease in the profits by placing a burden on the cost of production in a proportion representing not three times, as many persons believed, but often from five to six times the pre-war figure. In addition, the taxes and State imposts were crushing, the amount affecting the company in 1921-22 having exceeded 2,000,000 fr. These new burdens, for which it was impossible for industry to find compensation in an augmentation in the sale prices, were the result of [illegible] voted by the public authorities, who were [illegible] to the tendency of making a single class of citizens bear the imposts. At present the portion of the profits remaining to the shareholders did not represent more than [illegible] of the total of wages, cost of transport, and taxes combined. In conclusion, the directors state that this situation of affairs [illegible] it was hoped would only be transitory, could not [illegible] without being dangerous.

Local Exhibitions.—The recent electrical exhibition at Poplar met with a large measure of success. Although only 10,000 visitors were expected, 20,700 attended during the week, and on many occasions there were queues waiting for admission. These results were remarkable, as there were a number of adverse circumstances to be met—including the excitement of the General Election. The electric bakery showed a profit of £103, although the current prices were charged. This balance was sent to the Poplar Hospital. Another centre of interest was a working man's electric kitchen in charge of Mrs. Hunt, the wife of the Council's mains foreman. The borough electrical engineer (Mr. J. H. Bowden) and his assistant (Mr. F. Tait) are to be congratulated upon the results.

At the Blackpool "Ideal Homes" Exhibition, MESSRS. R. DARBYSHIRE, LTD., had three stands on which they displayed everything from electric lamps to a complete wireless telephony installation. Amongst their exhibits were electric washers, vacuum cleaners, fires, ranges, irons, boiling rings, and electric light installations. The firm also made a feature of its "Exide" battery service.

Unemployment.—The following are the details of unemployment compiled from Employment Exchange registers, as on November 27th:—Wholly unemployed, 1,387,400, increase 8,382, short-time workers, 53,200, increase 2,200.

The State of Swiss Industry.—In the report of the Swiss Engineers' Union on the year 1921, the complaint was voiced that the importance of the export industry to Switzerland's well-being was wholly under-estimated by Government officials, and the industry's taxibility was overrated. It was a matter for thankfulness that the Federation scheme for the electrification of the railways, notwithstanding the unfavourable financial situation, was still being actively pursued. In the home market the principle must be more and more insisted upon that what could be manufactured at home must be ordered in the home market in order to improve the industrial situation. For the outside market the question of rise in quality in particular was a subject for consideration. Hope in this direction was afforded by the fact that in the countries with depreciated currency, and in Germany in particular, prices were hastening towards the level of the world market. When this point was reached it would be Switzerland's opportunity, with its sound currency, to work again under normal conditions. As to foreign trade, the aggregate volume of imports was 28,550 tons (against 52,154 in 1920 and 31,391 in 1913), of which 530 tons represented electric generators (against 380 and 751 in the years forenamed); steam engines and turbines, 521 tons (against 355 and 763); and fuel power motors, 201 tons (against 326 and 192). In power machines of all kinds and electrical machines and apparatus, the import figures with such a highly-developed industry were very small indeed. The aggregate volume of exports reached 49,397 tons (against 66,778 and 56,667), of which dynamos figured for 7,154 tons (against 6,657 and 7,936); steam engines and turbines, 3,852 tons (against 3,249 and 5,595); and fuel power motors, 4,769 tons (against 7,668 and 6,372). About half the imports, but only 1.8 per cent. of the exports were German.

Copper and Lead Prices.—Messrs. F. Smith & Co. report December 6th:—Copper (electrolytic) bars, sheets, wire rods and h.c. wire, no change.

Messrs. James & Shakespeare report December 6th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £27 5s., 5s. decrease on last week's quotation.

Chinese Notes.—Lu Wen-mei, a merchant of Chuan-shahsien, Kiangsu, and others have petitioned the Ministry of Communications for the registration of the Ta Chuan Electric Light Co., Ltd. They propose to organise with a capital of $20,000. The request was granted providing that the erection of the plant was commenced within six months' time from the date of the grant.

The Chapei Hydro-Electricity Co., Ltd., promoted by Shen Lien-teng and other notable merchants at Shanghai, is now issuing capital to the extent of $3,000,000 in 300,000 shares of $10 each. The company will carry on the water, electricity and tramway systems in the locality. Its preparation bureau is, at present, situated at Tienchili, Paoshan Road, Shanghai.

The Ministry of Communications has registered the establishment of the Kienyang Electric Light Co., in Fukien, which was proposed by Chen Shou-sin and other local merchants of the district.

Diary.—We have received from Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, one of their Simplex diaries for 1923. Instead of the customary fast-bound booklet they have this time adopted an inset diary and a loose solid calf cover. The diary is essentially one for engineers, sectional ruling being retained throughout. In some cases new tables have taken the place of old ones, and these renewed are checked and revised where necessary. Where prices are subject to fluctuation these are, of course, only corrected up to the time of going to press; they can always be checked on application to the company.

Improvement in Swedish Electrical Industry.—The heavy depression which marked 1921 in the Swedish electro-technical industry is abating, says the Swedish *Teknisk Tidskrift*. Both employment and orders are increasing. The

state of affairs in 1921 was such that the number of workmen employed fell from 7,500 to 3,500, with shorter hours, the loss being equivalent to 19,000,000 kronen, or 10 per cent. of the capital. While the cost of living remained at 80 per cent. above pre-war level, the price of products had to be reduced 20 per cent. below, in order to find buyers. The chief causes were the retrenchment of enterprises owing to the falling prices and the high level of the kronen, which throttled the exports and favoured the countries with depreciated currency, with which such legislation as was passed only weakly grappled. The successful issue from the crisis is solely to the credit of the industry itself, which has carried on with reduced establishments and at great sacrifices.

A Finnish Contractors' Association.—The Finnish Association of Electrical Contractors, which has just celebrated the tenth year of its existence, now numbers 26 firms in different parts of Finland. The Association has supported its members in the case of labour disputes, maintained statistics with regard to wages conditions, expressed opinions concerning legislation proposals, and organised courses of instruction for fitters which are supported by the State.

Trade Commissioner for Nairobi.—*The Times* Nairobi correspondent learns that the Trade Commissioner "is expected to return to duty in January, and that the indications are that the post will be maintained. It was recently proposed to discontinue it for reasons of economy."

LIGHTING AND POWER NOTES.

Australia.—Burrinjuck (N.S.W.).—It is announced that a start is to be made this year with the Burrinjuck hydro-electric scheme. The Burrinjuck dam was built for the dual purpose of providing water for irrigation and of developing hydro-electric power. A dozen towns over a wide area will be supplied with cheap light and power, and it is anticipated that important industries will be established in consequence. Mr. Ball, Minister for Works, states that plans and specifications are in preparation, and tenders will be called for the supply of machinery. Practically all the preliminary work in connection with the scheme has been completed, including the survey of the transmission lines. The following are the chief towns concerned in the scheme:—Jugiong, Cootamundra, Gundagai, Junee, Wagga, Harden, Murrumburrah, Young, and Yass. The work will be carried out in stages, and there is no complete estimate of the whole scheme. The initial work will be the construction of the off-take tunnel from Burrinjuck to the power house and the foundations of the power house. Tenders will be invited for this work, and separate tenders for the turbines, switchgear, transformers, &c.—*Reuter's Trade Service* (Melbourne).

Rockhampton.—The Queensland Premier has sanctioned the borrowing of £70,000 for an electricity scheme.

Burgess Hill.—Special Order.—The Burgess Hill and District Electric Supply Co., Ltd., is applying to the Electricity Commissioners for an Order authorising it to generate and distribute electrical energy for public and private purposes within the urban district of Burgess Hill and portions of the parishes of Wivelsfield and Ditchling, Cuckfield rural, Keymer and Clayton, and Hurstpierpoint.

Berwick.—Electricity Charges.—The Electricity Commissioners have sanctioned an application by the Urban Electric Supply Co. to fix the maximum charge for electricity at 1s. per kWh.

Cheadle and Gatley.—Electricity Supply.—The Council has arranged to obtain a supply of electricity from the Manchester Corporation, and a sum of £10,000 is to be borrowed to meet expenditure.

Continental.—Germany.—Referring to the strike of the workers of the Baden Aniline Works at Ludwigshafen, the Ludwigshafen correspondent of *Die Zeit* states that the French Occupation Authorities have ordered work to be continued in the vital industries. This order affects, among others, the workers in the Ludwigshafen electricity works, who had declared a sympathetic strike with the workmen of the Baden Aniline works.—*Reuter* (Berlin, December 1st.)

Czecho-Slovakia.—According to *El Obzor*, an electro-technical year-book for 1922, the number of private electricity works existing in the Republic is 255. The public undertakings are 146 in number, with a total capacity of 210,530 h.p. Of the total, 104 (equal to 251,660 h.p.) are steam driven; 33 (11,300 h.p.) water driven; 30 (12,360 h.p.) are equipped with Diesel engines; and 15 (1,010 h.p.) with gas engines. The capacity of the undertakings ranges from 50 to 50,000 h.p., there being five steam-driven plants between 5,000 and 10,000 h.p. and six between 10,000 and 50,000 h.p.: the highest of the other forms of power production does not exceed 5,000 h.p. The current generated is continuous in the case of 202 stations (51,116 h.p.) and alternating in the case of 157 stations (331,850 h.p.), 42 being of mixed character (58,025 h.p.). The nationality of these undertakings is not wholly Czecho-Slovakian, over half being returned as German and Hungarian, having been established before the war in most cases.

Belgium.—The recently-formed Société Générale de Force & Distribution Electrique has secured the concession for the supply of electricity for lighting and power purposes in Ypres.

Criccieth. Electricity Supply.—The Town Council has decided to take steps to light the town by electricity.

Glasgow.—Extension of Supply.—The Corporation Electricity Committee has agreed to an overhead system of electric lighting at Sandyhills.

Horsham. Year's Working.—The accounts of the electricity department (engineer Mr. J. Fitzpatrick) for the year ended June 30st last, show a total income of £9,173 as compared with £8,550. Working expenses amounted to £6,820, as against £5,287, leaving a gross profit of £2,644 (£3,263). The net result, after payment of capital charges, was a profit of £995, as compared with £371 in 1920-21. The sales rose from 343,834 to 390,777 kWh.

Lancaster.—Purchase or Undertaking.—The electrical engineer has submitted to the Electricity Area Scheme Committee details as to capital cost of the National Projectile Factory power station if adapted to give a bulk supply to Lancaster and Morecambe, together with the cost of converting the present power station in Marton Street to a rotary substation and connecting by cable to the National Projectile Factory station. Particulars were also submitted of the estimated cost of production at the Projectile Factory station. It was resolved that the town clerk arrange for an interview with representatives of the Disposal and Liquidation Commission relative to the purchase of the National Projectile Factory station.

Leeds.—Extension of Supply.—The residents of Alwoodley, who are outside the city boundary, have applied to Leeds Corporation for a supply of electricity, and the Corporation is seeking the necessary sanction of the Electricity Commissioners.

Maidstone.—Loan.—The Town Council has applied to the Electricity Commissioners for a loan of £17,266 for a new boiler, accessories, and buildings for the electricity works.

Milnrow (near Rochdale).—Electricity Scheme.—The Urban District Council has received Parliamentary approval to an electricity supply scheme for the district. The scheme provides for a bulk supply from the Rochdale Corporation, and the demand is already sufficient to ensure against any charge on the district rates. The total cost of the scheme will be over £8,000.

New Zealand.—Hydro-electric Development.—The progress being made in the Dominion with the erection and extension of hydro-electric works was dealt with by the Hon. J. G. Coates, Minister for Public Works, who presided at the Power Board's Conference at Wellington. He stated that since the last conference the Lake Coleridge power plant has been increased from 8,000 h.p. to 16,000 h.p. capacity. Contracts have been placed for the increase of the Horahora plant from 8,400 h.p. to 14,000 h.p., and of the Waipori plant from 8,000 to 12,000 h.p. The Mangahao plant of 24,000 h.p. is well in hand, and the Monowai plant, of the Southland Power Board, is under way with a capacity in the first installation of 5,000 h.p., capable of extension up to 16,000 h.p. The New Plymouth Borough plant is being extended from 1,000 h.p. to 6,000 h.p. The first development of Waikaremoana of 1,000 h.p. will be ready for operation in a few weeks, and finally the Arapuni plant, with a capacity of 36,000 h.p., capable of extension to 140,000 h.p., has been started. By 1925 the total output of the plant installed in the Dominion will have been increased from 69,000 to 147,000 h.p.—*Reuter's Trade Service* (Melbourne).

Portsmouth.—Price Reductions.—The Town Council has decided to reduce the initial charge for electricity for lighting by ¼d. per kWh, for power by ¼d. per kWh, and for street lighting by 5s. per annum on small lamps, and 20s. per annum on the larger ones.

Loans.—Application is to be made for a loan of £31,000 for the installation of a 4,000-kW turbo-alternator and two water-tube boilers, and £40,000 for services and mains extensions.

Sheringham.—Electricity Supply.—The Urban Council has under consideration a proposal to light the town with electricity, and steps have been taken to obtain a report from consulting engineers.

South Africa.—Proposed Standards.—The *South African Engineer and Electrical Review* states that the Electrical Section of the South African Branch of the British Engineering Standards Association has recommended that the following standards be adhered to in new installations:—Direct current systems: Consumers' pressure 220 and 440 V; station pressure 242 and 484 V. Alternating current (3-phase) systems: Consumers' pressure, between phase and neutral 240 V, between phases 416 V; station pressure 264 and 457 V. The specification for extra-high pressures stipulates that the delivered (declared) pressure and the station pressure shall be the same for 3,000 V supplies. Above this an increment of 10 per cent. is added to the declared pressure to give the station pressure.

King William's Town.—Owing to heavy rains the Buffalo River recently came down in flood partially submerging the municipal electric power station and causing a stoppage of the supply for several days.

Stainland (near Halifax).—ELECTRICITY SCHEME.—At the [illegible] last week a letter was received from [illegible] stating it was not prepared to entertain the Council's application for electric lighting, pending the Electricity Commissioners' decision on the Aire and Calder Electricity District. The Council decided to ask the company to give the matter further consideration and to arrange an interview.

Truro.—ELECTRICITY IN BULK.—The Town Council has decided to take a supply of electricity in bulk from the Cornwall Electric Power Supply Co. The price at any time is not to exceed 2½d. per kWh, and, in order to carry out the scheme, a loan of £[illegible] will be necessary. It is proposed to supply electricity to consumers at 10d. per kWh for lighting and 5d. per kWh for other purposes.

Ullapool (Ross-shire). — ELECTRICITY SUPPLY. — Electric lighting has recently been installed in the district.

TRAMWAY AND RAILWAY NOTES.

Australia.—MELBOURNE.—We have received the report of the Melbourne and Metropolitan Tramways Board for the year ended June 30th, 1922. Both cable and electric systems showed a profit. Some idea of the comparative extent of the two systems may be gained by regarding the capital expenditure upon each. This, at the end of the year, was:—Cable system, £2,356,580; electric system, £1,853,026. The revenue of the electric tramways totalled £600,698, and the working expenses amounted to £436,519, leaving a gross profit of £164,179. This, together with the gross profit from the cable system, and interest received, gave an available total of £460,053. After the payment of capital charges, &c., a balance of £306,217 was carried to the appropriation account. From this various payments were made, including £190,000 to renewals reserve and £98,107 to the State, and a balance of £7,792 was carried forward. A total of £239,245 has been contributed to the State consolidated revenue. The number of passengers carried was:—Cable, 151,201,763; electric, 63,546,435; total, 214,748,198. The report refers to the appointment of Mr. T. P. Strickland, M.I.E.E., as chief engineer, and discusses the electrification of the cable routes. The various systems of electrification are reviewed, and the conclusion arrived at is that the overhead trolley system is the most suitable and economical.

Birkenhead.—TRACK RENEWALS.—With a view to providing work for the unemployed, the Tramways Committee proposes to reconstruct the tramway track along Conway Street, between Claughton Road and Park Road East, at an estimated cost of £20,000.

Continental.—SPAIN.—A company has been formed in Ferrol to construct and operate an electric tramway between that town and Jubia.

Derby.—YEAR'S WORKING.—The accounts of the municipal tramway department for the year ended March 31st last show a total income of £112,084, as compared with £120,569 in the preceding year. The working expenses amounted to £96,613, as against £105,922, leaving a gross profit of £15,471 (£14,647). Capital charges, &c., absorbed £12,240, making the net result a profit of £3,231, comparing with £2,099 in 1920-21. Against this was debited a loss of £527 upon the omnibus services, leaving £2,704 to be carried to the renewals fund, as against £1,755. The numbers of passengers carried were 1,162,686 (electric cars) and 191,944 (electric 'buses); the car-mileage was 1,162,686 and 18,963 respectively.

India.—CALCUTTA TUBE RAILWAYS.—Mr. Dalrymple-Hay's report says that the construction of tube railways in Calcutta is possible on the hooded-shield and clay-pocket system. The proposed route from east to west is 6.6 miles in length, and the portion in tunnel will be 5.9 miles. The internal diameter of the tunnels will vary from 12 ft. 6 in. to 13 ft. 6 in., and the gauge will be 5 ft. 6 in. The estimated cost is £3,500,000. *Eastern Trade Service* (Bombay).

Leeds.—NEW ROUTE.—The Corporation Tramways Committee contemplates extending the tramway system to Templenewsam (*via* the Selby Road), to Killingbeck (*via* the York Road), and from there into Crossgates.

Leicester. [illegible] REPLACEMENT OF TRAMCARS.—According to the *Daily Mail*, the Chief Constable has reported in favour of the gradual replacement of tramcars by motor omnibuses to relieve traffic congestion in the city.

Linthwaite (Yorkshire).—ACCIDENT.—A heavy Bradford [illegible] in the early morning of [illegible] knocked a tramway standard so far out of position that the overhead wires were broken. The driver was injured and had to be taken to the infirmary. The tramway service was delayed some time while the damaged [illegible] was being repaired.

London. [illegible] REDUCTIONS.—As the Highways Committee of the L.C.C. recognises that much of the reduction in working costs [illegible] is due to improved wages paid to workmen, it proposes that only [illegible] shall be made, as from January 1st, 1923, in workmen's fares. The new fares will be [illegible] Not exceeding [illegible] miles, 2d. return (approx. distance 4.8 miles); exceeding four, but not exceeding eight sections, 4d. return (approx. distance 9.6 miles); exceeding eight sections, 6d. return. The committee has also decided that during those hours in which the 2d. maximum (mid-day) fare is in operation, the penny fare stage shall be three sections of approximately .6 mile each.

The London United Tramways, Ltd., are reducing the 1½d. tramway fares to 1d.

Paisley. SALE OF TRAMWAY UNDERTAKING.—The shareholders of the Paisley and District Tramways Co. have unanimously agreed to sell the Paisley tramway system to Glasgow Corporation for £250,000. Directors and certain officials are to be compensated for loss of office.

Salford.—YEAR'S WORKING.—The report of the general manager of the Corporation tramways (Mr. G. W. Holford) for the year ended March 31st, 1922, records a gross income of £564,226, as compared with £542,747 in the preceding year. Working expenses amounted to £458,052, as against £433,950, leaving a gross profit of £106,174 (£108,797). After the payment of capital charges a net profit of £7,574 remained, a large decline from the previous year's figure—£16,812. The number of car-miles run increased from 6,019,067 to 6,085,439, but the number of passengers carried decreased from 78,[illegible]12,501 to 76,207,988. All the above statistics include those of the motor-omnibus service.

West Ham.—REDUCED FARES.—The Town Council has decided to reduce its tramway fares on January 1st next, when the charges will be one penny for two sections and 1½d. for three sections. Each section is approximately half a mile in length. Workmen's fares are to be at the rate of single fare for the double journey, with a minimum of 2d. return.—*Westminster Gazette.*

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—RADIO TELEGRAPH PATENTS.—It is understood, writes the Exchange Telegraph Co.'s Antwerp correspondent, that the Radio Corporation of America is prepared to cede its rights for the exploitation in Belgium of certain patents applying to apparatus for the reception of radio messages and to antennæ.—*Financial Times.*

Cuba.—BROADCASTING.—Radio telephone broadcasting is about to be inaugurated in Cuba, says the *T. & T. Age*, and interest is thoroughly active in the matter.

Germany.—INCREASED TARIFFS.—The commercial adviser of the Imperial Post Office has recommended that the postal, cheque, telegram, and telephone charges be increased on the average by 100 per cent. This proposal must be submitted to the Reichsrat and the competent committees of the Reichstag before coming into force.—*Reuter.*

New Zealand.—RADIO TELEGRAPHY.—The Postmaster-General, Mr. Coates, is in favour of a direct radio system giving New Zealand world communication in preference to the chain system. Two companies have been negotiating for rights, but the Government is unable to move because Great Britain has not yet decided on her action.—*The Times.*

Radio Telephony.—BROADCASTING.—Since broadcasting actually began there has been a steady and growing demand for licences. A striking increase is shown in the number of experimental licences, which are granted only to those who are competent to make a useful contribution to radio research. Up to the end of last March 8,000 such licences had been issued, but by October 31st the number had increased to over 18,000, an increase of more than 10,000 in seven months.

THE FIRE "RISK."—The St. Pancras Estates Committee recommends "that applications from tenants of flats in the Council's dwellings to fix wireless installations be not acceded to." The committee reports that the insurance company with which the property is insured against fire considers that it would be advisable to refuse permission if the sets are being installed and fitted by amateurs, or else insist on their being inspected by a qualified engineer and on a signed report being obtained that everything is in order. The company also advises that special attention be given to fixing the aerials and to the earthing having been properly carried out. With regard to the Council's maisonnettes, where garden ground is available, and the apparatus need not be fixed on the buildings, the committee has deferred its decision pending consultation with the chief electrical engineer.—*The Times.*

A correspondent of *The Times* complains that the Corporation of the City of London has refused him permission to erect an aerial on a building which is the property of that body. The building is a large block of flats of which the roof is flat and put to many uses by the occupants of the dwelling. The view taken by the Corporation was that if one such request were granted no similar one could reasonably be refused. The erection of a forest of aerials would make it impossible to use the roof for other purposes, but it is not to be assumed that an objection would be raised to putting an aerial on a roof of one of the Corporation's buildings if the amenities of the place were not thereby impaired, subject to the approval of the fire insurance company concerned.

Radio Telegraphy.—Ship's Operators.—The Cunard Steamship Co. has decided to maintain its radio branch, so that every member of the crew shall be subject to the company discipline. Hitherto the fifty operators in the company's fleet have been employés of the Marconi Co. The Cunard operators will wear a specially-designed uniform, and a senior operator will rank equivalent to a second officer of the navigating branch; junior operators will be graded as officers. The White Star and other lines do not intend, at present, to follow the Cunard example, but will rely on the Marconi Co. and other radio firms for their operators and installations.—*Evening News.*

Russia.—Eastern Telegraph Rates.—The Great Northern Telegraph Co. expected to open offices at Moscow and Omsk on December 1st. The Soviet Government has guaranteed the officials of the company full liberty and has allowed the company to establish special food centres. All telegrams for East Asia by the company's route will be forwarded from Omsk. At present two lines, *via* Irkutsk and Peking and Kiachta and Harbin, are working, and telegrams from London to Shanghai can now get through in two hours. There has not been very great difficulty in repairing the lines, the damage done having been less than was expected. Danish engineers have examined the whole route, accompanied by Russians, who have learned to use the apparatus. Telegram rates in Russia were not raised during the war; most of them are unchanged, but some have been reduced. The Danish company expects that there will be great telegraphic traffic to the East *via* Copenhagen as soon as the new Russian stations are opened.—*The Times.*

Sweden.—Broadcasting.—The Allgemeine Elektrische Gesellschaft, Svenska Radio Aktiebolaget, and Tidningarnas Telegrambyras Aktiebolaget have applied to the Swedish Government for a joint concession for a monopoly of broadcasting in the country. The radio companies intend, if the concession is granted, to form a special company for this purpose with a minimum share capital of kr. 1,000,000.—*Reuter.*

The Telegraph System.—Tariffs.—Mr. N. Chamberlain, Postmaster-General, answering a series of questions in the House of Commons, said that the number of inland telegrams sent in the United Kingdom (including Ireland) during the financial year 1913-14, when the rate was 6d., averaged about six millions a month. The number sent during the financial year 1921-22 at the shilling rate was about five millions a month. In view of the fact that even with a 1s. tariff the service was run at a considerable loss, he could not hold out any hope of a return to the 6d. rate in the near future.—*The Times.*

West Indies.—Cable Communication.—In order to maintain cable communication throughout the British West Indies, an agreement has been entered into between the British Government, the Dominion of Canada, the Crown Agents for the Colonies, and the West India and Panama Telegraph Co., allowing the company to increase its charges. The agreement provides for increases in the existing maximum rates of 6d. per word on "through" rates, and an increase of one-third, with a maximum of 6d., for inter-island rates. Deferred Press and Government telegrams are to be carried at half the ordinary rates. These increased rates are authorised until March 31st next, and the future rates are to be decided by circumstances.—*Financier.*

The Treasury considered various proposals to prevent the cessation of the company's system, including its purchase by the Governments concerned, but decided on the above policy.—*Morning Post.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Abertillery.—December 15th. Electricity Department. One 2,200-V, h.p. feeder, one 200-kW and one 30-kW converting sets; h. and l.p. switchgear; static transformers and l.p. switchgear; a.c. overhead and underground distributing system. (November 24th.)

Atherton.—December 20th. Urban District Council. Two 30-kVA, single-phase transformers and one 150-kVA ditto. (December 1st.)

Australia.—Perth.—January 17th. Postmaster-General's Department. Telephone and telegraph apparatus, testing instruments, and protective apparatus.*

Newcastle, N.S.W.—December 14th. City Council. Transformers and control equipment.*

Melbourne.—January 24th. Tramways Board. 1,650 steel poles, either solid or in three sections.—*Reuter's Trade Service* (Melbourne).

[illegible] January 31st. [illegible] Department. [illegible] Director, Stores Department, Melbourne.

Belgium.—December 1st. Director of Public Service Contracts, Treasury, Brussels. Electric motor and [illegible] transformers, [illegible] [illegible] [illegible]

Hoylake and West Kirby.—Electricity Committee. Accepted subject to the sanction of the Electricity Commissioners:—

Condenser (£670. [illegible] & Morrison.
Cooling tower £621 [illegible] Cooling Towers, Ltd.

London.—Shoreditch Lighting Committee.

Dis. 20[illegible] ... [illegible] ... for Whiston Street substation:—

Herbert Morris, Ltd.	**£1,040**
S. H. Heywood [illegible]	1,087
Babcock & Wilcox [illegible]	1,285
Reyrolle, Ltd.	1,408
Vaughan [illegible]	1,693

Manchester.—Tramways Committee. Accepted:—
[illegible] W. Wadsworth & Sons, Ltd.

Waterworks Committee. Accepted:—
[illegible] Switchgear for West station, W. T. Henley's Telegraph Works Co., Ltd.

Electricity Committee. Accepted:—
Cable.—Macintosh Cable Co., Ltd.
[illegible] of electric telegraphs for Barton power station, Cradburn's (Ship) Telegraph Co., Ltd.

Housing Committee. Accepted:—
Installation of electric lighting at houses on the Fallowfield, Blackley, and Newton Heath estates.—J. V. Pyatt, of Manchester.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, December 9th. At the Grand Hotel. At 7 p.m. General meeting.

Royal Society of Arts.—Monday, December 11th. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture, "Brown Coal and Lignites," by Prof. W. A. Bone.

Junior Institution of Engineers.—Tuesday, December 12th. At the Royal United Service Institution, Whitehall, S.W. At 7.30 p.m. Presidential address, "The Utility of Theory to the Practical Man," by Capt. H. Riall Sankey, late R.E.

Friday, December 15th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Notes on Printing Machinery," by Mr. W. T. Marchant.

(North-Eastern Section).—Tuesday, December 12th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "The Heavy Oil Engine," by Mr. J. Calderwood.

Paisley Association of Engineers.—Thursday, December 12th. At 99, High Street. At 7.30 p.m. Paper on "Broadcasting," by Mr. H. Hamilton.

Illuminating Engineering Society.—Tuesday, December 12th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Recent Developments and Modern Requirements in Street Lighting," to be opened by Mr. H. T. Harrison.

National Association of Supervising Electricians.—Tuesday, December 12th. At St. Bride's Institute, E.C. At 6.45 p.m. Lecture on "The High Cost of Electrical Installations," by Mr. W. J. Rovell and Mr. F. T. Alldread.

Electro-Harmonic Society.—Tuesday, December 12th. At Caxton Hall, Westminster. At 8 p.m. Smoking concert.

Greenock Association of Electrical Engineers.—Wednesday, December 13th. At 22, West Stewart Street. At 7.45 p.m. Paper on "Lamp Manufacture," by Mr. J. M. Anderson.

Liverpool Engineering Society.—Wednesday, December 13th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Water and Water Power," by Mr. D. H. Thomson.

Nottingham Society of Engineers.—Wednesday, December 13th. At the Welbeck Hotel. At 7.30 p.m. Annual dinner.

Chelmsford Engineering Society.—Thursday, December 14th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Lubrication of Internal-Combustion Engines," by Mr. A. B. Smith.

Northampton Engineering College Engineering Society.—Thursday, December 14th. At the Northampton Institute. At 5.30 p.m. Paper on "Steam Turbines," by Mr. M. L. G. Semple.

Optical Society.—Thursday, December 14th. At the Imperial College of Science, South Kensington, S.W. At 7.30 p.m. Ordinary meeting.

Chemical Society.—Thursday, December 14th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Lecture on "The Metallurgical Applications of Physical Chemistry," by Prof. C. H. Desch.

Institution of Electrical Engineers.—Thursday, December 14th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Electric Arc Welding Apparatus and Equipment," by Mr. J. Caldwell.

(Students' Section).—Sunday, December 10th. At 3 p.m. Visit to the City and South London Railway Reconstruction Works.

(Liverpool Sub-Centre).—Monday, December 11th. At the University, Liverpool. At 7 p.m. Paper on "Domestic Load Building," by Mr. W. A. Gosset.

(East-Midland Sub-Centre).—Tuesday, December 12th. At Loughborough [illegible]. At 6.45 p.m. Short papers.

(North-Western Centre).—Tuesday, December 12th. At the Engineers' [illegible]. At 7 p.m. Informal meeting. Discussion on "Low- and Medium-pressure Industrial Wiring," to be introduced by Mr. J. [illegible].

(Scottish Centre).—Tuesday, December 12th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "The Possibilities of Transmission by [illegible] 100,000 150,000 V.," by Mr. A. M. Taylor.

(Scottish Centre).—Students' Section.—Friday, December 15th. At the R[illegible] Glasgow. At 7.30 p.m. Magazine night.

(Dundee Sub-Centre).—Thursday, December 14th. At the University College, Dundee. At 7.30 p.m. Paper on "Automatic Protective Gear," by Mr. A. [illegible].

(South-Midland Centre).—Wednesday, December 13th. At the University, Birmingham. At 7 p.m. Paper on "The Possibilities of Transmission by Underground [illegible] 50,000 to 100,000 V.," by Mr. A. M. Taylor.

Institution of Mechanical Engineers.—Friday, December 15th. At the Institution, Storey's Gate, S.W. At 7 p.m. Paper on "Reclamation Plant and Its Operation," by Mr. G. [illegible].

British Electrical Development Association.—Friday, December 15th. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Salesmanship Conference—Lecture on "Theory and Practice of Salesmanship in Relation to the Electrical Industry," by Mr. W. [illegible].

Institution of Production Engineers.—[illegible] December 15th. At the Engineers' Club, W. At 7.30 p.m. Paper on "The Production Engineer," by Mr. H. F. Heiser.

NOTES.

Appointments Vacant.—Lecturer on the design of electrical machinery, for Faraday House Engineering College. Shift charge engineer for the Kilmarnock Corporation Electricity Supply Department. Plumber-jointer for the Hackney Corporation Electricity Department. Chief electricity accounts clerk (£240) for the Guildford Corporation. (See our advertisement pages to-day.)

Service Notes.—Major F. W. Home, Royal Marine Light Infantry, has been appointed to H.M.S. *President*, London, for service with the Wireless Telegraphy Board at the Admiralty. Major Home was commissioned in the Royal Marines in 1901, reached his present rank in June, 1917, and having specialised in wireless telegraphy, has been associated with that branch of the service for some time. He will join the Board on New Year's Day. Captain A. J. Mellor, Royal Marine Light Infantry, has been appointed to the Cleethorpes radio telegraph station from the date of taking over. The officer got his commission in the Royal Marines in 1902, and was promoted captain in September, 1914. He held the temporary rank of major during part of the Great War, and was a staff officer for some time. Major W. D. Merrett, T.D., A.M.I.E.E., late of the London Electrical Engineers, has been posted in the same rank to the 11th A.A. Battalion, Royal Engineers, Territorial Army. Capt. W. H. Rodgers, from the London Electrical Engineers has been appointed a major in the 10th A.A. Battalion, Royal Engineers, Territorial Army. He was a captain in the Royal Engineers during part of the Great War.

Lectures.—"How Electricity Helps the Farmer."—On November 25th a crowded and appreciative meeting of the Bedford Park Natural History and Gardening Society attended a lantern lecture given on the above subject by Mr. H. A. Carney (who is associated with the work of Mr. R. Borlase Matthews, the apostle of electro-farming in this country). A comprehensive series of slides (many from photographs taken at Greater Felcourt) was shown, and according to data given by the lecturer the consumption of electricity is relatively trifling, the energy which will light a forty-watt lamp for 25 hours being sufficient, for instance, to chaff half a ton of hay, or cut up six tons of swedes, or milk 52 cows, or churn and make 165 lb. of butter; the work in all cases being accomplished without physical exertion and in a fraction of the time possible by other methods.

Electro-culture or the electrical stimulation of plant growth was referred to as a proven possibility and one likely to be of all-round benefit to the farmer, who can rely upon a minimum increase of 10 per cent. in his crop yields from its application. Instances of much higher yields were mentioned, up to 50 per cent. increase (for instance for wheat, oats, and potatoes), the annual financial gains varying (at pre-war prices) from £3 10s. to £15 per acre. It appears, however, that the necessary equipment has not yet been developed on a commercial scale for really practical work on farm. The success which attended electric haymaking has since been repeated on a large farm whose corn crop, extending to several hundred acres, was in danger of rotting on the fields. By installing suitable equipment the crop was saved, and is now being thrashed. Even in fruit growing it seems that electricity may be useful, for a reference was made to some experiments that are being carried out in New Zealand, where electric lamps are hung in the fruit trees. By increasing the producing capacity of farms and of the labour employed, the extended use of electricity in agriculture will eliminate the more monotonous and the heavier part of the work, and the status of the farm worker will be raised, his standard of living improved, and his wages increased because of his increased productive capacity.

"Safety First."—On November 27th, members of the Circle of Scientific, Technical and Trade Journalists, and representatives of the technical Press, paid a visit to the extensive repair works of the London General Omnibus Co., Ltd., at Chiswick, at which a fleet of 3,000 motor-buses is overhauled, with the result that the breakdowns have been reduced to a minimum.

Following the inspection of the works an address on the "Safety First" movement in England was given by Mr. H. E. Blain, C.B.E. The address dealt both with industrial safety methods and with the steps being taken by the London Safety First Council to diminish accidents in the streets of London, and thus followed very appropriately after the inspection of the repair shops. Mr. Blain illustrated his remarks by lantern slides of a great variety of posters which have been used in propaganda in schools, &c., and reference was made to the useful work of the Drivers' Educational Committee. It was stated that, in spite of the great increase in vehicular traffic, the number of accidents to persons or property in the Metropolitan Police District has been reduced from 55,700 in 1914 to 45,700 in 1920.

The work of the British Industrial Safety First Association is proving equally useful in factories. In 1920 a sum of £6,000,000 was paid in workmen's compensation in connection with 3,500 deaths, so that there is ample scope for the movement. It was stated that many members of the Association have been most successful in reducing accidents in their works

The Classification of Engineers.—In 1920 the Council of the Engineering Institute of Canada appointed a committee to consider the grading of members of the Institute, and recommend rates of annual remuneration. The committee's report was published in the November issue of the *Engineering Journal*, the Institute's organ. With regard to chief engineers it was considered that such positions were outside the committee's scope, and a commencement was therefore made at the grade of "assistant chief engineer," whose duties were defined as "to act in administrative charge of a technical organisation, or of a main division thereof." The necessary qualifications are set out, and an attempt is made to specify equivalent positions among which are those of city engineer, and superintending engineer of a province. Grade II is defined simply as "engineer," and the positions corresponding to this grade include those of district engineer and designing engineer. The subsequent grades are: III, Senior Assistant Engineer; IV, Assistant Engineer (chief draughtsman, estimating engineer, &c.); V, Junior Assistant Engineer (inspecting engineer, &c.); VI, Junior (senior draughtsman, inspector, &c.); VII, Senior Aid (draughtsman &c.), VIII, Junior Aid (tracer, chainman, rodman, &c.). In computing a basis for salaries years of service and the possession of a degree are taken into consideration. Minima and maxima are given in most cases, but in Grades I and II the maximum is given as "no limit." The minimum for Grade I is $7,200, the minimum and maximum for Grade VIII are $600 and $1,200.

Transatlantic Radio Communication Tests.—The main object of the forthcoming transatlantic communication tests between American, Canadian, and European radio amateurs is not only to pick up signals from the other side of the Atlantic, as was done last year, but also (if possible) to establish communication in both directions across the ocean solely between amateur stations when using amateur wavelengths. Arrangements have been made for the use of specially equipped transmitting stations in this country during the tests. Several French stations will also be transmitting. The dates of the transmission tests from this side will follow the transmissions from the United States. As in last year's tests, the transmission from America and Canada will be on the usual American amateur wavelengths in the neighbourhood of 200 metres, and also on the special wavelengths in the neighbourhood of 365 metres, which are licensed to some of their stations. Transmission will take place during five hours on each night, the stations taking part being allotted a different portion of the five-hours' period on successive nights. The wavelength of transmission at any given time will, therefore, be different on successive nights. With regard to the American Radio Relay League's preliminary tests to determine the best transmitters, several American stations have been heard in this country, so that the main tests this month should be productive of better results than were obtained last year. During last year's tests a broadcast report was made each morning by Carnarvon radio station, which report was repeated slowly by New Brunswick station for the benefit of the American amateurs, giving the results of the receptions made by the representative of the American Radio Relay League, who was listening-in in Scotland. Through the kindness of the Marconi Co., and of the Radio Corporation of America, it will again be possible to broadcast such daily reports from Carnarvon.

The French committee which is arranging the part to be taken by the French amateurs, both in listening and in transmitting, has also arranged for daily transmissions to be made from Sainte Assise station (near Paris), which reports will be repeated by Marion Station in the United States, the times being 0700 G.M.T. for Carnarvon, and 0710 G.M.T. for Sainte Assise.—*Wireless World*.

The daily Press announces that at Croydon, during the night of November 26-27th, music transmitted in the U.S.A. was heard, together with the call letters W.J.Z., on a wave length of 325 metres (Newark, New Jersey). The music was heard for over an hour, also on fewer than nine American amateur stations were heard calling each other, the most distant one heard being that at Chicago. On the same night music from America was heard at Holyhead, and members of the Manchester Wireless Society heard 23 American amateur stations communicating among themselves, one being in California. The society is attempting to communicate with the U.S.A. At Highgate, on October 15th, music and words were picked up from America on a special two-valve set, by means of which more than a dozen American amateur stations have been heard. At Liverpool, during the night of December 1-2nd the New Jersey broadcasting station was heard.

New Zealand Electrical Regulations.—Mr. Lawrence Birks, B.Sc., M.I.E.E., &c., Chief Electrical Engineer, New Zealand Public Works Department, has sent us a copy of the amended regulations concerning electricity supply in the Dominion. The greater part of the regulations govern the construction and working of overhead lines. One of the principal alterations is the change in the definition of high pressure from 3,300 to 6,600 V (between phases). A new feature is a scale of licence fees for electric lines based on the carrying capacity. The clause dealing with lines within towns and city areas has been recast to permit the use of bare wires without permit provided certain conditions are complied with. Additions are made to the [illegible] covering the precautions to be observed to prevent [illegible] with telegraph and telephone lines. Another new clause prescribes conditions where e.h.p., h.p., and l.p. lines are carried on the same poles. In the section dealing with inspection a scale of fees is given. Two new clauses provide for the [illegible] alteration of lines, one [illegible] at the expense of the owner of the line.

Removal of Boiler Scale by CO_2.—According to *Indian Engineering*, Messrs. E. J. C[illegible] and J. [illegible] of the Messrs. Institute of Industrial Research, have found that boiler scale can be removed by the action of a [illegible] carbon dioxide in water. In an experiment pieces of boiler scale were put into a bottle and just covered with water. Carbon dioxide was then applied at a pressure of 70 [illegible] per sq. in. After four or five days the scale started to disintegrate and this action continued until a week had elapsed.

Similar treatment was then given to the tubes of two horizontal return boilers with a scale accumulation of years, which withstood all attempts at removal by mechanical means. After the discharging of the CO_2 through the tubes the boilers were allowed to stand for eight days. At the end of this time it was found that the scale could be removed by simply applying a high-pressure water hose. In this way practically the whole of the scale was eliminated and the exposed surface of the tubes had the appearance usually possessed by new tubes.

Radio Reception on Moving Vehicles.—The Canadian National Railways are experimenting with radio receiving apparatus on their Toronto-Ottawa trains, and have met with an encouraging degree of success, says the *Electrical News*. The difficulties are greater than appears on the surface. It is necessary to put the antenna a considerable distance from any object, especially a conductor, within fifteen or eighteen inches from the steel of the car. No matter how tightly the aerial is drawn, it will sway and move with respect to the ground as the train travels. This causes a constant change in capacity between the antenna and the ground. The lead-in wire cannot be removed more than one or two inches from the steel car, thus bringing the antenna in close proximity to the ground. The ground wire is soldered firmly to the trucks of the coach, which makes a fairly good ground while the train is standing still, but as soon as the train is started an oil film forms between the journal and the axle of the car, causing a high resistance between the trucks and the ground. Mechanical motion in the set causes very audible noises in the receivers or loud speaker, and it will be appreciated what will happen on a moving train when the instruments are continually in mechanical vibration. Then there are the deafening train noises to overcome, as the output must be loud enough to be heard above all other competing noises. Apparently an inside aerial is not successful.

Conditions in a rapidly-moving train change so rapidly that perfect tuning is difficult. When travelling through heavily-wooded country the signals become very faint, and strong again when cleared land is reached. When near a body of water, the signal strength increases considerably, but when going over a high bridge it dies down. It is not affected to any extent by going through a cut with high walls of rock or clay on either side of the train. Sometimes, as the train goes round a curve, the signal strength becomes fainter and sometimes it increases. This may be due to the position of the antenna relative to the broadcasting station.

One other thing which affects reception is the proximity to power lines, which run along railway lines or across them. When near a power line, interfering sounds are heard distinctly in the loud speaker, sometimes so as to drown the radio signals. Telephone or telegraph lines have little or no effect. Experiments have been carried far enough to show that there are great possibilities in radio railroad work both in receiving and broadcasting, first as a source of entertainment for passengers by means of concerts, then for commercial purposes in sending and receiving communications and for train dispatching. A specially-constructed railway set will be necessary to overcome the peculiarities of train operation before dependability is reached. The secret of success may be in frequency amplification, upon which much experimental work is now in progress. When a point of reasonable perfection has been reached radio apparatus will be added as a part of national service on important trains. The reception of radio signals while riding in a motor-car has been achieved on various occasions. The Marconi Co. recently made some tests of such a nature between London and Chelmsford, and a car equipped with radio apparatus and a frame aerial took part in the Lord Mayor's show.

Electrical Betting.—One manifestation of the "electrical idea," which may not be considered favourably by everybody in the industry, was recently described by the *Times of Ceylon*. This takes the form of an electrically-operated "totalisator," installed on the Havelock Racecourse, Colombo, for registering and paying out bets. The integrity of the apparatus is said to be irreproachable.

Educational.—Northampton Polytechnic Institute.—On Friday evening last Dr. S. Z. de Ferranti distributed the prizes and certificates for the past year. There was the usual conversazione, which was continued on Saturday evening

A Large American Electric-Vehicle Order.—We are informed by Messrs. Electromobile, Ltd., of Otley, Yorks., that the Commercial Truck Co., their associated firm in the United States, has just been awarded one of the largest orders for electric vehicles that has ever been given out. This order has been placed by the Wagner Pastry Co., of Newark, N.J., and is for 177 standard one-ton vans fitted with nickel-iron batteries of the Edison type. These vans will supersede the petrol and horse vans required to deliver nearly 40,000 pies per day, the delivery of which on time is somewhat of a problem, and the Wagner routes cover a distance of 3,500 miles. About 15 months ago the Wagner Pastry Co. decided to experiment with electric trucks. It ordered six C-Ts and several of other makes, which it placed on all of its routes in turn. The results of the tests proved that electric trucks were far superior to any other type of equipment. This was definitely decided within a short time. To determine, however, the particular type of electric truck that would prove most satisfactory, the tests were continued for 15 months. The trucks were used through a winter, careful records being kept of every item of the cost. In these severe tests the C Ts proved to be clean and odourless—a decided advantage for bakery delivery—they covered the routes regularly without hold-ups due to weather conditions; repair troubles were negligible, and costs were greatly reduced. The "C-T" truck is the counterpart of those manufactured in this country by Messrs. Electromobile, Ltd.

Standardisation of Electrical Equipment for Motor Vehicles.—At the last meeting of the Accessories and Components Committee of the Society of Motor Manufacturers and Traders steps were taken to form a technical sub-committee to act in connection with the standardisation of dynamos, starting motors, and switches for use on motor vehicles.

The Channel Tunnel.—In an interesting letter to *The Times*, Mr. Robert Donald advocates the construction of the Channel Tunnel as one means of providing employment. He points out that the military objections to the tunnel have practically disappeared, and that its economic and commercial advantages are admitted, whilst it would find work for a large number of men for four or five years.

The Society of Technical Engineers.—Whilst going to press we have received the following letter:—

Your very anonymous contributor, "One of Them," was rather unlucky in the timing of his attack on the S.T.E. He had only to turn to another page of your issue of December 1st to see that his case against the Society was not so complete as he had seemed to imagine, for while he assumed in his letter that the S.T.E. "is apparently moribund," "is a wash out," "appears to have made little or no headway," "is unknown to a very large number of potential members," &c., the account which you publish in the same issue of the successful launching of an unemployment scheme by the Society for its members tells a somewhat different story. The next time he wants to judge us "by the paucity of Press references" he ought to select an issue of your journal which does not happen to contain at the same time a tribute to the work of the organisation he wishes to assail, or an account of its useful activities.

Your contributor is, of course, free to do any propaganda work he wishes for the E.P.E.A., but it is not usual to do this by attacking a kindred organisation that has a much larger and more difficult work to attempt than has the E.P.E.A., which confines its operations in the main to protecting the interests of a strictly limited and specialised class.

NORMAN WYLD,
Director, Society of Technical Engineers.

London, *December 5th*, 1922.

From New Zealand to Canada.—A printer's error occurred toward the end of our leaderette bearing this title in our last issue. After the page had gone to press the word "appointment" was inadvertently substituted for "question" in the last line but two.

The London Branch of the E.C.A.—The Electrical Contractors' Association is finding the London branch growing rather beyond control, owing to the increase of membership. It is proposed, therefore, to organise a number of sub-branches in the suburban districts. The first of these is to be at Ealing, to form a centre where Ealing, Acton and district members can [illegible] It is hoped that the organisation of other similar [illegible] rapidly follow.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—STREET LIGHTING. Members of the Institution have been invited to attend a meeting of the Illuminating Engineering Society at the Royal Society of Arts on [illegible] when a paper on the subject of street lighting will be read by Mr. H. T. Harrison.

NORTH-EASTERN CENTRE: LOCAL SECTION.—On December 1st the Centre held a joint meeting with the North-East Coast Institution of Engineers and Shipbuilders and the Mining Institution at Newcastle, when Mr. W. Owen lectured on "Some Observations on Distortion in Wireless Telephony." Ninety-three members and visitors were present to hear a very interesting lecture, and also some music which Mr. Owen received on the apparatus he brought with him, broadcast by the local station.

On December 2nd the same Institutions paid a visit to the Heaton Works of Messrs. C. A. Parsons & Co. About a hundred and fifty members and visitors spent a very interesting and enjoyable afternoon.

At the next meeting to be held on December 15th Mr. J. Piquet (Student) will read his paper on "Automatic Control Equipment Used in d.c. Traction" at the Armstrong College at 7.15 p.m.

Junior Institution of Engineers.—The Institution wishes to make known to engineering employers the facilities afforded by its Engineers' Register to assist employers in obtaining the services of men, technically and practically trained in all branches of engineering. The long-continued depression in the engineering world has compelled a number of members to seek the aid of the Register in finding fresh appointments. At present it contains particulars of men of all ages and degrees of experience who are open to accept positions; therefore the Council is anxious to broaden in every way the activities of the Register and thus jointly assist the members and also possible employers. No charge of any kind is made. Many employers have found the Register of great assistance to them, as only those men whose experience qualifies them for a position are put forward. All inquiries should be directed to the Secretary of the Institution at 39, Victoria Street, S.W.1.

Royal Institution.—At a general meeting of the members on December 4th Sir Arthur Keith was elected secretary in succession to the late Colonel E. H. Grove-Hills.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

We read in a Bradford paper that MR. THOMAS ROLES, Chief Electrical Engineer, to whose breakdown we referred some weeks ago, is progressing favourably at Brighton, though, as might be expected, he feels very keenly the enforced absence from work.

Shoreditch Borough Council Lighting Committee has elected ALDERMAN P. KELLEHER as chairman, and COUNCILLOR W. D. ELLIS as vice-chairman, for the ensuing year.

ALD. BOWES has been elected chairman of the Manchester Corporation Tramways Committee and ALD. CHAPMAN deputy chairman, and the Electricity Committee has elected ALD. DAGNALL chairman and ALD. WALKER deputy chairman, for the ensuing municipal year.

We read with regret a Paris Press dispatch to the effect that DR. VAILLANT, an X-ray specialist at the Lariboisiere Hospital, one of the many doctors who have fallen a victim of X-rays, has just had to have his right arm amputated in order to save his life. Some time ago he lost his left arm in similar circumstances.

We learn that MR. A. E. MCCLOSKEY has been called to the Bar after having completed thirty years' service on the engineering staff of the G.P.O., London. During this period his services have been successively "loaned" by the Postmaster-General to the Midland (N.C.C.) Railway; the Bombay, Baroda and Central India Railway; and the Ceylon Government Railways. He was also appointed State Engineer to the Commonwealth Government of Australia. During the war he held the rank of captain in the Ceylon Engineers, and was mentioned in despatches. Following a railway disaster at Ghaziabad, the Government of India arranged for Mr. McCloskey to deliver, at a conference of general managers, a lecture on the dangers common to all existing types of single line block systems. In an official minute the railway board expressed the opinion that the improvements suggested by Mr. McCloskey would provide "real protection to the traffic." Mr. McCloskey was in charge of the electrical train signalling on the occasion of the Delhi Durbar, and he is at present on a year's special leave studying the causes of the recent disaster at Rangoon, in which 150 persons lost their lives. In our issue of September 8th last he drew attention to a startling recurrence of accidents due to exactly similar causes, indicating the need for establishing a central "Safety Commission" to which suggestions for the improvement of railway signalling apparatus could be submitted for examination and development.

MR. W. S. SAYTELL, who had been appointed to take charge of the Carolina Port Generating Station, Dundee, has accepted

an appointment as chief engineer in the South of Scotland in order to fill the vacancy. The Corporation proposes to raise the status of Mr. Charles Lees, Mr. T. L. Reid, the salary of the former to be increased to £1,000 per annum.

We are informed that Mr. [illegible] Schlueder, assistant to the managers of the Supply and Merchandising Departments of the Westinghouse Electric and Manufacturing Co., and special representative of that company in foreign countries, left recently for a four months' trip in the Orient to study business conditions there. Mr. Schlueder will visit Japan, the Philippines, and China, to make a sales survey, investigating especially the possibilities of expansion of the market for household appliances.

Mr. David Jones, who has been on the electrical staff of the Powell Duffryn Coal Co., has accepted an appointment in India, and he has been presented by the electrical staff of the company with a gold watch and a silver cigarette case.

On the evening of November 24th a gathering was held in the canteen of the Falkirk Iron Works to mark the completion by two more of the Falkirk Iron Co.'s employés of fifty years' service with the firm.—Mr. William Anderson, of the B.B. fitting department, and Mr. Abram Henderson, of the stores department. Following their usual practice, the Falkirk Iron Co., Ltd., presented the two guests of the evening with gold watches, the presentation being made by Captain H. J. Kennard, managing director. The addition of Mr. Anderson and Mr. Henderson to the "Order of the Golden Timepiece"—as the holders of the honour have been termed—brings the number up to 32, and of these 30 are still in active service with the firm. After the presentation a social evening was spent.

The Rt. Hon. F. G. Kellaway, P.C., has been appointed a director of Marconi's Wireless Telegraph Co., Ltd.

Mr. George T. Redgment, following a breakdown in health in December last, has by mutual consent resigned his seat on the board of Mann, Egerton & Co., Ltd., and also his position as manager of their electrical department. Mr. Redgment has opened new offices at 69, London Street, Norwich, where he will practise as a consulting electrical and mechanical engineer.

Obituary.—Mr. H. Woodville Miller.—We deeply regret to learn of the death of Mr. H. Woodville Miller, M.I.C.E., M.I.E.E. He passed away on Monday after a long and painful illness. Mr. Miller was a prominent man in the electricity supply industry, and possessing a spirit of enterprise, he was advanced enough in receptivity and application of technical ideas to adopt at his station at Kensington the construction of boiler furnace to secure complete combustion which was suggested in the Electrical Review by our late contributor and friend, W. H. Booth. Mr. Miller, who was general manager and chief engineer to the Kensington and Knightsbridge Electric Lighting Co., Ltd., and a member of the Kensington & Notting Hill Electric Lighting Committee, was also a director of the London Electricity Joint Committee (1920), Ltd. He had also been a member of the Council of the Institution of Electrical Engineers. The final rites were performed at Golders Green Crematorium yesterday (Thursday) morning.

Mr. Miller was one of the pioneers of electric light and power distribution in London. He was selected, in 1886, from among the Chelmsford pupils, to assist in working out in London the system of electric light distribution which had just then been brought to completion by Cromptons, in Vienna. Throughout his life-time Mr. Miller was connected with this undertaking, and he was responsible for the design, carrying out, and the successful working, of the two companies which supply the Kensington end of London. In 1899, when it was seen that stations centrally placed in populous districts could not be extended to meet the growing demand, Mr. Miller designed and carried out the power station at Wood Lane for the supply of the Kensington & Knightsbridge Co. and the Notting Hill Co. He succeeded Col. Crompton as engineer-in-chief to the Kensington Co., and eventually became engineer and managing director of that company, and continued in this position up to the time of his death. His is a typical case of how much can be done by quiet unassuming work, gradually developing the lighting and power system to meet the requirements of the West End of London, and throughout with the utmost care for the interest of his shareholders by well-thought-out capital expenditure. He collaborated with Col. Crompton in the development of large accumulator stations as the best means of securing continuity of supply. His station placed underneath the Albert Hall is a good example of an accumulator station of its kind, and has been copied with advantage, not only in the United Kingdom, but in other parts of the world. He also worked out the system of bare copper underground mains which was, at the time of its introduction 35 years ago, considered a notable departure, and which has, to a great extent, vindicated its claims to durability, low cost of upkeep, and small interference with the surface of the streets. Mr. Miller said, and with justice, that he was proud of having in his charge an electric lighting system which could boast of being free from interruptions or extinctions for periods of 20 years at a time. He was responsible for the introduction of many improvements in steam raising apparatus, notably automatic stokers, as well as Halpin's thermal

[illegible] and many other [illegible] who knew him best [illegible] the [illegible] and [illegible] to the [illegible] with [illegible] capital [illegible] which ended on Monday last. [illegible]

Mr. W. Wilson.—In the sudden death of Mr. W. Wilson, the Indian Railway Conference Association has lost [illegible] Mr. Wilson was [illegible] town during the [illegible] the company [illegible] and was 71 years of age. His end, which is attributed to valvular disease of the heart, was extremely tragic, having occurred on his way to business on November 24th.

Mr. George Richard Wilson.—We regret to record the death, which occurred on November [illegible] in London, after a short illness, of Mr. George Richard Wilson, eldest son of the late Professor Frederick [illegible]. Mr. Wilson, who was an O.B.E., and a member of the Institution of Electrical Engineers, was chief [illegible] Indian Peninsula Railway [illegible]

Will.—The late Mr. Thomas Esplin, left £20,[illegible]

NEW COMPANIES REGISTERED.

Southern Radio Supplies, Ltd. (186,106).—Private company. Registered November 24th. Capital, £200 in £1 shares. To carry on the business of manufacturers of and dealers in [illegible] apparatus and [illegible] &c. The subscribers are [illegible] 29, Chesham Road, Leatherhead; L. Mason, 29, Chesham Road, Leatherhead; H. D. Grant, no address given. Qualification, £50. Registered office: 29, Chesham Road, Leatherhead, Surrey.

Wilkinson's (Liverpool), Ltd. (186,160).—Private company. Registered November 28th. Capital, £2,000 in £1 shares. To acquire from A. Wilkinson the goodwill of the business carried on by him as an engineer and dealer in [illegible] at 29, Dale Street, Liverpool, and to carry on the business as such. The first directors are: H. Brown, 184, Green Lane, Walton, Liverpool; J. Davies, "Harcourt," Kingsway, Wavertree, Liverpool; [illegible] Road, Wavertree, Liverpool; R. E. Hughes, 9th Green Road, Wavertree, Liverpool; W. Jones, 41, Evermore Road, Wavertree, Liverpool; [illegible] 62, New Green Road, Wavertree, Liverpool; and A. Wilkinson, 42, St. Nicholas Road, Wavertree, Liverpool. Registered office: 17a, South Castle Street, Liverpool.

Aspden Flywheel Dynamotor Syndicate, Ltd. (185,950).—Private company. Registered November 24th. Capital, £1,000 in £1 shares. To acquire certain patent rights, patents, and inventions relating to [illegible] and to carry on the business of engineers, electricians, [illegible] and dealers in engines, motor cars, carriages, ships, boats, aeroplanes, airships, and all other kinds of vehicles, &c. Share No. 1 shall be allotted to G. A. Edwards, and whilst held by him shall be called the Life Governor's Share. The subscribers, each with one share, are:—G. A. Edwards, 32, Oxford Street, Liverpool, engineer; A. Whittingham Jones, 41, Castle Street, Liverpool, associated accountant. G. A. Edwards is the first director. Registered office: Croxteth Works, 65a, Aspen Grove, Liverpool.

K. H. E. Ignition Co., Ltd. (185,873).—Private company. Registered November 21st. Capital, £1,000 in £1 shares. To adopt an agreement with G. A. Edwards for the acquisition of [illegible] patent, known as the "K.H.E. Synchronised Ignition," in consideration of which 250 ordinary shares fully paid up shall be allotted to him, and to carry on the business of manufacturing electrical engineers, electricians, repairers and manufacturers of, and dealers in, engines, motor cars, carriages, ships, boats, aeroplanes, airships, and all other kinds of vehicles, &c. Share No. 1 shall be allotted to G. A. Edwards, and whilst held by him shall be called the Life Governor's Share. The subscribers, each with one share, are:—G. A. Edwards, 32, Oxford Street, Liverpool, engineer; A. Whittingham Jones, 41, Castle Street, Liverpool, associated accountant. G. A. Edwards is the first director. Registered office: Croxteth Works, 65a, Aspen Grove, Liverpool.

Wark and District Electric Lighting Co., Ltd. (186,144).—Registered December 1st. Capital, £1,500 in £1 shares. To acquire a sublease of a certain piece of land at Wark, Northumberland, and to erect thereon a generating station for the purpose of supplying the village of Wark and district with electric light and power. The first directors are:—A. H. Ridley, Park End, Wark-on-Tyne; T. Taylor, Chipchase Castle, Wark-on-Tyne; A. Chapman, Horraby, Wark-on-Tyne; S. S. Haggie, Lee Hall, Wark-on-Tyne; A. Andrews, Woodlands, Riding Mill; T. Reed, The Nook, Wark-on-Tyne; J. Storey, Harlow, Park Avenue, Hexham; T. Rowell, Bridge End House, Wark-on-Tyne; T. Civil, Wark-on-Tyne; Mary Charlton, Black Bull Inn, Wark-on-Tyne; Mary Bell, Hexham House, Wark-on-Tyne; A. Charlton, Battlesteads, Wark-on-Tyne. Qualification, £50.

British Radio Manufacturers and Traders' Association (186,058).—Registered on November 29th as a company limited by guarantee. The objects are: To promote and protect in the United Kingdom and abroad the various trades concerned in the supply of materials for use by suppliers of electricity, manufacturers of wireless instruments and component parts in wireless [illegible] persons and companies engaged in [illegible] industries or in any branch or section thereof (collectively called "traders"), &c. The subscribers are:—E. Merriman, 73, Ellscombe Road, Charlton, S.E. 7, joint managing director; Pettigrew & Merriman, Ltd.; B. G. Calver, 52, Linver Road, Hurlingham, S.W. 6, manager, Whale Wireless Co.; J. E. Sutton, 18, Melford Road, East Dulwich, S.E. 22, wireless engineer; E. E. Rosen, 158, City Road, E.C.1, wireless engineer; H. G. Walker, A.M.I.R.E., Park Lodge, Brentford; C. Hall, 10, Fitzroy Square, W.1, wireless engineer; A. W. Knight, 26, Stanbury Road, S.E. 15, wireless engineer. The management is vested in a council, upon which no persons but [illegible] November 28th. None but trade members may be [illegible] Solicitors: Kenneth Brown, Baker, Baker, [illegible] House, Norfolk Street, W.C. 2. No notice of situation of registered office was filed at time of incorporation.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Marconi's Wireless Telegraph Co., Ltd.—A trust deed dated November 17th, 1922, has been registered to secure £1,500,000 debenture stock [illegible] to £3,000,000. The company's undertaking and property, including [illegible] Holder: [illegible]

General Electric Co., Ltd.—Satisfaction to the extent of £35,000 on November 17th, 1922, of debenture stock dated July 22nd, 1921, securing £100,000.

National Signs, Ltd.—Mortgage dated November 20th, 1922, to secure £5,000 charged on the [illegible] premises in Hendon Heights, Dr. A. T. Cranfield, "The Wellesley," Market Harborne, and S. Hastings, 44, Devonshire Street, W.

London Magneto Repairing and Winding Co., Ltd.—Debenture dated November 24th, 1922, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. [illegible] 68, Rayner Road, Harrow-on-the-Hill.

Varley Magnet Co., Ltd.—Satisfaction in full on November 1st, 1922, of debentures dated June 3rd and June 24th, 1913, securing £2,500.

Oliver Pell Electric and Manufacturing Co., Ltd.—Satisfaction in full on February 17th, 1921, of debentures dated May 30th, 1907, securing £15,000. (Notice filed November 24th, 1922.)

Willesden Electric, Ltd.—Mortgage debenture dated November 16th, 1922, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. E. Cuttle, 72, Leicester Road, North Kensington.

Pynex Manufacturing Co., Ltd.—Particulars filed of £400 debentures authorised November 23rd, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; the whole amount being now issued.

CITY NOTES.

India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd.

The ordinary meeting was held on November 30th at the offices, 106, Cannon Street, E.C., Mr. C. H. Gray, chairman and managing director, presiding. In proposing the adoption of the report the chairman said that it was a matter of extreme regret to the directors that they had again to report a net loss. That loss was due mainly to two causes, first, the necessity to further depreciate the stock values at home. Persan, and foreign branches, in which respect the accounts were affected by a sum approximating £65,000; secondly, the conditions surrounding the tire section of the business, brought about by intense foreign competition. Comparing the accounts with those of a year ago, when the trading loss was £149,640, they were able to show a gross profit of £166,490. That was a decided improvement, even though the net result revealed a loss of £94,406. The reserve fund now stood at £140,721, having been reduced by the transfer of £75,000 to the profit and loss account to cover the loss on trading. Their liabilities to bank and other creditors were less this year than last by £20,094, whilst on the assets side trade debtors and estimated amount of claim for refund of excess profits duty were £32,000 greater. With regard to tax matters, here and in France, in both cases no settlement had yet been arrived at. The cash and bills in hand stood at £84,276, as against £65,786 last year, showing an increase of £18,500. Stock in trade, including expenditure on work in progress, was less by £46,550 than the figure in last year's balance sheet. Regarding the cash, stock, debts, &c., at Persan and branches, there was a reduction of £136,643 in the figure at which these assets stood last year. The depreciation of stock values amounted to £65,000, and was brought about by the falling markets and the keen competition to obtain business. In buying their raw material they had found it very difficult to follow the fluctuations in price between the American and Egyptian varieties of cottons, which seemed to vary irrespective of their technical value. Their policy, therefore, during the past year had been to go slowly in this connection until the market settled itself into some degree of steadiness, but even with this precaution they had had to write down their raw material to the lower market value at the time of stock taking. In dealing with the second cause of the year's loss he briefly reviewed the varying phases of the tire business at Silvertown, which had culminated in the present situation. About 1902 they experimented on and produced a cord tire which was known as the Palmer cord tire. It was expensive to make, but from the point of view of efficiency it was ahead of any tire at that date. Their competitors, who were making a canvas tire (as distinct from a cord), in course of time improved in the manufacture of their product, so that in 1914 their product was relatively more efficient, although still not equal to the efficiency of the Palmer cord tire. The Palmer cord tire, however, did not fulfil the condition of low price, and therefore the works set about designing a cord type of tire (which was now known as the "Dunlop") which would be at least as efficient and cheap to produce as any competitive tire. After exhaustive experiments they produced the type of tire they were seeking in the size which would be suitable for Ford cars and vans, with the result that they were at last in possession of the expensive Palmer cord tire on the one hand, and a cheap and efficient tire on the other (the latter, however, only in one size). The tire business was a very big one, even in these times, and they wished to get their fair share of it; they thought they would be able to do so with their new tire, but they must have the necessary assortment of sizes to meet the market requirements. In turning to the general production at Silvertown, the total sales showed only a slight increase over the sales during the eleven months ended August 31st, 1921, the figures being £1,061,736, as against £1,031,130, but analysis of those sales showed a very considerable reduction in the re-sale of bought-in goods, and an increase in the sale of Silvertown manufactures from £902,917, in 1921, to £1,009,980 in 1922. Although considerable reductions had been made in the expenditure on repairs and upkeep, on the supply of steam and power, and on administrative and non-manufacturing salaries and wages, the burden of these on-cost charges was still too much for the output of the year to carry if the selling prices at present obtainable were to yield a satisfactory profit. The market value of the stocks was again lower at August, 1922, than at August, 1921, with the result that values had to be written down in the stock sheets. They were affected by the engineers' lock-out, which commenced in April last, and continued for about three months. That caused the closing of their instrument shop for this period, and delayed the manufacture of tools and appliances required for the various departments of the works, but they were able to keep a sufficient number of non-union men to carry on the repairs and maintenance of machinery and the supply of engineering material required for customers' orders. The indirect effect on their business due to the failure of demand from engineering and other firms for their products was undoubtedly serious. They had been entirely free from any disputes with their workpeople in the rubber works. With regard to the hourly output of workers, it was difficult to get accurate comparisons, owing to the variety of goods manufactured, and the changes in rates of pay made during the year. It was thought, however, that the improvement in the output of piece workers had been maintained, and that there had been an improvement in the output of time-workers. During the past year they had done a certain amount of submarine cable work, and if, as seemed probable, the demand increased in the near future, they hoped to get their fair share of the orders. The costing section was efficient, far-reaching, and ably handled, and the work of that section was greatly responsible for the improvements which had steadily taken place during the past year.

Major Darwin seconded the motion, and remarked that, despite the present balance sheet, his confidence in the future of the company was as great as it ever had been, and he hoped to remain on the board until a dividend was again paid.

The report was adopted unanimously.

Western Telegraph Co., Ltd.

The annual general meeting was held November 29th, Sir John Denison-Pender, G.B.E., presiding. The chairman expressed the company's regret at the recent death of Mr. John G. Griffiths, and then, turning to the accounts, said that the surplus, although smaller than in the previous year, was satisfactory having regard to the difficulties of the period. The position had been improved by reduced working costs and lower taxation payments, and consequently the rate of dividend had been maintained. Over £400,000 capital expenditure had been incurred during the year, the principal additions being cables between Pernambuco and Maranhao, Pernambuco and Maceio, and between Rio de Janeiro and Santos. The city of Victoria, on the Brazilian coast, had been connected to the system by duplicate cables to Bahia and Rio de Janeiro. The United States Government had rescinded its refusal to permit the landing of cables at Miami, Florida. The chairman was glad to say that there were signs of improvement in South American trade. The recent earthquake on the coast of Chile had broken numerous cables, but the repair ship had reached the spot within six days, and many of the breaks had been repaired. To take the place of the cable steamer *Cormorant*, which foundered on January 24th last, the company had chartered the cable steamer *Sentinel* until a new steamer, now under construction, was completed. It had also been decided to replace the *Norseman* with a somewhat larger vessel, which was being built.

The report and accounts were adopted, and in reply to a shareholder Sir William Plender said that the company had had to realise investments to provide funds for new capital expenditure. This accounted for the change in the amount shown in the balance sheet.

Anglo-Argentine Tramways Co.

The Times says it is reported that at a meeting held in Brussels the company decided upon a plan for funding the arrears of interest on the company's second preference shares. The company's issued capital consists of £3,200,000 5½ per cent. first preference shares, £2,500,000 5½ per cent. second preference, and £3,250,000 ordinary. All the ordinary capital is now held by La Compagnie Générale de Tramways de Buenos Ayres, but the preference capital is largely held by investors in this country. This once prosperous undertaking has been passing through lean times, and the interest on the second preference

shares is in arrears as from July 1st, 1918, which means an accumulation of arrears as on June 30th last of £550,000. It is intended to raise the rate of interest on the second preference shares from 5½ to 6 per cent., and to satisfy interest outstanding by an allotment of second preference shares carrying the higher rate. By this step the way will have been cleared for a resumption of dividends on the ordinary capital, which has been without any reward since 1914.

French Companies.

The accounts of the *Société l'Electro-Cable* show net profits of 2,543,000 fr. for 1921-22, as compared with 1,611,000 fr. in the preceding year. It is proposed to pay a dividend at the rate of 35 fr. per share, as against 50 fr. in 1920-21, a large balance being carried forward as a measure of prudence and also having regard to the recent increase in the share capital to 20,000,000 fr.

The report of the *Société des Accumulateurs Electriques* (late A. Dinin) states that the turnover in 1921-22 was greater than in the preceding year, and production on a large scale at the Nanterre works had resulted in favourable prime costs. Having regard to general conditions and the fall in prices due to very keen competition, the financial results ought to be considered satisfactory, the net profits being 839,000 fr., and the dividend (statutory) 6 per cent.

The *Compagnie des Etablissements Industriels* (Grammont) reports a deficit of 2,479,000 fr. for 1921-22. Speaking at the recent annual meeting, the chairman stated that it was now possible to expect a normal yield on the capital invested. Concerning the business expected to result from the electrification of the railways and the renewal of the telephone and telegraph network, the speaker stated that the particular expenditure which interested the company and its branches amounted to more than a milliard of francs spread over only a few years. It was conceivable that this enormous work would raise very keen competition among the few French manufacturers. As to the technical difficulties, he said that other nations had obtained some advantage during the war, but since then the French had resumed their position, and their English allies had shown themselves, personally with regard to the company, quite willing to allow the French to derive the benefit of their experience on most moderate terms. As a consequence the French industry would not be inferior to that of other countries either in the matter of cables or telephones. In conclusion, the chairman stated that he and the other French makers had confidence in the patriotism of the Government to entrust the works in question to the national industry.

The accounts and balance sheet for the working year 1921-22 of the *Maison Bréguet* shows a credit balance of 1,866,160 fr., being an increase of 125,245 fr. on the previous year. A dividend of 50 fr. gross per share was declared, half of which has already been paid on account. The company has concerned itself to sell ordinary machinery than to realise its mechanical and electrical specialities. With this end in view it has supplied this year to the national marine eight turbine motor groups for four 3,000-ton cargo boats and four oil tank ships. The results shown by these equipments had doubtless influenced the Minister of Marine's decision to equip the six torpedo-boat destroyers of the new naval programme with turbines of two systems, one of which is that of the company. Following up this the board has come to an understanding with two of the leading French naval shipyards that, should the latter secure the contracts for the ships, their plans will embrace the use both of Bréguet turbines and of motors, the latter developing 50,000 h.p. The new workshops at Douai, expected to be ready by March next, occupying 2½ hectares, of which 12,000 metres are roofed, have a plant of 1,800 h.p. and 130 machines, and represent a capital of 3,000,000 fr. These, with the Paris workshops, will be available for carrying out the naval programme.

The board of the *Energie Industrielle* has been empowered by a recent extraordinary meeting to raise the company's capital by the issue of 40,000 100-franc shares, payable in cash. The board was also authorised to issue a further 1,000,000 shares, to be employed in payment for the several undertakings it is intended to absorb. These are as follows:—The Usine électrique d'Oloron, the Société Haute Dordogne Force et Lumière, the Société d'Eclairage et de Force de Vougeot, the Compagnie de Fréjus et de Saint Raphaël et Services des Eaux de Fréjus, and the Compagnie Electrique de Menton. The acquisition of the network of the first-named company will give the Energie Industrielle a considerably enlarged field of action, its available power being 4,000 h.p., the agreed compensation being 6,500 shares; the consideration for the absorption of the second company is three ordinary shares of the Energie Industrielle for each 1,000 fr. shares of the Taute Dordogne company, the latter bringing in its newly completed hydro-electric station on the Dordogne; the third company brings into the common stock a 72-km. network of high-pressure lines and 20 km. of l.p. in the Côte d'Or and Saône et Loire; the fourth company owns the electrical concessions for the towns of Fréjus and Saint Raphaël, besides possessing two gasworks in the same towns; the fifth company also owns the municipal concession at Menton, drawing part of its current requirements from its own 1,800-h.p. peat station and part from the Briel station on the Roya, owned by the Eenrgie Industrielle. These new resources are destined to give the greatest development and return to the business of the amalgamation. Future plans contemplated in the latter and the Basses Pyrenées are the doubling of two hydro-electric stations and the creation of a great high-pressure network, shared up to the various stations and concessions, for which further additions of capital will be needed.

German Companies.

The accounts of *Max Schorch & Co.*, electrotechnical works, of Uhingen, permit of the payment of a dividend at the rate of 25 per cent. for 1921-22, this compare with 10 per cent. in the previous year.

The directors of the *Bavarian Telephone Works Co.*, of Munich, whose new works was brought into use shortly before the close of the financial year, recommend a dividend at the rate of 15 per cent on share capital of 20,000,000 marks for 1921-22.

The directors of the *Telephone Works Co.* (late *J. Berliner*) recommend an increase in the rate of dividend from 20 per cent. in 1920-21 to 35 per cent. in 1921-22. At the same time the share capital is to be raised by 70 millions to 100 millions of marks.

The *Bank of Electrical Values*, which as an investment company is the present title of the former Berlin Electricity Works Co., reports net profits of 30,700,000 marks for 1921-22, as contrasted with 13,800,000 marks in the previous year, and the dividend is at the rate of 25 per cent., as against 18 per cent. It is now proposed to increase the share capital by 98,500,000 marks and redeem debentures for 55,000,000 marks.

The *Poege Electricity Co.*, of Chemnitz, states that the company successfully participated in 1921-22 in the work in connection with the supply of electricity in country districts, particularly in the erection of transmission lines for pressures up to 100,000 volts. After having made provision for depreciation, the accounts show net profits of 10,576,000 marks, as compared with 5,095,000 marks in 1920-21, and the rate of dividend rises from 12 per cent. in the latter year to 20 per cent. in 1921-22.

The *German Telephone and Cable Industry Co.*, of Berlin, reports net profits of 1,334,000 marks for 1921-22, as compared with 850,000 marks in the previous year, and a dividend at the rate of 12 per cent. and 8 per cent. in the two years respectively.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:

Toronto Power Co.—£2,344,623 4½ per cent. guaranteed debenture stock.
British Columbia Telephone Co.—$1s per cent. cumulative preference shares of 100 dols each; and 4½ per cent. first mortgage debenture stock.

The undermentioned have been ordered to be officially quoted:—

Pernambuco Tramways and Power Co.—£500,000 8 per cent. prior lien debentures, Nos. 1 to 5,000 (£100) (bearer), in lieu of the scrip now quoted.

Companies Struck off the Register.—The following companies have been struck off the Register and are dissolved:—

Institute of Medical Electricity, Ltd.
International Electrical & Mechanical Supplies Co., Ltd.
Mac Sparking Plug Co., Ltd.
Pebeo Accumulators, Ltd.
Simplex Power Generator Co., Ltd.
United Electrical Works, Ltd.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Final dividend of 3 per cent., less tax, being at the rate of 6 per cent. per annum on cumulative preference shares for the half-year ending December 31st.

Ferranti, Ltd.—The net profit for the year ended June, 1922, is £24,371, plus £16,123 brought forward. The directors submit a scheme for the reorganisation of the company's capital. The meeting is to be held on December 14th.

Waygood-Otis, Ltd.—Interim dividend on ordinary shares at the rate of 5 per cent. per annum.

Power-Gas Corporation, Ltd.—Dividend at the rate of 5 per cent., less tax, for the year ended September 30th, 1922.

Shawinigan Water and Power Co.—Dividend of 1¼ per cent. for the quarter ending December 31st.

Brazilian Traction, Light and Power Co.—Quarterly dividend of 1¼ per cent. on the cumulative preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The leading motive in the Stock Exchange markets is governed by ease of money on the one hand, a key note which is rather subdued, however, by the approach of Christmas, and the uncertainty of the outlook abroad, on the other. A good deal of capital continues to flow into Stock Exchange markets for investment purposes, though evidence of the public's invincible determination to maintain the tradition of window-dressing at the New Year is very obvious. The prices of gilt-edged stocks are firm; the electric lighting

market is good; recovery has occurred in some of the cable stocks and the Government's unemployment proposals are having a beneficial effect upon shares in various commercial undertakings, particularly those in the Midlands and the North, that are considered likely to obtain orders in connection with the relief and other works which are to be set up.

Curiosity is agog to know in what manner electrification of the various railways is to be financed. Railway companies like private individuals, seldom keep a greater cash balance at the banks than is necessary for ordinary working purposes. If called upon to provide substantial amounts for improvements or extensions, the companies may have to go to their stock-holders for new money. This factor is influencing prices to some extent. The prior-charge stocks of the leading railway companies, however, are maintained exceedingly well, in spite of the expectation that, if new issues are to be made, they will take the shape of debentures or some other pre-ordinary class of security.

Metropolitan Consolidated, after its substantial improvement, eased off to 60½; Districts are quiet at 46, following their jump of last week, and the Underground descriptions remain somewhat quiescent. Amongst the stocks of those steam railway companies which propose to put in hand important schemes of electrification, the disposition is for prices to improve, though the public demand for investments of this kind is very fitful, and it takes but a small amount of selling to bring about reaction after any spurt.

Details are now available of the manner in which will be allocated the award of £133,367 to the East London Railway as compensation in respect of the control of the undertaking by the Crown during the years 1915-21. The directors say they are advised that this sum is to be treated as revenue, and that its allocation to any purposes to which the earnings of the company may be appropriately applied, is within their discretion. It is proposed to pay the holders of the second-charge "B" debenture stock £16 on each £100 of stock, and the price of the security has risen to 82. The third charge 4 per cent. debenture stock is to receive 2 per cent., and the price of this stock is unchanged at 18, while the ordinary remains at 4⅛. There may be some disappointment felt at the way in which the amount is split up. Optimism had rather looked for a distribution of some trifling sum on the ordinary stock. However, no particular opposition is likely to be raised, and meetings are to be held on Friday next week at which an individual stockholder of each class will be selected to represent the interests of his class of stock in proceedings before the court.

Brompton Electric ordinary have risen to 10½, owing, of course, to the share bonus which the directors are going to distribute. City of London ordinary are better at 23s. 1½d. South Londons are nominally 4½, but can be bought at the price. Westminsters at 7⅛ show a rise of 2s. 6d.; there are 250 on offer at 8, at which the return on the money, on the basis of the last 10 per cent. dividend, works out to 6¼ per cent. City Lights can be bought at 44s. and the new County of London ordinary at 4s. 9d. premium, or a little less, equal to 27s. 3d. for the fully-paid; there will be a broken amount of dividend on these next time in consequence of the issue not being fully-paid yet.

Amongst the preference shares, selection is more limited, and apart from 500 Charing Cross 4½ per cents. offered at 4⅛, giving a return of 5½ per cent. on the money, there is not much to be obtained which gives this yield. County of London 6 per cent. preference are available at 23s. 3d., paying £5 3s. 6d. Yorkshire Electric 6 per cent. new preference at 21s. 9d., with a partial dividend in February next, afford 5½ per cent. on the money, and there are still a thousand or so of Scottish Power 8 per cent. preference to be had at 23s., at which the yield is nearly 7 per cent., taking into account the dividend due in February.

General Electric 7½ per cent. "B" preference at 21s. 9d., of which there are a thousand on offer, return £6 18s., and English Electric 6 per cent. preference at 18s. 6d. yield 6½ per cent.

The feature of the week in the tramway section is a rise of 15s. in Anglo-Argentine Tramways second preference. This has carried the price to 4⅝ and the first preference are also harder. The reason is simply that expectation looks for early publication of some scheme of funding the arrears of dividends on the second preferences, and it is hinted that any such scheme might involve an advance of ½ per cent. in the 5½ per cent. dividends. Brazil Tractions are two points down at 48, but the British Columbia stocks remain good and a further rise of three points has lifted the deferred to 89½. Mexicans are better on the whole, Mexican Light and Power preferred at 53½ being 2 up, though the common shares lost a point of their last week's advance.

West India and Panama Telegraph shares, after a long period of complete stagnation, have recovered on the announcement that the company is to be allowed to charge additional rates on its messages. The ordinary rose half-a-crown to 7s. 6d., the first preference rose 10s. to 10s., and the second preference at 25s. are 5s. up. The market is, however, more or less nominal, for there are more buyers than sellers. In the Eastern group, a better tone is discernible, with rises in Eastern Extensions, Eastern ordinary and Westerns. In fact, it may be said that the weakness of the last fortnight has been wiped out. Great Northerns at 23½ are 10s. up. United River Plate ordinary at 7⅛ show a gain of 5s., but the Marconi market is dull, the parent shares going back to 2½. The newly issued 6½ per cent. debenture keeps steady at 3⅛ premium over and above the issue price of 99.

Babcock & Wilcox hardened to 3 7/16, on the idea that engineering companies are likely to benefit substantially from the Government programme for provision of employment. Electric Constructions at 1⅜ are 1s. 3d. better, and Siemens strengthened to 22s. Metropolitan-Vickers ordinary are a better market at 28s. 9d. British Aluminium at 16s. 3d. lost a few pence. Otherwise the manufacturing market is very quiet. Rubber keeps firm, though not quite at the best which it recently touched. The market in rubber shares, after showing pronounced activity, subsided to some extent as regards the interest shown, without, however, prices going back to any noticeable extent. In the iron, coal and steel group, the passing of dividends by some of the principal companies in the business is partly offset by the hope that the renewed activity in the shipbuilding trade, coupled with the Government schemes for employment already mentioned, will have a favourable effect upon the fortunes of the companies concerned.

The South American Light & Power Co. announces that the Board are prepared to purchase any number, up to 50, of the 5 per cent. debentures of £100 each of this company. The circular adds that the "latest official quotation in the Stock Exchange Official List for these debentures is £71—£76 per cent." We may add that for some time past there have been buyers in the market, and very few sellers, so that a holder who cared to offer his debentures might not be unreasonable if he did so on the basis of 82 to 85 per cent.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend. 1920.	1921.	Price Dec. 5, 1922.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	12	10½	+ ½	£5 17 1
Charing Cross Ordinary	8	9	7⅜	—	5 16 2
do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6⅜	—	4 9 0
City of London	14	14	2⅝	+ 1/16	6 14 3
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1⅞	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1⅜	—	5 4 4
Kensington Ordinary	9	10	7⅜	-	6 7 0
London Electric	2¾	4	3	—	4 0 0
do. do. 6 per cent. Pref.	6	6	5⅜	—	5 17 1
Metropolitan	7	7	6⅜		5 7 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9½	—	6 9 9
South London	7	7	4½	+ ¼	6 4 5
South Metropolitan Pref.	7	7	1⅛		5 18 0
Westminster Ordinary	10	10	7⅛	+ ¼	6 7 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	102	—	5 17 6
do. Def.	1½	34/6	22½	—	6 19 0
Chile Telephone	6	6	6⅜		4 16 0
Cuba Sub. Ord.	7	7	8	+ ¼	8 15 0
Eastern Extension	10	10	19½	+ ¼	5 4 0
Eastern Tel. Ord.	10	10	190⅝	+2	5 5 0
Globe Tel. and T. Ord.	10	10	19½		5 4 0
do. do. Pref.	6	6	11⅛	-	5 7 10
Great Northern Tel.	24	22	23½	+ ½	7 14 4
Indo-European	10	10	35⅝	—	7 1 0
Marconi	25	15	2⅜	— ¼	7 1 2
Oriental Telephone Ord.	12	12	2⅝	—	*5 4 0
United R. Plate Tel.	8	8	7⅜	+ ¼	*5 5 0
West India and Panama	Nil	Nil	7/6	+ ¼	Nil
Western Telegraph	10	10	19⅜	+ ¼	*5 4 7

Home Rails.

Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	60½	— ½	2 14 5
do. District	Nil	1	46	—	2 8 6
Underground Electric Ordinary	Nil	Nil	8	— ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5

Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5½	12½	84	+ ¼	7 2 0
do. do. 2nd Pref.	Nil	5½	4⅜	+ ⅛	5 19 0
do. do. 5 per cent. Deb.	5	5	82½xd	—	6 1 3
Brazil Tractions	Nil	Nil	48	—2	8 6 8
British Columbia Elec. Rly. Pcs.	5	5	80	—	6 5 0
do. do. Preferred	5	93/-	77½	+1	*6 2 6
do. do. Deferred	3	124/-	89½	+3	*6 18 8
do. do. Deb.	4½	4½	80		5 6 3
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½		6 2 8
do. 6 per cent. Bonds	Nil	Nil	56½		Nil
Mexican Light Common	Nil	Nil	22⅜	-1	Nil
do. Pref.	Nil	Nil	53⅛	+2	Nil
do. 1st Bonds.	Nil	5	68½	+1	7 6 0

Manufacturing Companies.

Babcock & Wilcox	15	16	3⅜	+ 5/16	4 13 10
British Aluminium Ord.	10	5	16/3	—6d.	6 8 1
British Insulated Ord.	15	15	2⅞	—	6 17 0
Callenders	15	15	2⅛	—	7 1 2
do. 6⅞ Pref.	6⅞	6⅞	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	2/6		Nil.
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1⅜	+ 1/16	7 5 6
English Electric	8	5	15/-	—	6 7 0
do. do. Pref.	6	6	18/3	—	6 8 0
Gen. Elec. Pref.	6⅞	6⅞	21/9	—	5 19 6
do. Ord.	10	5	17/0	-	5 17 8
Henley	15	15	2½	—	6 11 8
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	12/6	—	—
Met.-Vickers Pref.	8	8	9⅜	—	6 14 9
Siemens Ord.	10	10	1⅜	+ 1/16	—
Telegraph Con.	20	20	25⅞	—	*4 13 6

* Dividends paid free of Income Tax.

CAUSES OF TRANSFORMER FAILURES.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

(Concluded from page 817.)

15. Coil conductors may be violently displaced on the occurrence of an external short circuit, as the result of internal unbalanced electromagnetic conditions. With concentrically wound primary and secondary coils (as in the rectangular core type of transformer) the horizontal axes may not coincide, and therefore a vertical force acting upon the coils is introduced in addition to the usual radial one. This vertical force has often been responsible for the distortion of end coils, particularly of the older designs of transformers in which the impedance was low. When a number of pressure-adjusting tappings are fitted, it is often very difficult to preserve electromagnetic symmetry at all ratios, and sometimes the unbalancing is unavoidable.

With sandwich-wound primary and secondary coils (as in the rectangular shell type of transformer) the axes of the individual coil sides may not coincide on account of the differences required in electrical clearances from coils to core, and of the differences in winding spaces. In this case the lack of symmetry introduces distorting forces acting radially upon the coil sides; which become pushed in towards the core and forced out away from the core, depending on the relative positions of the axes of the coil-sides and upon the relative short circuit currents flowing.

16. Short circuits between turns, breakdown of windings to earth, and puncture of insulators may take place due to the following transient phenomena:—

(*a*) Concentration of potential on the terminal end coils when switching-in or when lightning discharges reach the transformer. Owing to the change of surge impedance at the transition point between transformer and line, the phenomenon of reflected and transmitted pressure and current waves occurs, which may produce high voltage rises in the transformer windings. While the end coils bear the brunt of the shock, the remainder of the windings is not immune against breakdown, as high voltages may still penetrate any part of the windings.

(*b*) The concentration of potential on the end turns referred to above may be increased if a cable of high electrostatic capacity supplies the transformer. In effect each phase of the transformer is shunted by a capacity to earth which must be charged up before the disturbing wave can proceed, and the greater this capacity the longer will it take to charge up. Hence the pressure concentration on the end turns will also occur for a longer period of time.

(*c*) An effect analogous to (*b*) is produced by reinforcing the insulation of the individual conductors of the end coils. This decreases the electrostatic capacity between turns, and therefore the ratio of capacity to earth and capacity between turns is increased, and pressure concentration will be more intense.

(*d*) The phenomenon of reflected and transmitted pressure and current waves may also occur at open-ended tappings, at any point of change of surge impedance in the windings (such, for instance, as at the termination of conductor reinforcement, or at the space between series coils), and at the neutral or mid-point. Care should be taken to insulate the conductors in these regions very thoroughly, in order to eliminate so far as possible short circuits between turns.

The disturbing cause may be either ordinary switching-in, lightning discharges, an arcing ground, chattering switch contacts, or single pole connection by advancing switch spark.

(*e*) Internal local resonance of the coils may occur under the influence of any of the exciting causes mentioned under (*d*). This danger is perhaps somewhat remote.

(*f*) When switching-out of circuit a highly inductive winding, such as a transformer primary with the secondary open circuited, the magnetising current, and consequently the magnetic flux, tends to collapse instantaneously. While due to various reasons the flux does not do this, it does sometimes drop at a much more rapid rate than that corresponding to the normal cyclic rate of change, and as a result high pressure rises are sometimes produced. The rapid cooling of the interrupting arc, particularly during the last half cycle, has been found to augment this effect.

17. Sustained heavy overloads produce high temperatures throughout the transformer. The coil insulation becomes brittle, and in time probably flakes off the conductors in places, so producing short circuits between turns. The oil deposits sludge both on the tank bottom and on the coils and core structure. This deposit exerts a blanketing effect on the coils and core, so that the excessive heating becomes cumulative in effect. Narrow oil ducts also intensify the heating. Transformers with a high ratio of copper loss to iron loss are less able to withstand overloads, and are, therefore, more liable to fail on account of the troubles arising from this phase of operation.

18. When changing over tappings, the terminals of which are arranged on a single board, say, under oil level, wrong leads may be joined and part of the windings may be short-circuited. Heavy currents would then circulate in the short-circuited winding, which would produce a fault between turns unless the transformer was very speedily tripped out of service.

19. Bolted joints or connections carrying current may, if not very effectually locked, become loose in service, due perhaps to some slight vibration. Such joints will rapidly heat up, and even so trivial a fault may temporarily place a transformer out of commission.

(C)—Breakdowns in the Dielectric Circuit.

1. Moisture entering the oil as a result of the so-called "breathing" action greatly reduces its dielectric strength, so that breakdowns from coils or terminal leads to tank or core structure may take place. The greatest danger, however, is to the "minor" insulation of the coils, as previously referred to.

2. Deterioration of the oil may occur as the result of prolonged overloading of the transformer, and the action is materially assisted by the presence of bare copper and lead. Excessive oil temperature produces the formation of sludge, water and acids.

3. Dielectrics having different specific inductive capacities are often used in series, and unless their thicknesses are properly proportioned, they may be subjected to abnormally high dielectric stresses. For instance, the insulation between h.p. and l.p. transformer coils usually consists of cotton, linen or empire tape, bakelite and oil. Except in very high voltage transformers, the effect of the cotton covering and of the tape can be ignored, so that we only have to consider bakelite with a dielectric constant of 5, and oil with a constant of 2. The total pressure across two such dielectrics in series divides up so that the pressure across each is inversely proportional to the dielectric constants, and unless the respective thicknesses are proportioned so that the pressure gradient across each is within the safe working limit, first one and then the other dielectric will fail, due to corona discharge and overheating.

4. Corona may take place from sharp conducting edges or small diameter conductors if the surface pressure gradient is high. Corona discharge may also occur across the air space between the oil and tank cover of high voltage transformers. This can be remedied by short circuiting the air space.

5. Insulating parts, such as cylinders, tubes and

terminal boards, made of compressed paper bonded with synthetic resin, may occasionally have their surfaces contaminated during the manufacturing processes, or they may hold occluded air. The former fault is responsible for surface discharge, which renders the material useless, and, when occurring, generally does so on terminal boards. The latter imperfection usually results in complete puncture of the insulation concerned, as a result of ionisation of the occluded air and subsequent overheating of the dielectric. When this type of breakdown occurs, it is usually with cylinders and condenser terminals.

6. Earth shields placed between primary and secondary windings have been responsible for numerous breakdowns. Their presence produces a concentration of dielectric stress at their edges, which tends to strain the near-by insulation, while a breakdown at one point from the h.p. windings to the shield has often resulted in almost completely destroying the h.p. and l.p. windings on the limb concerned.

7. Narrow oil ducts are a serious menace to the serviceable life of a transformer. Adequate cooling cannot be obtained, the coil insulation becomes brittle in time, and a fault between turns naturally follows.

8. Occasionally metallic particles are found in the various kinds of pressboards, and these may result in a puncture of the board.

9. Careless workmanship may result in solder splashes on the coils and on surfaces which are depended upon for creepage clearances. The possible effect of these will be obvious.

10. During the course of time a certain amount of the oil disappears, due to evaporation and oxidation. Unless the oil is topped up to the proper working level, the transformer will overheat on account of the consequent loss of tank radiating surface and of the cooling medium.

11. Short circuits between phases may occur if there is insufficient clearance between the phases. This may be aggravated by the insertion of a pressboard barrier between phases if the presence of the barrier upsets the distribution of dielectric stress to such an extent as to throw too high a stress across the oil spaces and across the barrier.

12. If wood cleats which, for instance, support the terminal leads from coils, are not very thoroughly dried and impregnated, the moisture present will lead to burning of the wood and possibly to a short circuit between tapping leads.

13. In some instances the relationship of the electrostatic capacities between primary and secondary windings, and between individual windings and the core, may lead to the presence of high voltages in the low-voltage circuit. The solution of the problem is really one of earthing, and has been dealt with in a paper published in the Electrical Review in 1915.*

14. The presence of foreign conducting particles held in suspension in the oil may cause a temporary breakdown, due to the lining up of these particles between bare parts, having a difference of potential across them. Examples of this are the flashing over under oil of terminal leads to each other, and to the tank or core structure.

(D) – Breakdowns Due to Various Structural Defects and to Other Causes.

1. Core-type transformers fitted with adjustable axial coil supports usually have the necessary mechanical pressure for taking up the adjustment transmitted to the coils through heavy steel clamping rings. These rings have a gap in them in order to prevent the circulation of large short-circuit currents. Cases have arisen in practice where this gap has been bridged, and the steel ring melted in consequence.

2. Insufficient bracing of the leads from coils to terminals may result in these becoming distorted and making contact in the event of an external short circuit taking place on the system. The danger becomes very acute on large systems on account of the heavy short-circuit currents which may flow.

3. Transformer tanks, unless very careful attention is given to them, are a potential source of trouble. Bad welding, spongy plates, ungalvanised cast iron, and leaky fittings all lead to oil leakage and consequent overheating and breakdown of the transformer, if not attended to immediately. Rough handling in transit is also responsible for a large proportion of the leaky tank troubles.

4. Deposits of ordinary dust, coal dust, and salt spray on the surfaces of leading-through insulators often cause these to flash over to the case. The remedy is obvious.

5. In heavy current, low-voltage transformers, such, for instance, as are used for supplying electric furnaces, a number of coils each consisting of a number of heavy conductors in parallel are also connected in parallel. It sometimes becomes a matter of difficulty to design the low-pressure winding so that all the parallel paths between terminals will have the same impedance. If they do not, however, they will not share the load equally, and parts of the winding will overheat, with the usual inevitable result.

6. Transformers operating in parallel should preferably possess the same turns ratio, the same percentage impedances, and the same ratios of resistance to reactance drops. If any of these factors are different, one transformer at least will be overloaded, and may consequently burn out. This subject has been fully treated in a paper published in the *Electrician* in 1917.†

7. Heavy-current leads between furnace transformers and the furnace should be laid out so as to keep the impedance of the circuit within desired limits. If care is not taken to attain this, the voltage applied to the furnace will be very considerably below that required for successful operation. A case is on record where the l.p. leads formed a loop round an iron column supporting the building, thus increasing the inductance of the l.p. circuit and pulling down the pressure applied to the furnace.

8. When housing transformers, care must be taken to provide sufficient space around them so as to enable the tank to dissipate the losses. If a transformer is placed too near to another one or to the walls of the chamber, the tank will become lagged, and the temperature of the transformer will increase, so endangering the coil insulation and the condition of the oil. It is essential to provide adequate ventilation for all transformers. Closed pits and small brick chambers should be avoided wherever possible. In the case of furnace transformers, effective shielding should be interposed between the furnace and the transformers.

9. As the vapour at the top of the tank of oil-immersed transformers is of an explosive nature, a naked light should never be introduced for the purpose of examination of connections, &c. A case is on record where a transformer was wrecked and loss to human life sustained through neglect of this precaution.

10. The temperature of artificially-cooled oil-immersed transformers will increase to prohibitive figures if a stoppage of the cooling medium occurs due to some failure in the auxiliary cooling plant. If such a failure does happen, the load on the transformer should be decreased to such a value as it can handle as an ordinary self-cooled transformer without attaining an excessive temperature rise.

11. In water-cooled transformers the cooling tubes are liable to become clogged, due to deposits of lime or other matter from the water supply. If the tubes are not thoroughly cleaned out periodically, the water flow becomes lessened, and the transformer will attain a tem-

* "High-voltage Dangers Present in Static Transformers due to Electrostatic Capacities of the Windings," by J. Lindley Thompson and S. Austen Stigant. Electrical Review, January 1st and 8th, 1915.

† "The Parallel Operation of Static Transformers," by J. Lindley Thompson and S. Austen Stigant. *Electrician*, February 9th and 16th, 1917.

perature higher than the maximum permissible with the usual subsequent results.

12. Cases are on record where electrolytic corrosion has occurred in transformer oil coolers, due to the use of metals in actual contact, which are situated far apart in the table of electrochemical equivalents. The remedy, of course, is to use metals in contact which are as near together in the table as possible.

Conclusions.

A study of the records of modern transformer breakdowns which have occurred over a period of years shows very conclusively that between 70 and 80 per cent. of the number of failures are finally due to short circuits between turns, and a perusal of the foregoing lists will indicate that this may be caused in a number of different ways. Unfortunately, with a fault of this type it is usually very difficult to say definitely exactly what the failure has been due to, as all evidence is eliminated, as a rule, by the very nature of the breakdown. Consequently, the cause of the breakdown is often a matter for conjecture, and however unsatisfactory this may be from a point of definitely assigning the true cause, usually a very close idea of the real cause may be obtained by a careful study of the transformer itself and of the local and operating conditions. The foregoing review may further assist in determining the true cause.

The remaining percentage of breakdowns can often be minimised by provision of suitable transformer protective apparatus, and by regular and careful supervision of the transformers themselves, and of the operating conditions.

SOUTH AFRICAN TRADE AND INDUSTRY.

A report on South Africa, by H.M. Senior Trade Commissioner, has just been issued by the Department of Overseas Trade (price 1s. 6d.). After describing the consequences of the slump which occurred at the beginning of last year, Mr. Wickham alludes to information which was gathered in all parts of the United Kingdom that steady small replacement business was coming forward from South Africa in most lines. He adds, however, that there is no appearance of confident and large-scale forward buying.

No discouragement need be felt, for the United Kingdom seems to be obtaining its normal share of all the business that is passing. That this has been occurring for some time is brought out by a comparison which Mr. Wickham makes of the trade statistics for 1921 with those of the previous year.

The most noteworthy fact as to the character of imports is that in spite of a steep fall in cost, there is an increase in the total value of mining, manufacturing, and other machinery from £4,250,000 to £4,500,000, and an increase in electrical machinery and goods of £250,000. Similarly the Union Government's importations of machinery, rolling stock, and locomotives are approximately equal in value to those in the preceding year, and are therefore much greater in volume.

Foreign Competition.

There is a very marked falling off in Japanese competition, and a further loss of ground in the South African market by the United States, but an increased proportion of German goods. German competition is seen to be patchy—a feature which is becoming increasingly pronounced in many markets. For example, her imports of machinery aggregate only £89,000, as against over £1,000,000 from the United States, and electrical machinery and apparatus only £25,000. Again, whilst there was a notable importation of steel pipes, valued at £66,000, the entry of cast iron pipes to a value of £27,000 is less than normal.

The gradual reversion of trade into pre-war channels has reduced the American share of South African trade considerably. Some of the most important items of interest to the engineering trade are shown below :—

Imports from United States (1921).

Mineral oils, greases, and wax ...	£2,000,000
Machinery	1,087,000
Electrical goods	603,000
Iron and steel	279,000
Railway and tramway material ...	95,000
Tools (including machine tools) ...	140,000

On the whole, the imports of machinery in relation to foreign competition may be considered satisfactory. Of the total importation of electrical machinery and goods, including cable and wire, the United Kingdom and the United States of America shared about 96 per cent., in proportions of roughly 2 to 1. The American share is slightly larger than in 1920.

In the general machinery section the most important groups are "general manufacturing" and "mining." Of the former, the United Kingdom supplied over £1,000,000, as against £250,000 from America and £42,000 from Germany. Of mining machinery, £554,000 worth came from the United Kingdom and £347,000 from America.

Of the small quantity of machine tools (£22,000), America supplied nearly half. Of pumps, Switzerland and America shared half the supply. Of cranes, Canada supplied goods to a value of £20,000 and America £15,000. Half the printing machinery supplied was American. Of £22,000 worth of plant for confectionery manufacture, Germany supplied one-third.

In view of the constant inquiries as to openings and agents for petrol and oil engines, it is perhaps worth calling attention to the fact that the total importation for the year is set down at £43,000, of which 72 per cent. was British.

Automatic Telephone Extensions.

Over 63 per cent. of the small general trade in telegraph and telephone material was British. The preponderance of Swedish material imported by the Government is of course due to the nature of the existing telephone installations. As in the case of New Zealand, the British branch works are not allowed to supply this market. It is to be hoped that when automatic telephones become general, British works will be able to compete. The business in railway material, apart from the Government railways, is not large. The United Kingdom took second place to America in locomotives and supplied 25 per cent. of the light rails. Tramway rolling stock is being built locally to an increasing extent. Of such orders as were placed overseas, 75 per cent. went to America.

Mr. Wickham solicits support for the South African Association of British Manufacturers and their Agents, particularly in view of the projected revision of the Customs tariff next year. He points out that in the case of legislation of this kind it is useless for manufacturing interests in the United Kingdom to sit still and wait for information as to concrete proposals to reach them. By the time they have been studied and criticisms have reached the Union, it may be too late to secure amendments even of the most reasonable character. The Association is well equipped and eager to assist in such matters, and is prepared to make representations also in any case of unfair conditions of tendering or inequitable incidence of taxation or legislation generally.

Local Manufacture.

A particularly interesting section of H.M. Trade Commissioner's report is devoted to the problem of industrial development in South Africa. He agrees that from the point of view of British trade as a whole, the matter is not of vital importance, because if the Union embarks definitely on a policy of industrial expansion, the United Kingdom can supply machinery and manufacturers' requisites quite as easily as finished goods. The individual supplier will, however, be affected. Whether it is a question of continuing to import certain lines or of deciding to establish branch factories on the spot, the cost of distribution, particularly in the interior, is an important factor. With regard to bulky goods, such as iron and steel products, glassware and earthenware, domestic hollow-ware, steel trunks and tin boxes, furniture and many other lines, the raw material has for the most part to be imported if the goods are to be manufactured in the country, but the cost of transport of the finished article is so great compared with that of the material, that manufacture on the spot shows considerable saving.

On some classes of heavy goods, the railway freight rate for distances such as from Durban to Johannesburg is considerably higher than that by sea from Europe to South African coast ports. Actual instances can be multiplied, just as parallel cases in the United Kingdom itself may suggest themselves in relation to the cost of distribution of local products from one part of the country to another in competition with imported goods. In South Africa, however, the distances are so much greater, the towns smaller, and owing to the comparative paucity of traffic over the railway lines the cost of transport, of necessity, so much higher.

Reporting at the end of September last, the United States Trade Commissioner at Johannesburg says that the import statistics would indicate that the electrical trade must have "touched bottom," and that in the total statistics for the entire year some recovery should be recorded. He adds, however, that local stocks are about normal, and that no great increase in imports can be looked for as the result of any need to replenish them.

The large number of bids received, where quotations have been asked for indicates the keenness of competition in the South African market. A recent tender for lamps put out

by the Johannesburg municipality brought fifteen offers covering products from six different countries: the United Kingdom, Holland, Germany, Switzerland, Austria, and the United States. The total value of this contract was only £1,342.

At the same time, the trade Press of South Africa sees a distinct improvement in the local market for electrical supplies, and it is noted that inquiries are numerous and orders increasing. Prices are generally firmer. There is also, continues the Trade Commissioner, the promise of considerable expansion in business, in view of the installation of new electric lighting plants and extensions of existing power stations. It is also an encouraging fact that many municipal building schemes, requiring considerable electrical equipment, have still to be completed.

To the foregoing summary of the remarks of the British and United States Trade Commissioners may be added the following figures of South African imports of electrical goods during the first seven months of this year and last:—

	1921	1922
	£	£
Batteries, primary	22,634	5,500
Batteries, secondary	24,815	9,000
Cables and wire	248,000	104,000
Heating and cooking apparatus	32,000	15,000
Lamps, incandescent	96,000	47,000
Motors and parts	156,000	51,000
Transformers	45,000	9,000
Material and machinery, n.o.d.	648,000	276,000

DOMESTIC LOAD BUILDING.

Suggestions upon Propaganda Work.

By W. A. GILLOTT, A.M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

The object of this paper is to show some of the channels open to electricity supply undertakings for securing the domestic load. In certain districts it might be fatal to adopt a too progressive attitude, and one must therefore lead up to the point by suggestion; in others it may be found desirable to combine the development scheme, such as an educative campaign, by actual demonstration with Press and other advertisements. These methods are briefly discussed and a skeleton scheme (which has been embarked upon by certain authorities) of one year's propaganda campaign is outlined.

The author's remarks are not put forward as definite proposals as to how matters should proceed, but merely as a suggested principle upon which the framework of an organisation can be constructed to deal with the business.

The first matter that should receive attention is the personnel. From the chief engineer to, at least, the sales representatives each individual should possess an adequate knowledge of the subject of domestic electrification before attempting to advise others. In addition, an electrical installation, complete in every detail, should be in the homes of such members of the staff to enable them to thoroughly appreciate their operation, establish a belief in the commodity, and encourage prospective consumers.

It is desirable to keep a careful set of records and a two-part tariff, with a comparatively high fixed charge, and with the charge per unit so low as to provide a satisfactory return, is desirable; the fixed charge should be sufficient to cover a consumer's normal lighting costs when the low unit charge is added. In other words, his lighting account would be practically identical under this tariff with what it would be under the standard flat rate which may be in operation. This provides a safeguard against supplying the consumer at a loss, and it is only upon an increased consumption that he obtains the benefit of the cheaper units.

Taking 1 kW of lighting installed, under average conditions the normal consumption would be approximately 300 units per annum, thus:—

Flat rate, 300 units at (say) 8d., £10. Two-part tariff, fixed charge per kilowatt (lighting) installed (say) £8 10s., plus 300 units at (say) 1½d., £1 17s. 6d., total £10 7s. 6d.

The lighting account remains, for all practical purposes, unaltered. If such a consumer installs a cooker, catering for six persons, his consumption would be increased by approximately 1,750 units per annum, making:—

Fixed charge as before £8 10s., plus 2,050 units (lighting and cooking) at 1½d. £12 16s. 3d., total £21 6s. 3d.

The average price obtained per unit will be approximately 2¼d. It is good business to prove to a consumer that his adoption of a domestic or multi-part tariff does not increase his normal lighting account, and that wastage or extravagance in the use of light is costing him only 1½d. per unit, which can for practical purposes be ignored. He will then see that his cooking, heating or power is charged at this low rate and he will appreciate the change. The education of the consumer upon this point will be of great value, as he will learn to look upon his supply as being given at 1½d. per unit, and regard the fixed charge as a rental. Such an installation would create a maximum demand of approximately 3.5 kW, which would occur about mid-day, *i.e.*, at a time when the majority of generating stations would deal with the load. An increase of 3 kW of heating and 2 kW of auxiliaries would make but little difference to the maximum demand, this being approximately 5.5 kW, and then only in winter time, but the total consumption would be in the neighbourhood of 3,500 units per annum, representing, on the basis given above, an amount of £30 7s. 6d., *i.e.*, an increase of £20 7s. 6d. above the ordinary lighting returns.

Taking 500 of such consumers on the system, the maximum load installed would be 1,000 kW, the maximum demand on the station would not, however, owing to the high diversity factor, exceed 600 kW. The consumption of the whole would be 1¼ million units, and the revenue approximately £15,200.

One of the most important characteristics of this class of business is its continuity; in contrast to the industrial load it is unaffected by strikes or lock-outs, and this should increase the desire to cultivate it.

The accompanying curves indicate the nature of the load upon the Billingham Housing Estate and show the result of the demand of 25 houses only, *i.e.*, approximately one-third of the whole village.

The details of the installation of each house are: one cooker, one wash boiler (10 gallons), one fire, kettle or iron, lighting.

The average number of kilowatts installed at each house is 11.28, and the total connected load is 282 kW. The pressure at the consumers' terminals is 250 volts. The highest demand (approximately 31 kW) occurred on Sunday, December 11th, at 12.30 p.m., and lasted for only a few minutes, the average maximum demand being in the neighbourhood of 24 kW. The returns, being taken in winter time, are consequently at their maximum.

On Sunday much cooking is done, and a certain amount of heating is carried on from breakfast (8.15 a.m.) to 2.30 p.m. There is a short period of rest before tea is prepared, about 4 p.m., and at 6.30 p.m. the load quickly drops to the normal lighting demand, as is the case on each day of the week.

The morning load on Monday and Tuesday is due to the wash boilers and cooking. Monday's curve indicates that the boilers are in operation soon after 8 a.m. and that the cooking load is not so heavy, as probably no mid-day meals will be cooked. On Tuesdays almost the same conditions apply, but more cooking is done, as shown by the demand from 12.30 p.m. to 2 p.m. Thursday is the bread-baking day, as shown by the comparatively longer period of demand. Saturday appears to be a day of "put-off" meals.

These curves give much information, and one is able to estimate with accuracy the size of feeder cables necessary for a district. They amply prove the load to be a daytime demand, and that it is continuous, *i.e.*, it is an everyday load. The high diversity factor is well demonstrated, and proves the value of the load to an undertaking. It is possible for the domestic load on many stations to be larger than the industrial load. The curve for Sunday and that of a gas company's output on a similar day are identical in shape, and the value to the gas company of 5 hours' Sunday's load is equal to that of a whole week-day's combined domestic and industrial load.

The author suggests that the Institution might consider the advisability of investigating the matter in detail and submitting a report upon its findings. The Electrical Development Association has obtained certain information of a general nature, and by co-operation most valuable assistance could no doubt be given to the industry.

Considerable revenue can also be secured from commercial cooking. For four installations, including three staff feeding kitchens and one restaurant, totalling some 452 kW connected, the total number of units consumed was 290,000 per annum, and the resultant maximum demand was 190 kW (approximately).

Many small undertakings are not at present in a position to handle a big demand for cooking and heating. It is suggested, therefore, that a start should be made upon a small scale and it will be found that if auxiliary appliances are used their existence will have a greater effect on the financial returns than on the station maximum demand.

Unless one has lived in an electrically equipped home it is almost impossible to realise its worth.

For the hire of cookers, if a rental of 20 per cent. per annum on the net cost be established, it will provide a satisfactory

return on the capital invested and cover the cost of maintenance.

Those undertakings where the cooking load is not required so rapidly as when simply hire is established may conduct a hire-purchase scheme, which does not involve as much capital outlay and will encourage the consumer to handle the appliances with greater care. Political conditions prevent certain undertakings from supplying appliances under this plan,

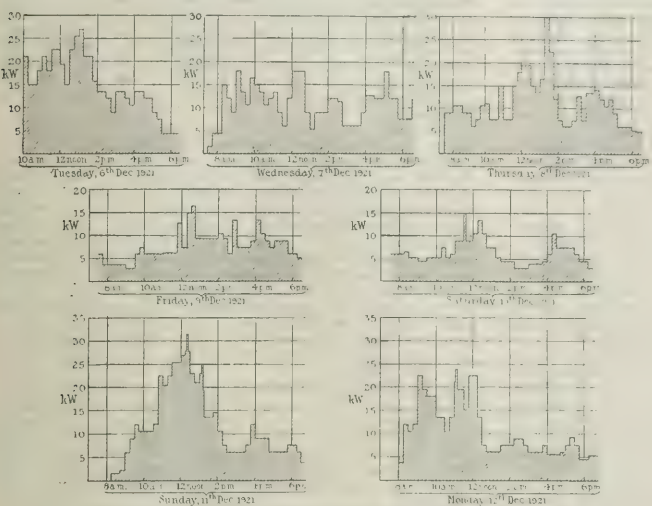


Fig. 1.—One Week's Demand Chart of a Housing Estate.

but the formation of a company to conduct such work, as mentioned by Mr. C. H. Wordingham at the Sanitary Congress, would overcome the difficulty.

Discussion in London.

Mr. L. L. Robinson pointed out that the public was ready for the reception of propaganda on the subject. They were fond of discussing generation costs, but did not seem to bother about whether their services were being used as they should be. The most important part of the paper was the load chart, a study of which would dispel many old fears about peaks clashing, &c. He was now installing cookers in whole streets, and hoped to have similar charts available before long. A two-part tariff was good, but the second charge was invariably too high for the electrical "whole hogger." Before long it would probably be possible to allow the user as many kW points as he liked at, say £8 each, plus ½d. or ¼d. per kWh which, in conjunction with a limiter, would allow him when not cooking to use the energy for water heating. The cost of the previously-used coal and gas would pay for the kW charge and the electricity would only cost ½d. per kWh.

Mr. H. Berry emphasised the fact that they must secure the right men to pass their propaganda on to the prospective user, and the right men should be adequately remunerated; it was a matter of the personal element. The kW points should be regarded as the hose pipes through which the consumer drew his electricity, which cost only ½d. The combined coal, gas, and electricity bills would pay for a "service" the like of which they had not dreamed of. "Service" was all important; everything was ready to provide it, and the public wanted it. There was no question of the ultimate result.

Mr. J. W. Beauchamp explained that the subject under discussion was increasing in importance at such a rate that it could be regarded as a fit one to be discussed at the Institution meetings. They should have guessed many of the facts the author had pointed out, but the fact remained that they had not done so, and it was, therefore, proper to reiterate them occasionally. Load curves of single house were quite different things to those relating to groups of houses, and the more of the latter they could get the better. He would like to see engineers devoting more study than they did to methods of putting propaganda before the public.

Mr. W. R. Cooper said the housewife's point of view was: What does a mere man know about cooking and washing? In the paper the word "he" had been used where it would have been better to use "she." Women were much more efficient at "spreading the news" amongst their friends than men were.

Mr. W. Rawlings thought there was no question about the supply authorities being able to offer cheap energy and the manufacturers' ability to provide the apparatus, but they could not deliver their goods. The contractor was the man to supply the goods to the consumer, and there was much need of co-operation between the three. Although the supply authorities would spend much money on advertising they would not assist the contractor by giving him a rebate on the energy he used for demonstrating devices, &c., in his show-rooms.

Mr. A. C. Cramb approved of electrical engineers using electrical apparatus in order to prove its merits, but it was difficult, he said, to convince an electricity committee of that desirability, and so they were handicapped. The two-part tariff was good, but when introducing it they were liable to be accused of trying the therm dodge—ignorance, of course, and if it was explained properly it would be taken up at once. That some supply authorities were not allowed to sell electrical apparatus or let it out on the hire-purchase system was due to the Electrical Contractors' Association, and it was up to the Association to carry out those functions if it would not allow others to do so.

Mr. A. N. Rye said that the smaller concerns were not in a position to offer such attractive rates for electric cooking and heating as the larger ones were. The former should, therefore, concentrate on encouraging the use of small apparatus, and leave the larger plant alone until they were ready to consider re-laying their mains. The concerns he was connected with had succeeded in placing 8,000 (net, excluding disconnections) pieces of small apparatus in use within four years, which showed that such devices were popular even if the energy had to be paid for at the lighting rate in some cases. They could offer apparatus on the hire-purchase system by all means, but the hire of such another matter, and its success was devices was quite questionable.

Mr. C. J. Baker declared that it was still cheaper to cook on a coal fire or gas stove, and it would, therefore, need very seductive propaganda to introduce electric cooking. He also referred to the desirability of making all plugs and sockets for portable apparatus interchangeable, and thought it would be no great difficulty to preach a sermon on standardisation.

Mr. Young called for action and not mere words. "Service" was essential, and the gas companies were giving it; they must not only sell apparatus, but be prepared to keep it in working order. A very big lever in the hands of the gas authorities was their knowledge that electrical men often did not use electrical apparatus themselves. To obviate that difficulty an enterprising company had taken a step in the right direction by offering electrical men apparatus at a cheap rate; its example should be followed by the wiring contractors and electricity supply authorities.

Mr. W. A. Gillott, in replying to the discussion, said that the tariff was a very important item, and should be so simple that anyone could understand it. The contractor was as essential as any other party in an electrical venture, but there was need for co-operation. He denied that it was cheaper to use coal or gas than electricity, and quoted instances in support of his contention; moreover, a cook could use an electric range without any previous tuition. Unless they were prepared to give "service" it would be useless to go in for the business.

Discussion at Newcastle-on-Tyne.

The above paper was also read and discussed at a meeting of the North-Eastern Centre of the Institution on November 27th, Mr. F. G. C. Baldwin presiding.

Mr. W. F. T. Pinkney, in opening the discussion, thought that it was the first frankly commercial paper brought before them, and the fact that the I.E.E. had accepted the paper showed that it was realising that the engineering side was not the only one that had to be considered, and also that the domestic load was possibly the biggest field for development in the future. They had rather toyed with the domestic load perhaps, because they did not know exactly what effect it would have on the mains, and they had no records. A domestic boom was coming along, and customers were relatively easy to get and retain. Mr. Gillott had mentioned 300 kWh per kW for lighting; that figure was too high, but where a cooker was installed it was probably about right. It was implied that an improvement in the efficiency of cookers would reduce their consumption, but that would not prove to be the case. The tariff suggested in the paper was greatly to the advantage of the supply companies because it gave them a fixed minimum of revenue. All sections in the electrical industry were interested in the development of the domestic supply.

Mr. W. Cross said that in recent months more attention

had been given to the selling side of the industry, which had hitherto been too little regarded. It was, therefore, pleasing to get some definite facts which they could put before customers, for previously there had been too much variation. He had not found the "labour-saving" argument very helpful in his efforts to extend the sales of those devices, and little heed seemed to be paid to what the engineer called efficiency. If a man had the domestic work to do the labour-saving contention would bear much more fruit. There should be more co-operation between the supply companies and those who supplied the fittings, so that the canvassers could agree on their arguments and figures. The effect was very bad upon a possible consumer or purchaser when two different sets of figures were placed before him. He agreed as to the desirability of the hire system with regard to expensive cookers and similar apparatus, but it was not necessary with respect to cheaper articles, the rate of hire for which should be such that it was cheaper to purchase than hire them.

Mr. R. D. Spurr assumed that they could take the curves in the paper as representing the load of better-class artisans' houses, but curves taken in another town recently gave a very different set of figures, therefore, in a large town, they might expect a good deal of variation in that way. In a better-class house there was a markedly different demand from that shown in the paper. Another possible source of revenue was in the heating of churches. At the present time it was done with coke, and it sometimes took a long time and half a ton of fuel to warm the church, whereas electric radiators would do all that was necessary in a few hours. The comparative costs of the various types of equipment were one reason why electric heating was not more popular.

Mr. P. F. Allan declared that the opposition to the use of electricity was lessening, and there was not so much complaint as to the higher charge when compared with gas. Design should be closely considered; they had a new mode of heating, and must produce new apparatus suitable for the purpose for which it was intended. They should not slavishly follow the types that had been adapted for gas or coal use. Another use for electric heating was the heating of prisons; it had been used in many other cases. They could not put ordinary heating apparatus in prison cells, so they were forced to circulate hot air, and this had been done satisfactorily with electrical apparatus.

Mr. Schuil spoke of the difficulty often experienced in getting a supply of electricity, and said once when he applied for a supply he was informed that it would cost him £70 in respect of the cable. Glasgow had adopted a scheme to treat heating by itself, and by distributing it at a low cost and by encouraging the use of electricity in the house they were doing everything possible to induce consumers to use it. Amsterdam, he understood, had the best heating load in Europe.

Mr. A. G. Shearer regretted that the author had not referred to a supply of hot water. In many installations more energy was wasted than was used because of the manner in which the installation was arranged. Those going in for domestic load should get rid of coal fires and adopt a proper scheme.

Mr. P. W. Ward thought a better diversity of load might be obtained than was shown in the diagrams in the paper. If an article on hire went wrong it was at once put right, whereas if it were privately owned it was often allowed to continue defective.

Mr. T. Carter thought that the whole question as to the extended use of electricity was one of cost. It was all very well to say that houses should be electrically equipped, but what was it going to cost and, if installed, were consumers going to get any real benefit? Those were points upon which the paper did not enlighten them.

Others who took part in the discussion were: Messrs. W. Lambourne, T. W. Muncaster, W. A. Royle, and A. W. Crompton.

Mr. W. A. Gillott, in his reply, said that several of the speakers had missed the real point of the paper. It was a commercial paper, and was meant to deal with the commercial, not the technical, aspect of the question.

THE NEW COLWYN BAY SYSTEM.

On November 16th the Colwyn and Colwyn Bay District Council celebrated the inauguration of the bulk supply from the North Wales Power Co.'s Dolgarrog works. The ceremony was one of peculiar interest inasmuch as Colwyn Bay is the first [illegible] in the North Wales area to be supplied by the North Wales Power Co., whose undertaking has been adopted by the Electricity Commissioners for the supply of electricity in bulk throughout the whole of the North Wales Electricity District, which comprises the six northern counties of Wales and part of the border counties of Cheshire and Shropshire.

The power company has two generating stations, one at Dolgarrog situate in the Conwy Valley and another at Cwm Dyli, from which it [illegible] an unlimited supply to local authorities within the area. The Colwyn Bay Council has constructed a new station on the site of the old works. The current is supplied at a pressure of 34,600 V to a central sub-station at Bronynant, where it is reduced to 6,600 V pressure and transmitted to a converter station situated in the centre of the town. In the top floor of the sub-station are fixed the 35,000-V switch cubicles to control the incoming overhead 3-phase transmission lines. There are three incoming 35,000-V feeders, two from Dolgarrog and one which will link through to the Conway sub-station and beyond, thus providing two alternative sources of supply. The e.h.p. switchgear was supplied by Messrs. Ferguson, Pailin, Ltd., of Manchester, and consists of four sheet steel cubicles containing the necessary isolating switches, oil-break main switches, bus bars, &c. Three cubicles are arranged to control the incoming outgoing feeders; the fourth controls the supply to the two 1,000-kVA transformers through a set of bus bars with selector switches.

The 6,600-V switchgear was also supplied by Messrs. Ferguson, Pailin, and is of their standard truck type.

Provision is made for installing three 1,000-kVA main transformers, but at present two only are installed. These transformers, supplied by Messrs. Ferranti, Ltd., are of the oil-immersed, self-cooled, 3-phase type, with boiler-plate tanks, fitted with radiating tubes. Each transformer steps down from 34,600 to 6,600 V, with 5 per cent. plus and minus tappings. The transformers are delta connected for operating as at present at 20,000 V primary, and later will be connected star on 34,600 V when the line pressure is increased.

The feeders to the new distributing station are laid in duplicate, being 0.1 sq. in. copper, paper-insulated, lead-covered, and steel tape armoured cables, laid direct in the ground. This contract was carried out by Messrs. W. T. Glover & Co., Ltd., of Manchester.

The distributing station is designed for an ultimate capacity of four converting sets of 500 kW each. (The capacity of the old steam station was 540 kW.) The system of supply in Colwyn Bay is 3-wire d.c. at 220/440 V. The conversion machinery adopted comprises motor converters, supplied by Messrs. Bruce Peebles & Co., Ltd. There are two 125-kW converters, one of 300 kW, and one of 500 kW, operating at 750 r.p.m.

The extra high-pressure switchgear is Messrs. Reyrolle's draw-out armour-clad type switchgear in two parts, interconnected by a bus bar section switch, and comprises: Two feeder panels with interconnecting switch between and four machine panels. Murday recording voltmeters are mounted above the interconnector unit. Each feeder unit is complete with overload relay on each phase. The machine units are complete with 250-A switches with overload and no-volt relays, with time limit fuse. Merz-Price protection gear is fixed on each machine cable.

The low-pressure switchgear was supplied by Messrs. Bertram Thomas, of Manchester. The d.c. board comprises: Four generator panels, one spare generator panel for extension, one summation panel and four feeder panels for eight feeders.

The generator panels are equipped with plugs and shutter interlocks for either traction or lighting in place of throw-over switches, and with bus bars throughout for either load.

The mountings of each panel comprise negative, equaliser, and neutral switches of heavy knife pattern, at the bottom of the board, and positive breaker at the top. The whole of the switches are of the full rated capacity of the machine on circuit.

The summation panel is mounted with indicating ammeter for each circuit of the 3-wire system, one ammeter to indicate balance of system, recording voltmeters, recording ammeter, and watt-hour meters for registering the output.

Each feeder panel is mounted with double-pole breakers for a feeder at top and bottom, with indicating ammeters to each pole of each feeder in centre.

The capacities of the panels are:—Two feeders of 500 A each; two feeders of 250 A each; two feeders of 250 A each; one feeder of 200 A; one feeder of 100 A.

The panels can be brought up to 500-A capacity each when necessary.

After the converters had been set in motion the company adjourned to the Council Chamber where light refreshments were served. Mr. Hugh Hughes, J.P., chairman of the Council, presided, and he was supported by Lord Colwyn, Mr. Henry J. Jack, managing director of the North Wales Power Co., Councillor J. J. Price, chairman of the Electricity Committee, and others.

Radium from Madagascar.—Some two years ago French inhabitants of Madagascar drew attention to the fact that Madagascar was rich in radioactive minerals. Experts were sent to prospect, and found that the Manandona region was rich in ufanite (uranium phosphate), and that uranium oxide was found in the Ankaratra district. The working of these deposits has been begun, and last year nine tons of uranium oxide were exported. Eighteen tons will leave Madagascar this year, and it is hoped that in the near future the island will be able to supply half the quantity of radium produced in the world.—*Reuter* (Paris).

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY FOR OCTOBER, 1922

The October returns of electrical export and import business show considerable increases as compared with the September figures. Electrical exports reached £1,008,281, an increase of £230,274 as compared with the previous month, but a decrease of £202,342 as compared with October, 1921. Electrical imports for October totalled £217,092, an increase of £16,160 on September, 1922, and £84,181 on October, 1921.

The electrical re-export figures for the month were £11,092, an increase of £678 on the September total, but a decrease of £11,810 on October, 1921.

For the ten months ended October 31st the total weight of electrical machinery exports was 13,253 tons, as compared with 15,336 tons for the same period in 1921.

Below will be found a table showing the values of electrical exports and re-exports for the month, with increases or decreases for each item as compared with the months of September, 1922, and October, 1921.

Values of Electrical Exports, Imports and Re-Exports for October, 1922, and Comparisons with September, 1922, and October, 1921.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Oct., 1922.	Inc. or dec. as compared with Sept., 1922.	Inc. or dec. as compared with Oct., 1921.	Electrical imports for Oct., 1922.	Inc. or dec. as compared with Sept., 1922.	Inc. or dec. as compared with Oct. 1921.	Electrical re-exports for Oct., 1922.	Inc. or dec. as compared with Sept., 1922	Inc. or dec. as compared with Oct., 1921.
Electrical goods and apparatus.	£428,846	+ £28,935	− £8,658	£57,164	+ £20,293	+ £19,541	£3,064	+ £293	− £1,488
Insulated wires and cables ...	167,714	+ 42,174	−103,448	33,180	+ 7,643	+20,040	96	+ 48	− 14
Glow lamps	30,343	+ 1,810	+ 7,457	20,614	+ 6,236	+ 3,889	805	305	2,875
Arc lamps and parts	175	− 518	− 135	989	− 806	+ 674	439	+ 274	+ 150
Batteries and accumulators ...	68,532	+ 24,518	+ 25,674	19,758	+ 1,145	+13,605		+ 450	− 1,116
Meters and instruments ...	30,713	+ 10,873	− 5,798	5,460	+ 227	+ 2,639	1,125	+286	− 2,544
Carbons	8,243	+ 1,952	+ 4,515	6,300	+ 5,128	+ 2,563	327	−151	338
Electrical machinery, railway and tramway motors ...	24,039	+ 4,605	+ 20,969	—	—	—			
Other motors and generators...	132,582	+ 14,968	− 45,719	—	—			—	—
Switchboards (not telegraph or telephone)	10,467	+ 1,504	− 8,773	121	+ 121	− 67	—	—	—
Electrical machinery, unenumerated	149,385	+ 32,618	+ 14,379	14,538	−26,976	+ 16,651	3,955	− 290	− 4,292
Telegraph and telephone cable and material, telegraph and telephone wires and cables (not submarine)	73,390	+ 42,781	− 72,473	2,098	+ 101	+ 2,277	—	—	—
Submarine telegraph and telephone cable	36,467	+ 31,513	+ 27,094	—		—		—	—
Telegraph and telephone instruments and apparatus ...	147,326	− 6,889	− 57,456	26,877	+ 2,978	+ 6,856	1,284	−383	+ 679
Totals	£1,008,281	+£230,274	−£202,342	£217,092	+ £16,160	+ £84,181	£11,092	+ £678	−£11,810

PARLIAMENTARY NOTES.

[By our Special Parliamentary Reporter.]

Schemes to Relieve Unemployment.—On November 30th, in reply to the Labour Party's amendment to the Address with regard to unemployment, Sir M. Barlow, Minister of Labour, outlined the Government's proposals for alleviating the evil. Referring to relief work, he said that the Post Office would be able to put in hand rapidly work dealing with the laying of cables. This would mean some £650,000 worth of work, and, with other similar schemes, the Post Office proposals totalled about £1,000,000. This would provide work for large numbers of men in digging operations, and also for skilled craftsmen in factories on electrical plant, cables, &c. The Government was also making grants for road works, and, in addition, the Trade Facilities Act would be renewed for another twelve months and the maximum of capital in respect of which guarantees might be given would be increased from £25,000,000 to £50,000,000. The Exports Credits Scheme would be extended to the existing limit of £26,000,000. Turning to the railways, he said that, at the request of the Prime Minister, the railway companies were prepared to expedite their programmes of development. The various companies had informed the Government that they had in hand, or could speedily undertake, programmes of work, which would involve the following expenditure:—North-Western and Midland Railways, £2,000,000; Great Eastern, £1,000,000; Great Western, £1,000,000; London & South-Western, £1,000,000.

In addition, schemes involving between £1,000,000 and £2,000,000 more were in contemplation, and the companies had further assured the Government that, as the grouping proceeded, they would be able to launch further development work.

Still more important, perhaps, than all these works were the proposals of the new Southern group for electrification. The chairman-elect had promised, not only to press on with the electrification of the South-Eastern & Chatham Railway suburban area, but also to extend the electrification of the London, Brighton & South Coast and the London & South-Western Railways.

The Electricity Commissioners had reported proposals for new power stations, or large extensions of existing power stations, at Barking, Deptford, Stourbridge, Ferry Bridge, Agecroft, Preston, and Nottingham. The Grampian Electric Power Co. had an Act empowering it to construct large works on the River Tay. All these schemes would, between them, involve operations on a very large scale, totalling something like £10,000,000, while, in addition, there would in every case be the work on the construction and laying of new transmission lines and cables providing a good deal of additional employment.

It was satisfactory to read of contracts for the electrification of railways in South Africa being secured by a British firm, and for the supply of railway wagons in India secured by another. Even from the Clyde came reports of contracts for the steel trade, and furnaces in the North which had been idle for the last two years were re-starting.

Midland Railway Electrification.—On November 29th, Mr. W. Thorne asked when the electrification of the Midland line to Tilbury and Southend would begin. Col. Ashley replied that the railway company was not in a position to make any definite proposals. In any case, the Ministry of Transport had no compulsory powers.

Telephones in Rural Areas.—On November 30th Mr. Millar asked the Postmaster-General if he could state the terms on which new telephone exchanges were now being opened in rural areas and the present tariff and rates for rural party lines.

Mr. N. Chamberlain replied that new exchanges were being provided in rural areas at an installation rental of £2 a quarter per circuit, within a mile of the exchange, provided that at least eight subscribers were forthcoming and the cost was not abnormally high. If 15 subscribers could be found the normal tariff charges applied. These terms covered a day service only, but it was often possible by a party line arrangement to extend the subscribers' circuits at night to an exchange open always, subject to a payment of 5s. a quarter. Party lines were provided at a charge of £1 or £1 2s. 6d. a quarter per station where there were three or two subscribers respectively per mile of line beyond a radius of half a mile from the exchange.

Mr. N. Chamberlain, in reply to Commander Bellairs, said that old military telephone systems in rural areas were being used as far as possible for the public service.

Overhead Lines.—In reply to Sir Wilfred Sugden, Col. Ashley said that permission to transmit electricity by overhead lines was invariably given to authorities which established a good case for this system.

Special Orders.—On November 30th a number of Special Orders, made under the Electricity (Supply) Acts, 1882 to 1922, were approved.

Great Northern Railway.—On December 4th Col. Ashley, replying to Col. Newman, said that no scheme regarding the electrification of the suburban lines of the Great Northern Railway was at present before him.

ELECTRICAL CHRISTMAS GIFTS.

The annual problem of the suitable Christmas present is once again in evidence, but to those in the electrical industry the question should, by this time, be easy of solution. Those who would break away from the hide-bound tradition forced upon them by vendors of "specialised" Christmas gifts, and at the same time help to build up the industry by encouraging the domestic consumer, cannot do better than purchase electrical appliances. It is safe to say that, at the present day, electrical gifts present as wide a field of choice as can be desired, both as regards cost and variety. They range from the humble pocket lamp to the elaborate cooking range, disregarding such side lines as electrically-operated grand pianos, or radio sets "*de luxe*."

In this page we endeavour to stimulate the electrical Christmas gift "idea" by presenting a selection of possible presents, but considerations of space necessarily limit our choice.

If radio sets are required, we would refer readers to our issues of October 6th, 13th, and 20th, when a variety of equipment was described in connection with the recent Wireless Exhibition.



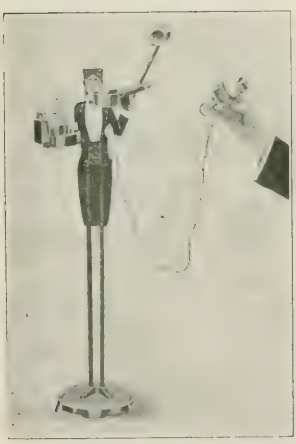
Plate warmer (Metropolitan-Vickers Electrical Co., Ltd.), of handsome appearance, nickel steel, highly polished. Consumption 100 W.



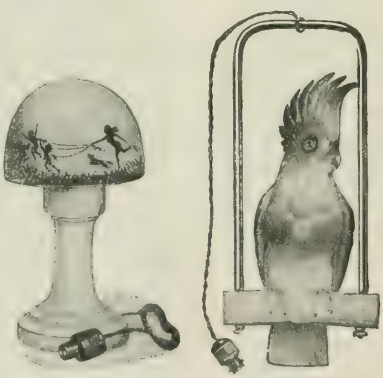
"Baby Revo" iron (Cable Accessories Co., Ltd.). Weight 4 lb., loading 250 W. Nickel-plated finish.



2-kW "Cosmos" radiant fire (Metropolitan-Vickers Electrical Co., Ltd.), "Empire" period design, finished in oxydised copper or silver.



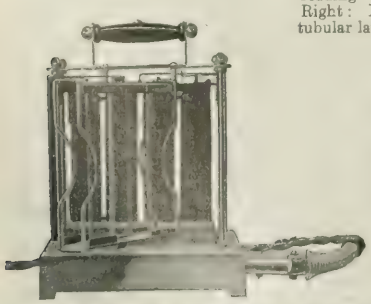
"Jeames" dumb butler (Berry's Electric, Ltd.). Reading lamp, cigar-lighter, ash tray, &c. Overall height 36 in.



Two examples of decorative lighting (Messrs. Ward and Goldstone, Ltd.). Left: A china-glass reading or table lamp with silhouette design. Right: Parrot in natural colours, with small tubular lamp in interior.



"Revo" boiling plate, of plain design (Cable Accessories Co., Ltd.). Top, 8 in. square; loading 750 W. Black enamel or grey porcelain enamel finish.



"Creda" "swing-gate" toaster (Credenda Conduits Co., Ltd.). With revolving bread racks, nickel plated, 500-W element.



"Magnet" pedestal heater (General Electric Co., Ltd.).



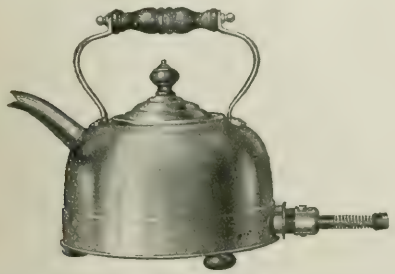
"Creda" saucepan (Credenda Conduits Co., Ltd.). Copper or nickel plated. Two 200-W elements. Weight 1¼ lb.



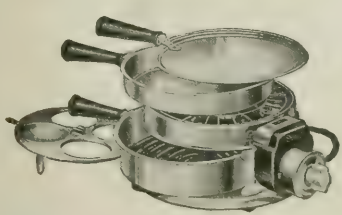
"Universal" tea pot (Messrs. L. G. Hawkins & Co., Ltd.), equipped with nickel-plated tea ball-infuser. Nickel-plated. 420-W loading, weight 4 lb.



"Creda" shaving pot (Credenda Conduits Co., Ltd.). Capacity ½ pt., 150-W element, weight 1 lb. Copper or nickel plated.



"Cosmos" kettle (Metropolitan-Vickers Electrical Co., Ltd.). Polished or nickel-plated copper. Loading 700 or 1,050 W. Weight 2¾ or 4¼ lb. Two or three pints capacity.



"Universal" electric grill (Messrs. L. G. Hawkins & Co., Ltd.). Nickel plated, "ebonised" handles. Three-heat snap switch. Three cooking pans of varying depths, 8 in. diameter.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North-Western Centre Chairman's Address.—*Abstract.*

The opening meeting of the 1922-23 session of the North-Western Centre of the Institution was held on November 14th, at Manchester, when Mr. A. S. Barnard, the chairman, delivered his inaugural address. He said he liked to think that in electing him some members had in mind that it was time the rank and file of the Institution received some official recognition. However useful the large consumer was to an electricity supply undertaking, the backbone was the immense number of comparatively small users. So also with the Centre. There was a list of comparatively small lines of electrical engineering of interest to a particular class, two or three of which subjects could be dealt with briefly at an informal meeting. Cheap generation and distribution were not the only matters which the Institution must consider. He would like to see some of the informal meetings devoted to discussions, not only on theory and design, but also on working experience in the lesser lines.

Why was it that they still had gas-lighted passenger trains in Great Britain? So far as he was aware, it was not even necessarily installed in new rolling stock. Wiring contractors should take part in the discussions and not leave it entirely to consulting engineers and theorists to determine what was good practice. The final authority in these matters was the user, who paid the bill. If wiring was made too expensive by elaborate specifications and regulations there would be less wiring done, but if they tolerated inefficient and shoddy work it would be of little use to build super-power stations and offer cheap energy. Contractors had as big a responsibility in the matter of wiring practice as plant manufacturers and central station engineers.

[illegible] to [illegible] the [illegible] [illegible] [illegible]

NEW PATENTS APPLIED FOR, 1922.

NOT YET PUBLISHED.

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THE

ELECTRICAL REVIEW.

VOL. XCI. DECEMBER 15, 1922. No. 2,351.

ELECTRICAL REVIEW.

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THE NATIONAL JOINT BOARD.

THE negotiations between the electricity supply authorities and their technical staffs regarding the new proposals that have been put forward by the former have come to an abrupt termination, the employers' side having withdrawn from the Board *en bloc*. This proceeding, we fear, will have a seriously detrimental effect upon the Whitley system, which has hitherto worked so well in the electricity supply industry.

From the secretary of the Board we learn that the following resolution of the employers' side was handed to the representatives of the Electrical Power Engineers' Association, who constitute the employes' side:—

> Having examined the agreements entered into by the E.P.E.A. with the Municipal Employés' Association and with the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motor-men and Electrical Workers, the Employers are of opinion that:—
>
> (1) The agreements which the E.P.E.A. have made with the Municipal Employés' Association and with the National Amalgamated Union of Enginemen, &c., are not in keeping with the arrangement of having a National Board and a National Joint Council whereby negotiations and agreements with the executive staff are kept separate and apart from negotiations and agreements with the manual staff.
>
> (2) These agreements between the E.P.E.A. and the Unions representing the manual staff are subversive of discipline.

The employers have, therefore, resolved that they will not continue to form part of the National Joint Board unless these agreements are terminated.

The agreements in question were published in the *Electrical Power Engineer* for September, and we commented upon them at the time as constituting valuable safeguards against the wanton and ill-considered attempts to shut down public electricity supply with which the industry has been threatened in recent years, often arising out of matters wholly alien to the supply industry. The employers, it will be seen, took a different view; they declared that unless the Association cancelled them, they would withdraw. The Association, of course, declined to do this, and negotiations were broken off.

Had the Association agreed to comply with the employers' terms, it would have ceased to command the respect of honourable men; and that would have been its ruin. Regardless of the terms of the agreements, we are of opinion that to have denounced them at the bidding of the other party on the Joint Board would have been equivalent to walking under the yoke in Roman times. The employers' side was ill-advised in putting forward so impossible a proposal; it did not place the Association on the horns of a dilemma—it left the representatives of the latter no option. Much as we regret the occurrence, we are bound to express our approval of the decision that they made.

This, we repeat, is without regard to the terms of the agreements; whether the latter were good or bad, wise or foolish, mattered not a jot when freedom and honour were concerned. But we have already given reasons for our belief that the agreements would—and will—bear good fruit: they will tend to preserve peace in the electricity supply industry, and we believe that they were conceived to that end.

Our approval was based upon the fact that they were "in essence, law-abiding"; their whole tendency was to discourage irresponsible strikes and to ensure that in no case should any drastic action be taken, without

the most careful consideration. The policy of the E.P.E.A., as we understand it, is directly opposed to strikes, above all to strikes about matters arising outside the industry; on the other hand, all questions which rightly concern the industry necessarily fall within the scope of the National Joint Council or the National Joint Board, and come before them for consideration. As we pointed out (p. 543), the parties to the agreements are "virtually pledged to observe the decisions of the Whitley Councils," and in fact they hold the only weapon for enforcing those decisions, with which the employers' side is of course in agreement. At least one case has occurred in which the employers' side of a District Joint Board has felt it necessary to entrust the issue to the hands of the trade-union side.

We understand that the chief bone of contention is Clause 5, which deals with disputes that do not come within this category; it is obviously conceivable that, however averse the E.P.E.A. might be to a strike on such a matter, its representatives on the "Joint Conference of Executives" of the trade unions concerned might be outvoted and the Association might thus be forced into joint action. As the E.P.E.A. executive cannot, we believe, under the constitution of the Association, take strike action without balloting the members, this seems a very remote contingency. But if this clause were the only stumbling block, presumably it could be modified. It is one thing to issue an ultimatum, but quite another matter to negotiate; and we venture to suggest that if a modification of this clause would satisfy the employers' side, the Association might well consider the matter in that light. The all-important need is to bring the parties together again in friendly discussion across the table—no good end can be served by cutting off communications.

The Association has retained its self-respect and the respect of the trade unions, and will undoubtedly gain increased strength from the incident. But the Whitley system has received a shrewd blow from those who should have been its best friends—for it affords the best means of maintaining peace and continuity of supply.

ELECTRIC TRACTION BETWEEN THE NORTH SEA AND THE MEDITERRANEAN.

The many attempts made by German electrical interests prior to 1914 to induce successive "governments" seriously to consider the question of converting main lines of railway to electric traction were always frustrated by the military authorities, owing to the belief that in the event of war it would easily be possible for an enemy to destroy a vital power station and thus disorganise the military traffic on the railways, which for that matter were always designed for strategic purposes. Since the revolution, and consequently the overthrow of the military party, provisionally at all events, more attention has been paid in Government circles to the problem of the adoption of electric locomotion on the railways, although the progress made in this direction in recent years has been comparatively insignificant. But a new reason has arisen in favour of the promotion of the modern method of railway traction—one which did not exist before 1914. We refer to the comparative scarcity of pit coal in Germany consequent upon the transfer to Poland of a large portion of the coal-mining fields in Upper Silesia, the loss of the production of coal in Lorraine, the elimination from German control of the output of the region of the Saar for a definite period of 15 years from the date of the coming into force of the Treaty of Versailles, and the compulsory deliveries of coal which have to be made by Germany on account of indemnity.

The German railways, now united in a Federal system, consume several millions of tons of pit coal per annum, or about one-tenth of the total consumption throughout the country. As, for the reasons already stated, the scarcity of coal has become acute, and is only relieved to some extent by imports at the present rate of millions of tons annually, any scheme which would tend to facilitate matters is likely to receive due consideration. In this connection Dr. Grooner, Minister of Railways, is reported to have conceived a scheme for the electrification of all the important lines in the national network. The project is based upon the establishment of steam generating stations using lignite as fuel in the north and centre of Germany, situated on the site of the lignite deposits, while in the south the power would be supplied by hydro-electric works proposed in connection with the Rhine, the Main, the Neckar, and the Danube. Although these schemes do not appear to be entirely new, the Minister of Railways hopes, as a result of their realisation, to be able in the course of time to reduce the imports of coal, which are mainly from England and are largely used for locomotive purposes, to minimum proportions, and after the expiration of the period of compulsory deliveries of coal to the Allies, to be able to render the country entirely independent of coal imports from other countries. In the meantime it may be mentioned that the Minister recently made an inspection of the electrical working of the St. Gothard Railway, and the impression which was gained was so favourable that he is reported to have decided without delay to proceed with the electrification of certain main lines, including those between Basle and Frankfort-on-Main, Carlsruhe, and Stuttgart, and then to extend the work to Berlin and Hamburg.

With regard to further developments of European railway working, a Berne (Switzerland) correspondent states that in the year 1924-25 the cities of Geneva, Lausanne, Zurich, and Lucerne will be connected by means of electric railways, and also with Basle. A little later the connection may be extended to Frankfort, Berlin, and Hamburg, which would represent an extraordinary development of the Swiss-German railway communications. A still further expansion is foreseen by an Italian newspaper, which mentions that electric trains will be inaugurated between Chiasso and Basle in 1924, and subsequently between Chiasso and the North Sea. In the case of Italy, it is stated that the electrification of the line between Genoa and Milan is being actively pushed forward, and that work will be completed in from two to three years. As to the question of the dispatch of trains from the port of Genoa through the St. Gothard tunnel, and thence to Hamburg, *via* Frankfort, it is pointed out that no technical difficulties stand in the way of the realisation of the scheme, and that it would have been possible—on the assumption that the previously-referred-to German proposals were carried out—if the Italian Government had not omitted from its programme a section of 25 miles represented by the trunk line, Milan-Chiasso. This missing link, the reasons for the exclusion of which are unknown, just interrupts—or will interrupt—the continuity of electric traction between Switzerland and the Italian network—between the St. Gothard railway and the port of Genoa. It is considered that as Switzerland is proceeding to extend the electric railway system and that as financial reasons are not responsible for the gap existing between Milan and Chiasso, a good understanding between the two countries might result in overcoming whatever difficulties now oppose the construction of this connecting link.

Electricity in Agriculture.

A correspondent draws attention to the fact that in the course of a debate in the House of Commons on the revival of agriculture, no reference was made to the subject of electricity. Unfortunately the average member of Parliament has little opportunity of making himself acquainted with technical progress,

and the daily Press, which ought to educate him in that respect, is too busy recording the sordid details of murders and divorces to devote attention to such matters. There are, however, a few engineers in Parliament, and whilst we deprecate the view that any member should regard himself as the representative of any special interest other than the welfare of the whole community, we feel that it is their duty as engineers to impart information on engineering subjects to their fellow-members. So will they most efficiently serve the State.

And the application of electricity to agriculture is most certainly an engineering problem. No one can read the illuminating articles which Mr. R. Borlase Matthews is contributing to our pages without realising that the use of electricity on the farm does not imply the mere installation of wiring and motors on ordinary workshop lines; the special conditions and requirements must be studied, and new methods must be devised to comply with them. In this respect we in this country are far behind the Continent, where the application of electricity to agriculture has attained an extraordinary degree of development.

The fault does not lie with the farmer; the experience of Mr. W. T. Kerr at Hereford, and Mr. Bexon at Kilmarnock, proves that when the farmer is given the opportunity to use electricity he takes advantage of it. Nor does it lie wholly with the supply station engineer, for up to the passing of the Act of 1919 his operations were more or less restricted to a limited area, and he could not extend his mains into the surrounding country without entering upon a cumbersome procedure; moreover, he had first to convince his committee or directors that such extension was not of so speculative a character as might appear; that the number of consumers per mile would be sufficient to justify the capital outlay, and that the load was of a desirable nature. All these and other points will be greatly elucidated by the scientific investigations which are being carried out on his own farm by Mr. Matthews, and which he so ably interprets for the benefit of our readers; his profession of engineer-farmer is at present unique, but we hope that his example will encourage others to assist in infusing new life into that most ancient industry which he has apparently undertaken to rejuvenate.

There is one point in Mr. Richardson's letter calling for a personal comment, where he says: "It is welcome indeed that the technical Press are now taking the matter up." For the past 20 years the application of electricity to agriculture has constantly received attention in the columns of the Electrical Review; our faith in its future has never wavered, and in suggesting that we are "now" taking the matter up, our correspondent, of course unintentionally, does us an injustice.

We are pleased to note that the Government is to set up a Committee of Investigation to inquire into the agricultural methods adopted in other countries, and we hope that the opportunity will be taken to state the case for electricity as fully as possible.

South African Industries.

July, 1922, was as far as H.M. Trade Commissioner in South Africa (Mr. W. G. Wickham) brought the information contained in his report on economic conditions in the Union, which was recently issued by the Department of Overseas Trade, and was abstracted in our last issue. It would therefore seem that some delay has taken place in its publication, and this is a matter for regret; these delays should be avoided. The report does not convey the same hopeful impression of the prospects of a revival of British trade as the report by the representative of the Federation of British Industries, which was recently summarised in these columns. Doubtless this is due partly to the guarded view that the official is constrained to take, and, to some extent, to the fact that the signs of revival in South African trade have been more distinct during the last two or three months than during the first half of the year. Railway electrification and telegraph and telephone extension should provide much work for United Kingdom factories in the not far distant future. British industry has already made a good start in competing successfully for the railway work, but, according to a recent message through Reuter, is apparently behindhand in obtaining orders for the automatic telephone installations which are being adopted. Mr. Wickham deals in an out-spoken manner with the Union's attempts at industrialisation, which have apparently not yet gone far in the direction of quality production. He says that the engineering industry proper is still exceedingly small, being mainly assembly and repair work, although good and ambitious efforts are being made here and there.

The Russian Electrical Industry.

The managers of the Russian electrical industry comprised in the Glavelectro Trust have decided to establish a representation in Berlin to supervise the execution of orders placed in Germany in connection with the electrification of Russia. The representation will also accept delivery of the orders and serve as an organisation for the conveyance of information for the Russian and German electrical industries, and will work under the control of the Foreign Trade Commissariat.

Mr. P. E. Brusewitz, who has just returned to Stockholm from a journey in Russia, is reported to have stated that orders received by one Swedish firm for hydraulic turbines would certainly be followed by other and similar orders for hydro-electric works in Russia. There is also a demand for Diesel engines, electric lamps, &c.

Several Reuter trade dispatches regarding Russian affairs have lately come to hand. One from Berlin quotes a director of Krupps as believing that the agreement reached between Krupps and M. Stomaniakoff, the commercial representative of the Soviet Government in Berlin, would be ratified by the Soviet Government. Krupps, it is stated, were enabled to take up the concession because the participation of certain British groups had been secured to the extent of 75 per cent. of the capital in sterling.

Another dispatch refers to the steady progress that is being made, in spite of all difficulties, with the Russian electrification plans drawn up by the Eighth Congress of Soviets in 1920. It is reported from Moscow that seven electricity stations are at present being constructed —one hydro-electric, three utilising peat, and three coal. The most powerful station is the 80,000-kW hydro-electric station at Volkhov, near Petrograd, which is to be finished in 1925. Stations are already partially working at Utkina Zavod (4,000 kW), Shatura (50,000 kW), and the Kashira (12,000 kW). Further construction on these stations is proceeding. Electricity works of great importance are being built at Nijni Novgorod, Kizelov in the Urals, and at Shtaro in the Donetz Basin.

Some interesting information respecting the Kashira undertaking appears elsewhere in this issue. One of the principal features of the scheme is a 115,000-V transmission line 80 miles in length mounted temporarily on wooden poles of very simple construction. Low-grade brown coal is used for fuel.

The German Electrical Industry.

The Government survey of the November reports of the Prussian Chambers of Commerce records a continuance of the "bad business situation" for electrical manufacturers, as under existing conditions prices have to be quoted according to a sliding scale. The uncertainty as to what the prices will eventually be has produced great reserve in the allocation of orders, and those for machines, switchgear, and meters have further decreased.

HYDRO-ELECTRIC DEVELOPMENT IN TASMANIA.

By FRED. A. TALBOT.

(*Concluded from page* 858).

Steel towers are used throughout upon this main transmission line. They are of angle iron, 65 ft. in height, and spaced at an average distance of 600 ft., with strain towers approximately two miles apart and at each angle of the lines. The most notable features of the trunk transmission are the crossings of the Derwent River at Bridgewater and Risdon, the last-named being only a few miles from Hobart. The Bridgewater crossing has a span of 1,010 ft., with a minimum clearance of 100 ft. between high water and the lowest sag. To meet the situation, special towers and conductors had to be introduced, the conductors being silicon bronze cable. At Risdon the conditions were somewhat more exacting. Inter-state shipping frequently passes this point, and, accordingly, to meet the requirements of navigation, a clearance of 150 ft. between high water and lowest sag had to be provided. The span is also somewhat more imposing, being 1,850 ft. Special towers and conductors had to be designed to complete the crossing, the conductors in this instance being copper-clad steel. The transmission throughout is protected against lightning by a 7/12 steel cable carried over the tops of the towers.

A single-circuit 88,000-volt line branches from the trunk at New Town, near Hobart, for Electrona. This line is 14 miles in length, and is of 3/.097 bare copper conductors carried on wooden towers of "A"-frame construction, though the insulators are similar to those used on the main line. Another single 88,000-volt line runs from the Waddamana power-house to Launceston, a distance of 52 miles. This line is similar to the 10,000-h.p. circuits running from the power-house to Hobart.

The receiving station at Hobart occupies a site adjacent to the Electrolytic Zinc Co.'s premises three or four miles from the capital. This sub-station is designed for an output of 68,000 h.p., of which 38,000 h.p. has been installed. It is at present equipped with two banks of single-phase transformers stepping down from 88,000 to 11,400 volts. Each bank is of 15,000 kVA capacity, and this installation is notable for being the largest transformer set yet erected in Australia. There are also two transformer banks of 4,000 kVA capacity per bank, stepping down from 88,000 to 6,600 volts. Transformers, 88,000-volt lightning arresters, oil circuit breakers, disconnecting switches, and bus-bars are all of the outdoor type, and, with the special steel structures for supporting the incoming lines, busses and switches, occupy a space measuring 240 ft. square. Adjacent to the outdoor installation is a brick building, 112 ft. long by 50 ft. wide, housing the 11,000 and 6,000-volt switchgear, meter equipment, and auxiliaries, as well as providing accommodation for stores and a workshop. All main 88,000-, 11,000-, and 6,600-volt main switches are electrically operated from a control board in the building. The equipment also includes a storage battery of 300 ampere-hour capacity (10-hour rate) for operating the oil switches and for emergency lighting.

The power demanded by the Electrolytic Zinc Co. is led to the sub-station of the latter, a distance of 500 yards, through 11,000-volt, three-core underground cables. Power for the Hobart distribution network is furnished through two overhead 3-phase feeders comprising 19/12 copper wire. These run direct to the tramway sub-station from which point the reticulation feeders radiate. The eastern suburbs of Glenorchy and Claremont are supplied through overhead copper feeders, the Cadbury-Fry-Pascall factory at the last-named suburb being an important consumer.

At the tramway station, transformers and rotary converters convert the 6,600-volt, three-phase current to 550-volt d.c. for use on the tramway system, and to 500-volt d.c. for private power consumers. The rotary converters are regulating pole machines, and the switching arrangements installed are of such design that any machine can supply current at either of the pressures mentioned for tramway or general power purposes.

The bulk supply at 88,000 volts to Electrona is stepped down through a bank of 4,000-kVA transformers to 6,600 volts, the transformers, together with the oil circuit breakers and lightning arresters, being placed out of doors. The switchgear controlling the 6,600-volt side and the metering equipment are installed in an adjacent building. Energy is supplied at 6,600 volts over bare copper conductors supported on a wood pole line with pin-type insulators to the carbide works for the operation of the electric furnaces.

The energy transmitted at 88,000 volts is received at the sub-station on a site adjacent to the Launceston municipal power-house. It carries a bank of 4,000-kVA, 88,000/6,600-volt step-down transformers which, with all equipment, is housed in a steel-frame building. A short overhead feeder line carries the power at the reduced voltage from the sub-station to the municipal power-house.

All the large power transformers installed at the various stations are water cooled. With the exception of the plant at Hobart, fresh water is used for this purpose; those at Hobart are cooled with salt water pumped from the harbour through a pipe-line approximately a quarter of a mile in length.

As already mentioned, although the Great Lake project is capable of furnishing about 250,000 h.p., it is probable that only one half will be exploited commercially—about 127,000 h.p. There are four subsidiary projects capable of development and embraced in this scheme. These are respectively:—

Upper Shannon	... ...	13,000 h.p.
Lower Ouse, No. 1	... ...	40,000 ,,
Lower Ouse, No. 2	... ...	8,000 ,,
Lower Ouse, No. 3	... ...	8,000 ,,
Total	... ...	69,000 h.p.

which, added to the 58,000 h.p. already being developed, gives the aggregate of 127,000 h.p. mentioned.

Although the Great Lake scheme may be said to constitute the basis of the comprehensive hydro-electric power programme which has been embraced, there are several other potential hydraulic fields capable of development. The preliminary surveys of these projects have been carried out, and the tentative designs for their exploitation are now under consideration. These comprise the following:—

Huon River	... ...	20,000 h.p.
Florentine River	... ...	40,000 ,,
Upper Derwent	... ...	40,000 ,,
Arthur's Lakes	... ...	16,000 ,,
Lake Rolleston	... ...	25,000 ,,
King River	... ...	60,000 ,,
Sundry smaller schemes	...	22,000 ,,
Total	... ...	223,000 ,,

These schemes, added to the Great Lake project, bring the total possible hydro-electric generating facilities to 350,000 h.p.

A considerable amount of exploration work in connection with foundations has already been done. Furthermore, in anticipation of future developments, river gauging stations are being established on every

important river. The investigatory work concerning the potential hydro-electric yield forthcoming from all the waters of the Island State is being actively pursued. Power surveys have been made over the greater part of the island, but there are several important rivers on the west coast which still remain to be explored in this connection. The survey of this untouched field is to be put in hand forthwith, and it is anticipated that field work will reveal the existence of at least 150,000 h.p. over and above what has already been definitely ascertained.

It is obvious from what has been related that hydro-electric development in the Island of Tasmania, now that it has been successfully launched, is to be pursued energetically, so that the department may be efficiently and completely equipped with data essential to any rapid development of available resources in accordance with commercial expansion. Once the full advantages accruing from the utilisation of electricity are appreciated for power and lighting, as well as heating, for industry, agriculture, commerce, and domestic purposes, rapid expansion may safely be anticipated, and should be productive of results as far-reaching as have been recorded in Canada and California.

ELECTRICITY SUPPLY PROBLEMS.

The Legal Position.

By W. S. KENNEDY.

The following problem was recently raised by a correspondent of the Electrical Review:—"An industrial company A taking a small amount of power and lighting—chiefly for stand-by and week-end purposes—from a municipal electricity supply authority, is desirous of extending its wires for the purpose of driving at the week-ends a small motor belonging to another industrial concern B adjacent to its own property. This small service can be quite easily given by the customer A as only a few yards of cable are required, but if the supply authority itself gives the supply it will mean a fairly expensive outlay in service cables, on which the prospective customer B would no doubt be called upon to pay a fairly heavy annual rental.

"Is there any regulation or legal objection to such a scheme being carried out? It is considered that the supply authority itself would not object, inasmuch as it is its electricity which is to be used, although the whole of the supply goes through the meters of A, and B (who really is a customer) is not on the books of the supply authority at all."

There seems to be no legal objection to the adoption of the course suggested by A if certain conditions are observed. The most obvious is that the supply authority would probably require A to become responsible for all payments; and, indeed, since B would not be a consumer, it could look only to A in that connection. If A's supply is charged for on a maximum demand system, the rate would probably have to be adjusted with the supply authority to meet the altered circumstances. It is assumed that the connecting cables from A to B are entirely on private property. If not, arrangements must, of course, be made with the local authority in case any underground work is required, and any existing regulations as to overhead lines must be complied with. Such a supply would probably not come under Section 23 of the Act of 1909, which prohibits unauthorised undertakers from competing with statutory authorities, but even if it could be held so to do, the present case would be covered by the proviso to that section, since the business of A (the person affording the supply) is not "primarily that of the supply of electrical energy to consumers."

Under the Clauses Act, 1899, the consumer must inform the supplying authority of the maximum power which he requires, and the authority is entitled to be satisfied that the internal fittings and apparatus on the premises to be supplied are in good order. This would apply to fittings, apparatus, &c., on the premises of B. Apart from these points, which should be capable of adjustment, no objection apparently exists to the course proposed, which seems to the advantage of all parties concerned.

The question leads to the consideration of another and cognate point which many correspondents have raised; that is, the charges made by a supply authority for that portion of the service main which goes over the consumer's premises and for "connecting supply" generally. This is purely a business question—the legal right of the supplying authorities to make such charges is, save in rare events, indisputable under the Clauses Act, Schedule, Sec. 27. Whether such charges pay the authority supplying in the end is more than doubtful. The thing which, apart from its general desirability, will in the long run profit supplying authorities is the widest possible use of electricity, and this can only be arrived at by making the supply as cheap as possible. In the case of small consumers, the heavy charges for connection now made by certain electricity supply authorities must outweigh even a low price per kWh and choke off many would-be users of electricity. It is not suggested that a supply should be given at a loss, but in order to make the use of electricity general—an end which becomes more and more desirable—the price must be cut to the lowest limit and the supply made in every way as accessible as possible. From the business point of view, it may be that the form in which the charge for connection is made deters would-be consumers as much as the actual amount, but this is a psychological question with which the author is hardly competent to deal. It is, nevertheless, worth considering whether an authority which makes no charge for connecting will not in a short time so increase the number of its consumers as to be more than repaid for any possible initial loss.

SALES: THE DECIDING FACTOR.

By J. E. CHAMBERLAIN.

Business can be divided into many sections, and one of the most important—especially under existing conditions—is, without doubt, sales. To conduct the commercial side of a prosperous business on sound lines it is essential that the head of this side of the business shall be a thorough organiser, with absolute confidence in himself and a complete knowledge of the work he has to undertake.

It is necessary to analyse the meaning of the word "organiser," which at the present day is probably used rather loosely. To be a successful organiser it is necessary for a person to have a general knowledge of the work concerned, but not a highly technical knowledge of all its branches; he must be capable of controlling other people's brains and diverting them into the correct channels—also of arranging departments, so that co-operation is assured and all departments work in perfect synchronism. Consequently, it is evident that the head of affairs, or the organiser, is responsible in all cases, whether a business prospers or otherwise. This, of course, is on the assumption that the manufacturing side is perfectly organised.

The reason why a large percentage of companies are not in a sound position is because the head of affairs does not possess the qualities of an organiser; if, on the other hand, all heads were capable of organising, the right man would have the right job in all cases, and the country, on the whole, would benefit considerably.

The writer would here quote one or two cases in point: A clerk in a large concern, employing many thousands of men, has admitted that he only does two hours' real work in a day, the rest of the day is spent, in the words of the Army, in "lead-swinging." Now, imagine how much better it would be for everyone concerned, and the country in general, if all people such as this man, were

employed in useful productive work. Another example the writer is aware of is where a highly technical man is on the road. Now, this man would be valuable in the works or laboratory, whereas on the road he is almost useless, due to lack of personality. These cases are typical of hundreds, or perhaps thousands, existing to-day, and they can in practically every instance, be traced to the responsibility of the head or organiser.

It is, of course, impossible for the head of even the commercial side of a business to be in direct contact with every individual in various departments, but it is without question "up to" the head to engage people directly under him whom he knows to be capable of carrying out their duties in the manner he wishes; consequently, if the head is a perfect organiser, he will never have on his staff any member who is not absolutely efficient; or, if he does, the employé's stay will be of short duration.

There is no doubt that many sales organisations fail because of lack of co-operation; no matter how large or small a business is, without co-operation it is impossible to attain success.

Even if a man on the road is endowed with all the necessary qualifications, if he does not receive sufficient and proper backing from his head his time is wasted. On the other hand, if a man on the road is a slacker, whatever backing he receives, the results will be bad; consequently it is impossible for either combination to bear perfect fruit.

The man at the head of affairs on the commercial side of a business must be a born organiser, and the men under him should be trained by him either directly or indirectly to obtain the best results; and for the benefit of people who are at the head of affairs, because they have money invested in the concern, I say: Analyse the results, and if you are not showing a profit, blame yourself and get out, and let the man with organising abilities take the wheel, and it will be money in your pocket and to the advantage of all concerned.

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

We publish below a list of proposals that will come forward in the next session of Parliament (1923). Readers who are desirous of obtaining further information will find the applications published in the *London Gazette* for November 21st, 24th, and 28th.

(a) Electric Light and Power.

London Electricity Joint Committee (1920), Ltd.—Provision for the improvement of the generation of electricity for supply in the administrative County of London, supply of electricity in bulk, to allow the Central Electric Supply Co., Ltd., to transfer its undertaking to the company, powers to supply electricity to electricity undertakings and other bodies, financial powers to provide for the suspension of any rights of purchase of the London County Council or other body over any electricity undertaking in or partly in the county or of any undertaking or company having an electricity undertaking therein or partly therein; to vary the London Electric Supply Acts, 1908 and 1910, and to exclude any provisions of these Acts from applying to the company or its undertaking; and to declare the company the Joint Electricity Supply Authority for the County of London; financial powers, &c.

Oakham Gas Co.—Powers to supply electricity within their present gas limits.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—Extension of powers for the supply of electricity; further financial provisions.

Stoke-on-Trent Corporation.—Repeal, consolidation and re-enactment of Orders regulating electricity undertaking; re-definition of area of supply, powers and provisions incident to supply of electricity.

Swanage Gas Co.—To transfer to the company the undertaking authorised by the Swanage Electric Lighting Order, 1900, and of the undertaking of the Swanage Electricity Supply Co., Ltd.; further powers with reference to the supply of electricity, including increase of charges.

Torquay.—Powers to increase electricity charges, &c.

(b) Electric Tramway, Motor 'Bus and Trolley Vehicles.

Birkenhead Corporation.—Construction of new tramways, further powers with respect to the tramway and electricity undertakings.

Chesterfield Corporation.—Further powers with reference to the Corporation's tramway and electricity undertakings; powers to run trolley vehicles and for the erection of overhead equipment; powers to run motor omnibuses within and without the borough; further borrowing powers.

Leicester Corporation.—Construction of new tramways within the city and further provisions with regard to the tramway undertaking.

London County Council.—Additional powers, including further financial provisions; extension of time for the completion of certain tramways, &c.

Lytham and St. Annes Corporation.—Continuance of the tramway undertaking of the Council; powers as regards trailers; and to run omnibuses within and outside the borough.

Maidstone Corporation.—Provision and working of trolley vehicles; powers to run omnibuses within and without the borough; further provisions with regard to the electricity undertaking.

Nottingham Corporation.—Construction of new tramways, power to increase tramway fares, further powers with respect to the electricity undertaking, to extend the area of supply, &c.

Plymouth Corporation.—Construction of new tramways, further powers in regard to the electricity undertaking, &c.

Potteries Electric Traction Co. and North Staffordshire Tramways Co.—Advancement or postponement and synchronisation of dates for compulsory purchase of undertakings (so far as they relate to tramways and light railways) of the companies, prolongation of intervals between recurring dates of purchase, requirements and provisions as to purchase, prohibition, or restriction of competition by omnibus with tramways and light railways of the companies.

Rochdale Corporation.—Construction of new tramways in the parish and borough of Rochdale; further borrowing powers.

Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.—Extension of time for the construction of the tramways authorised by the Company's Act of 1915; powers to run motor omnibuses; further financial provisions.

Thornton Urban District Council.—Powers to provide and run motor omnibuses within and outside the district.

(c) Railways.

City & South London Railway Co.—Powers to construct new railway in the metropolitan boroughs of Wandsworth, Battersea, Wimbledon, and the urban districts of Merton, Morden and Mitcham; further financial powers.

London Electric Railway Co.—Construction of new railways, including the linking-up of the Charing Cross, Euston and Hampstead Railway with the City & South London Railway, rebuilding Leicester Square station, reconstruction of Piccadilly Circus station; further financial powers.

Metropolitan Railway Co.—Additional financial provisions; extension of the time for the completion of railways authorised by the Metropolitan Railway Acts, 1912-1913.

Wimbledon and Sutton Railway.—Extension of time limited by the Metropolitan District Railway Act, 1915; further financial provisions.

LEGAL.

Ryan *v.* Scammell and Nephew, Ltd., and Kneller and Chandler.

An action arising out of damage to electrical machines came before Mr. Justice Rowlatt in the King's Bench Division on December 8th. Mr. John Harold Ryan, electrical engineer, of Middlesex Street, London, E.C., sued G. Scammell and Nephew, Ltd., of Fashion Street, London, and Messrs. Kneller & Chandler, of Southampton, for damages respecting four Siemens-Austin, 18-kW, petrol-electric generating sets, with switchboard, radiator, and baseplate tanks.

Mr. Ryan said the machines were purchased at a Government Disposal Board's sale at Richborough in 1920. He contracted with the first defendants to transport the machines from Richborough to Plaistow, and, without his knowledge, they passed on the work to the second defendants to do. A steam engine and trailer, in which the machines were being transported, overturned at Boughton Hill, near Canterbury, and the machines were damaged.

In answer to Mr. Charles, K.C., for Scammell & Nephew, Ltd., Mr. Ryan admitted that a Mr. J. Worple had bought the machines at the Disposal Board sale; but, he also said, that Mr. Worple did so only under his guidance, and he (Mr. Ryan) took over the machines after the sale.

On that point Mr. Charles submitted that Mr. Ryan was not the owner of the machines at the time of the accident, and therefore he had no action. Mr. Charles also contended that Mr. Ryan knew that the second defendants were to do the transport work.

For both defendants it was denied that there was negligence on the part of the driver of the steam engine.

Giving judgment, Mr. Justice Rowlatt said he came to the conclusion on the evidence that the property in the machines was exclusively Mr. Worples's and that Mr. Ryan had none; also, that Mr. Ryan did not fulfil the requirements of a bailee for the goods, as had been contended. Therefore Mr. Ryan's action failed.

His Lordship thought Scammell & Nephew, Ltd., were entitled to employ another contractor to do the work. He held that there was negligence on the part of the engine driver in that his engine went too fast down the hill and could not be controlled. If Mr. Ryan had been entitled to recover his damages, award would have been for £150; but, as he was not entitled to recover, the action would be dismissed with costs.

Rippingille *v.* Leys Malleable Castings Co., Ltd.

At the Birmingham Assizes last week, according to a report in the *Birmingham Post*, plaintiff, an electric fittings agent of Birmingham, brought an action against defendants to recover damages for alleged breach of contract.

It was alleged that the defendants verbally and in letters from January to July, 1919, represented to the plaintiff that they were about to undertake the manufacture of conduit fittings and castings, and could accept orders up to £50,000 per annum. In July the plaintiff entered into an agreement under which it was claimed he was appointed sole agent for the defendants in the British Isles. His commission was fixed at 5 per cent., with additional commission in specified cases. The agreement was to remain in force for two years. The defendants terminated the agreement improperly, as the plaintiff alleged, on the ground that the orders executed had not reached a minimum agreed upon. Plaintiff, on the other hand said the defendants did not in fact undertake the manufacture of the articles to the extent agreed on, and did not execute orders with due despatch.

There were lengthy legal arguments, the defendants averring that they were not bound to manufacture and accept the orders given to them by the plaintiff.

Judgment was given for the defendants.

The Judge said that one of the questions he had to decide was whether the defendants were entitled, at their own discretion, to refuse to execute orders. He held that the case was outside the purview of that class of case, which said that if there was an agreement to do a certain thing for a certain term of years there was an obligation to carry out the terms of the agreement.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Estimating for Internal Wiring Contracts.

A letter on the above subject in your issue dated December 8th and signed by Mr. Alan Kirk, contains a paragraph taken from the preliminary rules of the Scottish Mode: "Schedules of Quantities shall fully, completely, and accurately represent the work to be contracted for." This sentence may be held to contain the *raison d'être* of the Scottish Mode. At one time it was customary to measure wiring and its protective covering, which is undoubtedly the most just method of assessing the value of work done but is only possible when all the work is exposed.

The next stage in the development of internal wiring produced concealed work, where it was impossible, after the completion of the job, to ascertain the extent of the work carried out, and surveyors had to accept the measurements given by the contractors, or their workmen, which measurements were often lacking in accuracy.

It must be obvious to Mr. Kirk that this method does not provide any incentive for a contractor to make the shortest possible runs for his circuit wiring, with the result that proprietors too frequently had to pay for far more material than was necessary, and received an indifferent installation, as the voltage drop in the circuit wiring was unnecessarily high. In some cases measurers refused to pay for long runs, sometimes with justice, and other times without: where, for instance, the contractor had elected to deviate from the direct path in order to maintain the amenity of a building.

The rate per point method was therefore adopted, but even then it is only applied to that portion of the work which is concealed, as the outlet boxes behind switches and lighting points are separately enumerated, and the method gives every encouragement to the contractor to do his work economically as well as efficiently.

With respect to the measurement of power points, it must be obvious to most people that the size of the conductors, and consequently of their protective coverings, depends upon the work to be done by the power point, and it is seldom that more than two power points are supplied from one pair of fuses, making the measuring of the same comparatively simple, whereas in lighting circuits there may be 10 points, and it is usual to use the same size of conductor for all the lighting service branches and the rate per point becomes an equitable method of assessing the value of the work.

I do not think that Mr. Kirk needs any reply to his query as to the reason for "Voltage affecting the question," if he considers the diverse conditions between an installation for 25 volts and one for 250 volts.

The P.M.G. some years ago altered the method of charging for parcels by post from steps of one pound to the more practical method of charging for a variation of weight in larger proportions. Mr. Kirk apparently thinks that he ought to have adopted a method whereby the cost would be in direct proportion to the weight carried. This would have involved the introduction of new postage stamps valued at one farthing and something over forty stages of payment between the minimum package, and the maximum not over eleven pounds.

The method of charging for wiring at a "Price per point" as defined in the Scottish Mode is therefore approximately but at the same time sufficiently accurate; it promotes economical methods of installing, prevents underpayment or overcharging, eliminates the possibility of distrust between contractor and measurer, and generally as has been found in practice, provides an equitable arrangement for accurately assessing the value of the work carried out.

Basil A. Pilkington.

Edinburgh, *December 11th*, 1922.

In your issue of the 8th inst., Mr. Kirk had evidently misread our letter appearing in your issue of the 1st inst. We did not say we had "made use of this method in all contracts carried out by us." We said that "we had scheduled, estimated, &c." As regards the two Redford Barracks contracts, we are sorry we did not schedule these.

While we have scheduled installations at rates per point, we have never had any objection to quoting for work scheduled by others, however weird these methods appeared to us.

Lowdon Bros. & Co.

Dundee, *December 11th*, 1922.

[Messrs. Lowdon Bros. & Co.'s letter stated: "We have scheduled, estimated, and made out our accounts practically in accordance with this Mode in all the installations we have carried out during the last 30 years, that is, before the system was introduced in the Scottish Mode."—Eds. Elec. Rev.]

The Hastings Electricity Undertaking.

With reference to Mr. Sayers's interesting letter regarding his pioneer days at Eastbourne, he seems to be under the impression that the system of high-pressure direct-current supply has only one survivor.

I would point out, however, that there are still several undertakings which have the system in use at the present day. Several of the towns in the Isle of Wight are supplied from sub-stations fed by high-pressure (2,500 volts) direct current, and here, at Twickenham, we still have two high-pressure generators running to supply sub-stations.

An interesting feature of these sub-stations is that they are controlled from the generating station and, except where batteries are installed, no attendants are necessary.

M. Farrer.

Twickenham, *December 11th*, 1922.

Electric Power for Pulverising.

I should be very glad if any of your readers could send me costs of electricity for running pulverising plant for refuse disposal as compared with crude oil or gas.

C. Culmer Hodges,
Engineer & Secretary.

Electricity Works, Dawlish.
December 11th, 1922.

The Prospects for Young Engineers Abroad.

I have just read the letter on page 265 in your issue of August 25th, asking for information about the opportunities for young engineers in the Dominions.

Canada is a vast country, and each province has conditions peculiar to itself; but I will try to give some idea of the conditions as they are in Ontario. And, I suppose, the conditions here would be more or less true for other sections of the Dominion, since Ontario is the industrial centre, and is the province with the largest engineering plants—generating and manufacturing.

Technical education, in technical schools, colleges, and university, is on a sound basis here. It is not costly to obtain, and is very democratic. Therefore, you may rely upon an abundance of fully trained technical men well versed in local methods and requirements. In electrical development, too, this province is foremost, and everyone is therefore more or less electrically able and right up to the minute in progress. Then the Hydro-Electric Power Commission is

a big field in itself for the production of men—professional and working.

At the moment, business in the industry is not brisk, and several plants are working at not more than sixty per cent. capacity. There appears no brighter outlook possible for the next few months at least.

While chances for good men are better here than in England generally, just now any man would do well to think before making a trip on chance. The men most likely to get positions at any time, and those most sought after, are those who have held responsible positions as designers of electrical equipment, or are otherwise similarly experienced.

Station-men can get a chance. The stations here are all A.C. mostly five cycle, and mostly hydro power. It is this last point which counts, because so few station men in England have had water-power experience.

Good meter-men for repair and test-room work also have a fairly good chance of getting improved conditions here.

Any young man coming out should be a graduate from a recognised centre if he desires to make progress against the young men from local technical colleges. However, as in most things, determination, grit, and energy, will go a long way.

Old London U.

Toronto, Ontario,
November 7th, 1922.

A Metering Problem.

I have for some time been anxious to register the units actually lost in a set of machines consisting of a pair of balancers and two boosters, coupled up on one shaft. The balancers are, of course, used for the purpose of driving the boosters in addition to their balancing operations.

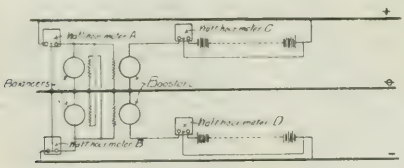
The following arrangement appears—on paper—to meet my requirements, but, before putting it into practice, I should be glad to hear if any of your readers have such an arrangement in use, and with what results.

Watt-hour meters A and B are connected up in such a way as to register the energy consumed by the booster fields in addition to the balancers' consumption.

Watt-hour meters C and D are arranged so that the pressure coils are connected across the battery terminals, thus enabling the watt-hour efficiencies of the battery to be obtained.

We will assume first that the balancers are running without the boosters in use, and with an out of balance on the system. In this case the two meters A and B would register the energy passing through. One meter would work forward, the other backwards. The units lost would be obtained by adding together the units registered by the two meters, one reading being a minus quantity.

Now when the boosters are put into use an extra load is put on to the balancers and both meters A and B will speed up in the forward direction correspondingly. The increased



energy registered by these two meters will be equal to the energy output of the two boosters + the loss in these + the extra loss in the balancers (say 15 per cent. of energy required by boosters).

The battery has a watt-hour efficiency of say 70 to 80 per cent., and it is the duty of the boosters to supply the extra energy required to make up this loss. It would appear, therefore, that the number of units lost in the battery per charge would correspond with the number of units delivered by the boosters during the same charge.

To obtain the total losses for the four machines the proposed procedure is as follows:—

Charge the battery to gassing point and note readings of all meters [illegible]. At some later date again bring battery to gassing point and again note readings of all four meters. Then:

Energy consumed by balancers = $(A_2 - A_1) + (B_2 - B_1)$

Battery [illegible]

Total losses in machines = $(A_2 - A_1) + (B_2 - B_1)\} - \{(C_2 - C_1) + (D_2 - D_1)\}$.

The small figures $_1$ and $_2$ represent respectively the first and second readings of the meters.

F. B. S.

December 7th, 1922.

Improvement of Power Factor.

With reference to Mr. Jones's letter in your issue of December 8th, it will be found that I have dealt with Mr. Rogers's statement regarding static condensers in the remarks which I have communicated to the I.E.E. as part of the discussion.

Mr. Rogers is evidently quite unaware of what is being done in the way of installation of static condensers, and as sales engineer for the Telegraph Condenser Co. I could take him to some of our installations of condensers connected to supplies with voltages ranging from 200 to 440, which give a return on capital outlay of nothing less than 40 per cent. per annum of the capital expended, and in the majority of cases the saving is 60, 70, and even as high as 100 per cent. per annum.

Mr. Rogers is quite unable to produce facts and figures in support of the statement he made, and in fact I challenge him to do so.

E. W. Dorey.

London, *December 9th, 1922.*

Once again I am much indebted to the correspondence columns of your excellent journal. In this case I refer to Mr. C. Jones's letter published in your issue of December 8th, 1922. Further, I am thankful to the Electrical Review for not misquoting me to the extent of some contemporary journals. In your case I will simply correct to "practical commercial proposition," and ask you to delete "commercial proposition." It is quite a while since I went into an actual problem and compared actual quotations for a specific case. Wherefore I suggest that Mr. Jones compares actual figures for, say, a 400-V problem and a 600-V similar instance. I think he will find an appreciable financial saving with regard to the latter, as by so doing he will eliminate master patents.

Further, in the case typified by Mr. Jones: Are his condensers connected direct at 400 or 550 volts, without any voltage transforming devices whatsoever? In conclusion, I hope Mr. Jones may never be called upon to tackle a condenser power factor improvement problem on a 200-V basis.

W. E. Rogers, A.M.I.E.E.

London, *December 10th, 1922.*

The "Standard" Brush Holder.

May we make further claim on your valuable space to reply to the letter from The Standard Carbon Brush Holder Co., Ltd., in your issue of December 8th, in which it states at some length the differences between its brush gear and that of Messrs. Flather & Co., Ltd. We would offer our comments and leave it to your readers to judge if these differences are improvements.

(1) Since with the majority of manufacturers various sized commutators are used with a standard radius brush ring, it is absolutely essential, to obtain correct relation between commutator and face of carbon, to have a universal movement, which can only be obtained with a circular spindle permitting adjustment.

(2) The Flather brush box spindle has a machined square end on which fits tightly a square mica bobbin. This again is a tight fit in the rocker arm, which has machined slots made on a divided jig, thus ensuring dead accuracy on a 90 deg. position. This ensures absolute rigidity with a much lower tension on the clamping screws than is possible with the Standard brush holder.

(3) The Flather spring is not covered, but does not extend over the box frame, and would not be affected in the event of a flash-over. This we think, in any case, to be unimportant with machines of modern design.

(4) The adjustment of the clock spring tension is obtained in both holders by winding or unwinding the inner coil of the spring. The type of spring used in the Flather holder has an even torque throughout the whole length travel of the brush and does not require any alteration after leaving the works. Until three years ago, the Flather gear was adjusted by a small lever in the same manner as the Standard holder, but this was abandoned in favour of the present method which has six definite positions of adjustment. The tension cannot be accidently altered, and it is as fool-proof as it is possible to make a gear.

(5) The point of removing single brush boxes is of little value, and where a brush box is held by one screw this might work loose under vibration. On the Flather type, this is impossible, as it is not only clamped but held by a grub screw. In the Standard holder it is impossible to stagger the brushes on individual spindles to compensate for uneven commutator wear. The brush spindle of the Flather gear, with its complete gang of brushes can be removed by loosening two screws and re-fixed in precisely the same relative position.

(6) The Flather holder consists of the body, which is a one-piece die casting, the spring, and clamping screws, an absolute minimum number of parts ensuring rigidity. An old spring can be removed and a new one inserted, should this become necessary, in 45 seconds.

There is another important point which has, not so far, been mentioned in this discussion, and that is that the Flather brush gear is of such a design that it can be produced at approximately a quarter of the cost of the Standard holder.

In our first letter of October 25th our main desire was to emphasise the point that the novelty of the principal points of design in this gear was by right Messrs. Flathers, but we are glad that The Standard Carbon Brush Holder Co., Ltd., have developed the discussion on the lines of the ideal brush holder, since the subject is one of the greatest interest to electrical engineers.

For **Bates & Windibank.**
E. H. Bates.

London, *December 12th*, 1922.

Electricity in Agriculture.

It seems rather surprising that it is possible for a momentous debate on the Revival of Agriculture to take place in the House of Commons in the year 1922 without any reference being made by the many prominent M.P.'s who took part in that debate to the subject of electricity. Mr. Lloyd George has long been a full-blooded apostle of electricity, but news has not apparently reached him that electricity is capable of contributing tremendously to the revival so imperatively needed on the land. Surely the fault is with electrical engineers as a body, who lag so far behind our Continental rivals in this respect. It is welcome, indeed, that the technical Press are now taking the matter up, but the backwardness of the industry as a whole where electro-farming is concerned is lamentable. Is it too much to hope that the I.E.E. will appoint an influential committee to thrash this whole matter out, and bring pressure to bear where necessary? After all, there is a limit to what Mr. Borlase Matthews and Mr. Beauchamp can accomplish, valiant as is the effort they are making.

H. W. Richardson.

Sutton Coldfield, *December 9th*, 1922.

[We refer to this subject in our leading columns to-day. —Eds. Elec Rev.]

THE TRADE POSSIBILITIES OF THE BRITISH EMPIRE.

In the course of a very interesting speech delivered at Edinburgh recently by Col. O. C. Armstrong, D.S.O., president of the Federation of British Industries, the financial state of Germany and the hostile tariff tendency of other countries were referred to. The speaker considered that it would be one of the more important tasks of the Federation during the forthcoming year to urge upon the Government that it should apply both more serious attention and more vigorous action to breaking down the hostile tariff barriers which were impeding the recovery of our trade. Col. Armstrong said that with regard to foreign markets in general, it appeared to him that we should in the immediate future look outside Europe—for instance, to South America and the Far East—for any substantial increase in our export trade. There were certain factors in existence which may be of considerable assistance to us. The force of German competition was weakening as her financial position became worse, while the present United States policy in regard to both tariffs and the inter-allied debts would have a considerable reaction upon their power to compete in external markets. The president went on to discuss the one remaining market, the possibilities of which were being widely canvassed at the present moment, namely, the British Empire. We quote his reference to this matter at length:—

"In the Empire we have great natural advantages in similarity of ideas, identity of language, and relatively favourable tariff and exchange conditions, and from the broad imperial point of view there can be no possible doubt that every step we take for the furtherance of inter-Imperial trade will in the long run redound to the benefit of the Empire as a whole and of each constituent part. But we must remember that there are many limiting factors to any immediate increase of that trade, and that we must not pitch our hopes too high. Recent discussions have referred more particularly to our overseas Dominions, namely, Australia, New Zealand, Canada, and the Union of South Africa. Now the population of these four Dominions only amounts to 22,000,000. Although we know that the purchasing power per head in most of the Dominions is high (in 1921 they took 15½ per cent. of our exports), there is an obvious limit to the absorbing capacity of markets with a relatively small population. Again, there must be limits to the productive power of areas, however vast their potential resources, unless those resources can be developed by an adequate population.

"It would be unreasonable to expect that we could make a very substantial increase in our trade with these Dominions until sufficient time had elapsed for them to increase their populations. That such increases will serve to add strength to the present movements towards fostering local industries is inevitable. We must regard this movement from the broadest point of view, we must welcome it and assist it actively by ensuring that such developments are effected by the support of British capital lest we find that, as is already the case to a considerable extent in Canada, capital has been supplied by competing countries. If a sane and healthy development of local industries takes place with the assistance of British capital and with due regard to the real industrial potentialities of the Dominions concerned, such a development can only tend to increase the general level of prosperity and consequently the growth of our trade with such Dominions.

"These conditions are all dependent upon an increase of population, and it is of the greatest importance that the Government should, in co-operation with the Dominion Governments, expand and perfect schemes of emigration to those parts of the Empire which are in need of additional population. For these reasons we cannot look to those Dominions for any immediate assistance in facing the problem of our foreign markets. We cannot, therefore, afford meanwhile to relax our endeavours in other parts of the world.

"In India we are faced with the difficulties of the political situation and possibly of a fiscal policy which may hamper any extension of British trade. With regard to India, I am afraid we can only say that the prospects of an immediate increase of our trade must be slight, and that we may even find difficulty in maintaining it at its present level.

"I am a firm advocate of doing everything which is possible to stimulate and develop our trade within the Empire. I look to this trade to be eventually the solution of many of our present problems, both economic and political. I believe that every effort should be made to stimulate such trade and to lay the foundations for its increase, but we must realise that such an increase can only be gradual, that thought and labour must be given to the solution of the problems involved, and that we shall have need of much patience before we see the fruits of our efforts. We must remember that the development of the consumption power of any market is necessarily slow and dependent upon the power of that market to develop its own production so that the consumption can be paid for.

"Whether this development will proceed smoothly and upon sound and healthy lines will depend very largely upon the wisdom and foresight of all concerned, and particularly, perhaps, on those responsible for the financial and general policy of the Dominions themselves. Development will not be assisted if we in this country rush into ill-considered schemes, or if through a lack of appreciation of the legitimate needs and ambitions of the Dominions themselves, we attempt to force upon them schemes based too much upon our own present necessities."

THE INSTITUTION OF ELECTRICAL ENGINEERS.

South Midlands Centre: Chairman's Address.—*Abstract.*

In the course of his inaugural address at Birmingham as chairman of the above-named Centre of the Institution, Prof. W. Cramp, after paying an eloquent tribute to the late Dr. G. Kapp, said *inter alia**:—The Institution of Electrical Engineers has become indeed the nucleus and life centre of the electrical profession, inasmuch as affiliation with it in some degree has become a necessity and membership of it a hall mark. It has the ability to be a great power and influence in the world if administered with wisdom and judgment, but all great endeavours do, at the very moment when they are greatest, and even because of that greatness, contain the germ of the disease which ultimately leads to their deterioration and decay.

It behoves us, therefore, at this time specially, to search carefully the body of our Institution for indications of the presence of any such undesirable microbe.

Presidents and councils should intrinsically be servants—chosen on account of their wisdom to express and carry out the best thoughts and intentions of the community. It they do wrong, the responsibility is general and rests not upon the executive alone. Nomination, voting, and the method of election, are therefore serious privileges—far too lightly esteemed among us. This is the microbe of utter indifference, which has a hold already in us as individual members, and through us is affecting the whole Institution. It is the mild form of a very insidious disease, apparent as one of the prevailing causes of the downfall of many institutions greater than ours. It is a question of conscience for each member, to see that he votes for no man of whom he knows nothing, or of whom it may be said that he acts specifically for some "interest."

The Institution, like a huge Briareus, now spreads its hundred arms all over the world, embracing all manner of subjects, and its growth has passed unmarked because so gradual. But while thus extending our activities, let us never forget the lofty objects of the Institution lest we fall into the position of a mere trade defence organisation. There is need for this warning! Has the Institution any call to deal with German reparation payments, E.P.E.A. and suchlike semi-political trade guild work? Politics are no concern of ours, I think, and can only lead to diffusion of energy better employed in other ways; it is but a small step from reparation payments to questions of tariffs. Far better to maintain and extend our

*See Elec. Rev., November 3rd, 1922; p. 634.

original and highly successful expansion, resulting in the system of Territorial Centres. Has not the real growth and success of the Institution been due to this wise move more than any other? Mark how the Institutions of Civil and Mechanical Engineers are being obliged to follow our example in this matter.

Other institutions' kinship with us fills me with much misgiving; their number increases alarmingly and one's list of subscriptions becomes a matter of importance. Each has had its own offices, staff, journal, meetings, *and subscriptions*. Curious, too, how a given subject will go the round of them with repetition of discussion *ad nauseam* and monstrous accumulation of redundant printing. Clearly the matter cannot be left where it is; co-operation or affiliation must be compassed in some manner.

But how to do it? The Inst.C.E. has called a conference on the subject and is apparently in labour. Will it bring forth anything? If not, the I.E.E. should and must take it up, as being concerned in the matter more vitally than any other. Did man ever hear the like of it? Over half-a-million sterling spent by engineers on three piles of bricks and mortar within one square mile, where some plans are indeed made, but virtually no engineering is actually done—and not so much as would shelter three blind mice in Manchester, Liverpool, Leeds, Sheffield, Birmingham, Bristol, Glasgow, or anywhere where engineers live and move and do verily make engines! Three palaces, I say; three libraries containing largely the same books, and three secretariats with all their appurtenances and vested interests. Which is going to give way?

If in London we had been content to limit our annual expenditure by a judicious arrangement with one or the other of the great Institutions, increasing thereby the present wretched load factor of their buildings, there might have existed by now an Institution library and reading room in every important centre in the kingdom. What splendid opportunities! Such a combination of interests might have led—nay, may still lead—to other advantages, of which not the least would be the reduction of our annual charges. To maintain our dignity and prestige we are content to pay not less than £18,000 every year. Our idea of the value of the papers we receive as shown by the premiums awarded is £208, and our contributions to research amount to £218. Does this indeed represent the relative importance of these items? And are not our colleagues of the other Institutions in a worse case? Ought not such a scheme of co-operation as I have suggested to be regarded as most urgent—the only way, in fact, to achieve further territorial expansion and adequately to develop the Students' Sections?

There are signs of grace upon which we are entitled to look hopefully, but far better were it to ignore them than to blind our eyes to the presence of the microbes of the disease which I have diagnosed as existing in our system and for whose extermination I submit the following prescription:—

(1) Whole-hearted devotion on the part of the rank and file to the objects for which the Institution was established; more interest in the discussions; and in the selection and election of representatives on Committees and Council. It would be well if all would read the objects as stated in the Memorandum of Association at least once a session.

(2) The elimination from our activities of any concern with political or semi-political movements, industrial relationships, or trade-guild propaganda.

(3) The encouragement and expansion of Territorial Centres and a much more generous treatment of them financially. In particular, the reduction of expenses in London in so far as that is practicable and the establishment of Institution accommodation and libraries in the provinces.

(4) Encouragement and more generous treatment of the students' sections.

(5) Co-operation and, if possible, fusion with other engineering institutions, ultimately to form one great English-speaking Institution of Engineers.

Electro-Farming.—Mr. R. Borlase Matthews, M.I.E.E., in continuation of his campaign to popularise electricity in farming, gave a lecture recently to the Hertfordshire Institute of Agriculture, at Oaklands, St. Albans. In commencing, Mr. Matthews emphasised the simplicity of electrical methods—no special training was necessary. Hay-making at the lecturer's farm was illustrated by lantern slides. The capacity for work possessed by the "unit" was explained by reference to actual cases. The lengthening of the farm day by means of electric lighting, and the use of the same agent for increasing egg production, were dealt with.

The Hertfordshire Institute has under consideration the electrification of its college farm.

Fish Netting by Electricity.—A temporary scarcity of fish in the canning industry at Stavanger, Norway, has induced certain individuals to send out to the Hardanger Fjord the steamer *Adonis*, which has been equipped with electric lighting apparatus for the purpose of attracting fish near to the surface at night. The light is said to the swarming with brisling, although at too great a depth to be caught at night.

RUSSIA'S FIRST REGIONAL POWER STATION.

Dr. C. P. Steinmetz, of the G.E. Co., U.S.A., writing in the *Electrical World* recently, says that the first regional power station, designed and built in accordance with the plan for Russian electrification drawn up for the Russian Government by a committee of engineers, came into being on June 11th last, when the Kashira central station began operation, transmitting electrical energy at 115,000 volts over a 130-km (81-mile) line to Moscow. To the south of Moscow lie extensive brown-coal deposits estimated at 8,000,000 tons. This is low-grade coal, containing 40 per cent. ash. It is soft and friable, and these qualities, with its low calorific value and high ash content, make it unsuitable for long-distance transportation; hence the Kashira station was built to burn this low-grade coal. The Kashira power house is connected with the railroad station by a branch line 5 km. (3 miles) long, which ends in front of the power house. The cars, laden with coal, enter directly into the boiler-room for discharge into the bunkers. In the future electric cranes and conveyors will be installed, but for the present use is made of pits. All the auxiliary railways are to be electrified and the cars are to be hauled by electric locomotives supplied at 1,200 V, d.c., with a truck having two axles, on each of which a 120-h.p. motor will be mounted.

As the station is on a high elevation with respect to the midsummer water level, it was necessary to build a pumping system on the bank of the river. Since in the spring the water rises very high at this part of the river, the pump-house is built in the form of a tower, and it is also adapted for an ice-cutting plant. The pump-house contains three 260-h.p., three-phase, 50-cycle, 3,000-V motor-pumps, each having an output of 2,500 cu. m. (88,290 cu. ft.) per minute. In view of the present lack in Russia of a sufficient quantity of cast-iron piping, the water is conveyed in wooden piping held together by iron rings. At the present time there are in operation two turbo-generator sets with a temporary transformer-house and one boiler-house. An extension of the building to contain two more turbo-generator sets and another boiler plant, and a house for transformers, distributing boards, and high-pressure apparatus, are under construction. At the present time there are installed three Garbé boilers with a heating surface of 450 sq. m. (4,815 sq. ft.) each, two B. & W. boilers with horizontal tubes and a heating surface of 302 sq. m. (3,230 sq. ft.) and two Stirling boilers with a heating surface of 515 sq. m. (5,510 sq. ft.) each, making a total heating surface of 3,434 sq. m. (36,740 sq. ft.). The boilers are fitted with economisers.

In the boiler-room adjoining the turbine-room are the feed-water heaters and four pumps, two electric pumps, and two turbo pumps, with an output of 135 cu. m. and 120 cu. m. (4,765 cu. ft. and 4,236 cu. ft.) respectively.

In the turbine-room are installed two three-phase, 3,000-V, 50-cycle, Brown-Boveri turbo-generators, rated at 6,000 kW each and separately excited. Railroad tracks are laid directly into the turbine-room. For its own needs the power station has two 750-kVA, 3,000/210-volt transformers and one reserve motor-generator set for excitation purposes.

On the second floor is the main distributing board, which controls the station generators and the outgoing lines. Under the switchboard are 3,000-volt oil switches and connecting switches. Close by is temporary accommodation for single-phase, 4,000-kVA. delta-star-connected, step-up transformers, with 3,000/115,000 volts between phases.

All the oil switches are calculated to interrupt 40,000 kVA under short-circuit, the whole output of the station.

The Koszuchow sub-station is situated to the south of Moscow, close to the station of the Moscow-Okrouszny railroad. The sub-station transforms the voltage received from Kashira to the city voltage (6,600) and to that of the high-voltage ring which is to surround the town, following the lines of the Okrouszny railroad.

The transmission line which carries the output of the Kashira station to Moscow is noteworthy because it is the first 115,000-volt transmission line built in Russia, and because it has been constructed entirely by Russian engineers of Russian material, with the exception of the high-pressure insulators, and under the most trying conditions. Another high-pressure line will be built from Kashira and two high-pressure lines from Shatouka to Moscow. From the Koszuchow sub-station underground cables carry the energy to the Moscow lines. Copper-conductor stranded cable is used with a cross-section of 70 sq. mm. (0.11 sq. in.) and a diameter of 11 mm. (0.4 in.). Instead of iron supports wooden poles 11 m. (36 ft.) high, with a top diameter of 22 cm. (8.8 in.) are used. Wooden supports were used only because the present position of Russian industry makes it very difficult to procure steel supports. It is recognised that wooden supports require replacement on an average once every seven years, and that this will interfere with the operation of the line. For this reason steel towers will be used later on.

BUSINESS NOTES.

The "Electrical Review" Issue for December 29th.—We desire to direct the attention of our advertisers and readers to the announcement appearing in our advertisement pages to-day respecting the dates for sending in copy for our issue of December 29th. All editorial matter must reach us much earlier than usual, as the greater part of the REVIEW will have to be "made up" before the Christmas Holidays begin.

Bankruptcy Proceedings.—CAPT. DANIEL DESMOND SHEEHAN (formerly for eight years Nationalist member of Parliament for Mid-Cork).—A Belfast newspaper report states that the creditors in this case met on December 6th at the London Bankruptcy Court. The liabilities are estimated roughly at £600, while a creditor has given notice of his intention to lodge an additional claim for £2,500. Debtor denies he is insolvent, and values his assets at not less than £13,000. They comprise interest valued at £25,000 in 68,000 acres of mineral rights in Western Ireland, to be developed directly the country becomes more settled, and interest valued at £10,000 in profits of a syndicate formed to utilise the water power from the River Bann for electricity, for which an unopposed Bill is now before the Ulster Parliament. A trustee was appointed.

H. N. MILES (Sheffield & Midland Schools of Wireless Telegraphy), wireless instructor, Central Chambers, High Street, Sheffield.—Receiving order made December 5th on debtor's own petition.

E. MITTON, electrical and automobile engineer, Queen's Hall Buildings, Church, Lancaster.—First meeting December 18th, at the Official Receiver's offices, Preston. Public examination: County Court House, Blackburn.

R. A. DEPLEDGE (Scunthorpe Electrical Co.), electrical engineer, 53, Frodingham Road, Scunthorpe.—Last day for proofs for dividend, December 22nd. Trustee, Mr. S. M. Forrester, 1, Town Hall Street, Grimsby.

W. H. BORROWS, engineer and electrician, Werrington, Northampton.—Last day for proofs for dividend. Mr. J. O. Morris, Official Receiver, 5, Petty Cury, Cambridge.

D. H. GRIFFIN (Midland Electric Co.), electrical engineer, 16, Hornby Road, Blackpool, and 5, The Mart, St. David's Road South, St. Annes-on-Sea.—Receiving order made December 8th, on debtor's own petition.

A. SMITH (Smith & Gill), electrician, 57, Albion Street, Nelson.—Receiving order made December 7th on creditor's petition.

H. S. ROGERS, electrical engineer's sales manager, 21, Derby Street, Walsall.—Last day for proofs for dividend, December 27th. Mr. S. W. Page, trustee, 30, Lichfield Street, Wolverhampton.

Company Liquidations.—BELL BATTERY CO., LTD., Laburnum Grove, Ilford.—*Correction.*—In the list of creditors in this case (*see* ELEC. REV., December 1st, p. 825), the Electrical Engineering & Equipment Co., Ltd., appear as creditors for £678. We are informed by the company that this is incorrect, as the goods represented by that sum had not been delivered, and they are not pressing any claim. A letter from the liquidator (Mr. F. Wilcock) says that although the company appeared in the books as creditors for £678, the goods were never delivered to the Bell Battery Co., but were otherwise disposed of, and the Electrical Engineering and Equipment Co., Ltd., have now waived their claim.

AQUA ELECTRIC CO., LTD.—A meeting of members is called for January 11th at 5, Victoria Street, S.W., to hear an account of the winding-up from the liquidator, Mr. C. H. McKnight.

WIRELESS APPLIANCES, LTD. — Winding up voluntarily. Liquidator: Mr. H. E. Harwood, 73/75, Albion Street, Leeds. Meeting of creditors, December 21st, at the Midland Grand Hotel, St. Pancras. Particulars of claims must be sent to the liquidator by January 10th.

SUBMARINE MOTOR SHIP CLEANER SYNDICATE, LTD.—Last day for proofs for dividend, December 28th. Mr. H. E. Burgess, Official Receiver and liquidator, Carey Street, W.C.

Dissolution of Partnership.—D. M. CARMICHAEL & ROBERTSON, wholesale electrical suppliers, 32, Abbotsford Place, Glasgow.—Mr. D. M. Carmichael and Mr. T. C. Robertson have dissolved partnership.

Receiver Appointed.—WILSON HARTNELL & CO., LTD., Leeds.—Mr. Peter McCandlish Wilson, of Lee & Whitfield, chartered accountants, 17, East Parade, Leeds, has been appointed receiver for the second debenture holders.

Trade Announcements.—MESSRS. G. H. STEVENS & CO., electrical engineers and contractors, who have moved to 108, Fenchurch Street, London, E.C., desire to receive catalogues.

MESSRS. MENZIES-SMART, LTD., have changed the address of their London office to 11 and 13, Southampton Row, London, W.C.2. Telephone No.: "Museum 4413."

MR. E. BRYIAN-HASELDEN has taken over the business of P. J. Weekes, Lombard Works, Lombard Street, London, S.E.1, for the manufacture of switch panels, &c.

STANDARD INSULATOR CO., LTD., has removed to more commodious and central premises at 41, Rathbone Place, Oxford Street, W.1.

MR. COLIN C. STEWART, formerly with the late Mr. Hugh Clark, has commenced business as an electrical engineer at Alloway Chambers, 259, High Street, Ayr.

MR. WILLIAM R. ALSTON has succeeded to the business of the late Mr. Hugh Clark, electrical engineer, 10, Alloway Street, Ayr.

THE LEWIS SPRING CO., LTD., Redditch, has appointed Messrs. Lionel Robinson & Co., 6 & 7, Staple Inn, London, W.C.1, sole agents for the electrical trade for its products.

Catalogues and Lists.—MESSRS. CROW, TOOGOOD & CO., 56, High Street, Charing Cross Road, W.C.2.—A priced catalogue of electrical fittings and appliances; a pamphlet illustrating the "Crogood" lantern for external lighting, and the "Rhodes" time switch; and a net trade price list of electrical appliances and material.

MADA ENGINEERING CO., LTD., 12, Bevington Hill, Liverpool.—An illustrated booklet (List G), fully describing the "Remca" electric riveter. Also an illustrated postcard giving the price of this machine.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 2251-A, illustrating and describing d.c. motors; and Descriptive List No. 4305-C dealing with porcelain handle fusible cut-outs.

MR. RALPH W. COWIN, 46, Churchill Road, Oldham.—An illustrated pamphlet dealing with special casing for exposed conduit.

THE LODGE FITTINGS CO., LTD., 57, Albert Road, Aston, Birmingham.—A priced leaflet and sheet of illustrations of lighting pendants. Also a leaflet giving prices and specifications of battery switchboards.

MESSRS. NATHAN & ALLEN, LTD., 25, Victoria Street, S.W.1.—An illustrated catalogue of electric time switches and ancillary apparatus. Fully priced.

MR. E. BRYIAN-HASELDEN, Lombard Works, Lombard Street, Southwark Bridge Road, S.E.—A pamphlet advertising lighting service, with a calendar for 1923.

THE GEAR GRINDING CO., LTD., Handsworth, Birmingham.—An illustrated pamphlet advertising a patent gear hardening and grinding process.

CONSTRUCTORS (TRADING CO.), LTD., 4, Brook Street, St. Paul's Square, Birmingham.—An illustrated and priced pamphlet dealing with "Welconstruct" slotted steel—flat, angle, and channel.

THE SYNCHRONOME CO., LTD., 32 and 34, Clerkenwell Road, E.C.1.—A booklet containing lists of some important installations of "Synchronome" electric clocks.

THE RUSSELL ELECTRICAL APPLIANCES CO., LTD., 60, Queen Victoria Street, E.C.4.—An illustrated and priced pamphlet describing the "Reako" heater-toaster and a domestic iron.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—An illustrated and priced pamphlet illustrating the "Cheery" electric fire, a new model.

MESSRS. FERGUSON, PAILIN, LTD., Edward Street, Higher Openshaw, Manchester.—Catalogue Section No. 190/A1, giving a detailed illustrated description of the firm's truck-type ironclad switchgear.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—A series of illustrated pamphlets in a folder advertising "Benjamin" industrial illumination.

Christmas and New Year Holidays.—The offices of the LANCASHIRE DYNAMO & MOTOR CO., LTD., will be closed from noon, December 23rd, to 9 a.m., Wednesday, December 27th, and from 5 p.m., December 29th, to 9 a.m., January 2nd. The works will be closed from noon, December 23rd, to 9 a.m. January 2nd. The works of MESSRS. BRUCE PEEBLES & CO., LTD., will be closed from December 29th to January 8th.

Book Notices.—The Christmas number of *Work* (Cassell and Co., Ltd.; 3d. net) is of larger size than usual, and contains many articles and notes upon scientific entertainments for the season. A special article deals with the reception of radio broadcasting, and there are numerous electrical notes by Mr. A. H. Avery.

"The *Journal* of the Junior Institution of Engineers." December. London: Percival Marshall & Co. Price 2s.—A paper on "Artificial Ice-making," by Edgar C. West is reproduced in this issue, and a report of the annual general meeting also appears.

"Science Abstracts A and B." Vol. XXV. Part 10. No. 298. October 31st, 1922. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

Irish Property Claims.—The Dublin United (Electric) Tramways Co. has lodged a claim for £1,608 with the Irish Free State Government in respect of damage to property during recent political disturbances. Marconi's Wireless Telegraph Co., Ltd., is claiming £7,199 from the Government in respect of damage by the "Irregulars" at the Clifden (Co. Galway) wireless station.

A Pen-knife Sharpener.—The Pelican Electric, Ltd., has sent us one of its sharpener slips for pen-knives. It is in a red American cloth case, and of very serviceable size.

New Belgian Wireless Company.—A new company has been formed in Brussels, with a capital of 4,000,000 francs, and the title La Société Belge Radio-Electrique. The Compagnie Generale de Telegraphie Sans Fil, Marconi's Wireless Telegraph Co., Ltd., and several other concerns are interested in the new undertaking.

Social.—The London Station Engineers (Branch No. 1), Electrical Trades Union, held their sixth annual concert on December 8th. An excellent musical programme was arranged, and the audience numbered about 300. During the interval a successful collection was taken in aid of the branch benevolent fund.

Visit of Swedish Engineering Students.—A report has recently been published of the visit of Swedish engineering students to England during the past summer. This was arranged on the initiative of the Department of Overseas Trade and the British Commercial Secretary at Stockholm, and the Swedish Commercial Board offered each of the visiting students 400 kr. to defray their expenses. The party was divided into sections, each of which paid attention to its particular branch of engineering. Power stations, manufacturing works, gasworks, shipyards, and other works were inspected, both the technical and economical sides being studied. The programme included visits to the London Underground Railways, the Metropolitan-Vickers Electrical Co., Ltd., Messrs. Ferranti, Ltd., Messrs. Waygood-Otis, Ltd., Messrs. W. & T. Glover, Ltd., Messrs. C. A. Parsons & Co., and Messrs. Hadfield's, Ltd.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Batometa. No. 427,951. Class 8. Electric meters, apparatus for testing or indicating the condition of electric batteries, &c. Percy J. Gumbley, 39, Morley Road, Ward End, Birmingham. November 22nd, 1922.

Metrovick. Nos. 428,500, 428,501, and 428,502. All goods in Classes 5, 14 and 15 respectively. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. December 6th, 1922.

Lokap. No. 426,719. Class 6. Machines for winding coils for use in wireless telegraphy and for other electrical purposes. John F. Sutton, 18, Melford Road, East Dulwich, S.E. December 6th, 1922.

Marconi. No. 425,707. Class 8. Wireless telegraph apparatus. Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C. December 6th, 1922.

Meccolite. No. 428,655. Class 8. Crystals for wireless communicating apparatus. Frank Hornby, 236, Binns Road, Old Swan, Liverpool. December 6th, 1922.

R.S. (lettering and design).) No. 430,089. All goods in Class 8. Radio Service Co., Ltd., Evelyn House, 62, Oxford Street, London, W. December 6th, 1922.

A.D. Le Carbone (lettering and design). No. 427,336. Class 11. Electric batteries. La Société Le Carbone, 12-13, Rue de Levallois, Levallois-Perret (Seine), France. (D. Young, 11-12, Southampton Buildings, London, W.C.). December 6th, 1922.

Lælios. No. 425,210. Class 13. Electric lamps (ordinary). Lælios Lamp Co., Ltd., 32-34, Holborn Viaduct, London, E.C. December 6th, 1922.

Rosolco. No. 428,418. Class 13. Electric lamps (ordinary) and electric lighting fittings and accessories. Good Bros., Ltd., 35, South John Street, Liverpool. December 6th, 1922.

Our Foreign Trade.—November Figures.—The following were the values of imports and exports of electrical goods and machinery during November, 1922:

	1922 Nov.	Inc. or dec.	1922. 11 months Inc. or dec.
Imports	£	£	£
Electrical [illegible] and apparatus	177,643	- 14,807	158,407
Machinery	651,171	- 3,027	2,889,197
Exports			
Electrical [illegible] and apparatus	617,653	143,242	5,582,416
Machinery	1 [illegible] 822	1 205 171	22,183,852
Reexports			
Electrical [illegible] and apparatus	6,172	5,143	61,441
Machinery	97 857	- 627	150,919

Trade Union Membership.—The Chief Registrar of Friendly Societies, reporting upon the membership of trade unions during 1920 [illegible] there was an accession of 400,000 persons, making the total membership over 7,000,000. Under "General and Miscellaneous" 1,644,659 members are placed. In the metals industry there were 1,134,389; transport workers numbered 1,091 [illegible] mine workers 1,007,617. A feature of the year was the registration of more than 20 of non-manual workers' unions registered. Several amalgamations took place, and 19 unions disappeared from the register owing to these.

"Model Engineer" Exhibition.—The sixth "Model Engineer" Exhibition is to be held at the Royal Horticultural Hall, S.W., from January 5th to 12th. An interesting and instructive display is being arranged.

Russian Electrical Industry.—According to a Russian journal, the output of the electrical industry in Russia in 1916 was valued at over 83,000,000 pre-war roubles. Later the industry suffered a severe decline. In 1920 the output was valued at only about 5,000,000 pre-war roubles, or about 6 per cent. of that of 1916. A change came in 1921, when the output of electrical goods was over 8,000,000 roubles in value, or about 20 per cent. of that of 1914 and 10 per cent. of that of 1916. With regard to the year 1922, a special committee has been examining the situation of the four electrical trusts—The Central District Trust; the Petrograd District Trust; the Accumulator Trust; and the Weak-Current Trust. The position of these trusts, deprived of working expenses, and short of labour, was similar to that of the metallurgical industries. Between January 1st and May 1st this year the Central District Trust produced goods to the value of 3,662,000 pre-war roubles, but could only realise a very small proportion, namely, about 760,000 pre-war roubles value. Its "funds" largely consist of unsold goods made for Government departments unable to pay for them, and of raw and semi-raw materials (over 7,000,000 roubles value), which cannot be used for some time. The finished goods are valued at about 10 per cent. of the working capital. The position of the Petrograd Electrical Engineering Trust is no better. Its output from January 1st to May 1st was valued at 1,100,000 roubles, of which it realised 230,000 roubles, or about 20 per cent. of its products. The old pre-Revolution firms had a great system of branch establishments in the country; but these have ceased to operate. The first step of the new trusts was to open such branches for the supply of electro-technical materials. The Central District Electrical Trust has now established ten or twelve such branches. Before the war Russia's own electro-technical workshops covered 60 per cent. of Russia's requirements, and the present production is estimated to amount to about 25 per cent. of the pre-war output, or about equal to one-fifteenth of the pre-war demand. The demand from the agriculturists, it is stated, is now very strong, and it is felt that in the near future Russia's electro-technical industry will revive on a solid basis. It is held that many Government orders are going abroad that could quite well be executed in Russia. The inquiry committee points out, for example, that the Weak-Current Trust should get more home support. A large quantity of Morse apparatus has been bought abroad, whilst Russian factories are idle. The writer continues that it is only a good market that is wanted to put the industry on its feet—our readers may give a very wide meaning to the term "good market"! Before the war the inland accumulator works covered Russia's requirements to the extent of 98 per cent. Their production amounted to 2,900,000 roubles value. But between January and May this year this Trust produced only to the value of 120,000 roubles, of which only 35,600 roubles value was realised! This trust works only for Government departments. The Weak-Current Trust is similarly situated.

Longevity of Exide Batteries.—Some few months ago a Melbourne, Australia, client of the Chloride Electrical Storage Co., Ltd., visited the firm's Service Station with his Hudson car, which he had just sold. He was anxious that everything on the car should be right before handing it over, and instructed the depôt staff to open up and inspect his "Exide" battery, type 12-SD-3. On examining it, it was found that the battery needed no repairs, and was good for further service. At that date it had been in use for 9½ years, and at one time stood in a garage for nine months—and then started the car. The battery is still in service.

New Italian Companies.—There has been formed at Savona the Società Anonima di Elettricita di Savona, with a capital of 6,000,000 lire, which may be raised to 8,000,000 at the request of the Commune of Savona. The objects of the company are the construction and working of electrical undertakings.

With a capital of 900,000 lire the Società Elettrica del Santerno has been embodied at Venice. Its aims are the purchase, erection, and working of industrial and electric plants, more especially in the Imola district.

Commission on Awards to Inventors.—Lieut.-Colonel Joseph I. McMullen, head of the Commission appointed by the Government of the United States to settle the claims of British inventors whose work was made use of by the United States Army during the war, is in London making arrangements for the first sitting of the Court of Investigation. Members of the Commission landed at Plymouth on December 6th. The whole of the work is to be done in conjunction with the British Commission on Awards to Inventors, and in every case the decision arrived at will be after full discussion with the British representatives.—*Daily Mail.*

A Reply from the East.—Mr. F. H. Howell, the London Sales Manager for "Hotpoint" and "Falco" heating and cooking appliances, informs us that our recent note on the special terms offered to electrical salesmen to assist them in the acquisition of appliances for their personal use has not only brought many replies from this country, but even from so far away as the Sudan.

New French Companies.—There has been launched at Paris (41, Boulevard Haussmann) the Compagnie Française d'Installations et Exploitations Electriques (G. Gilbert et Cie.), with a capital of 1,000,000 fr., with objects as indicated by its title.

The Radio Industrie is a company founded to cater as makers and sellers for the newest departures in wireless telegraphy and telephony. Its capital is 200,000 fr. Offices: 25, Rue des Usines, Paris.

With the object of the sale in France and her colonies of the magnetos made by the Italian firm of Marelli, the Société Française des Magnetos Marelli has been established with a capital of 250,000 fr. Offices: 77, Boulevard Gouvion Saint-Cyr, Paris.

Lea Coal Meters at Kilmarnock.—We are informed by the Lea Recorder Co., Ltd., that it supplied the coal meters fitted to the triple-grate B. & W. boilers illustrated in fig. 2 on p. 831 of our December 1st issue. In view of the fact that these meters are, at the present time, somewhat novel appliances, it is pleasing to know that Mr. W. C. Bexon, engineer and manager of the Kilmarnock electricity undertaking, is very satisfied with them.

South African Tariff.—The South African Customs authorities have lately given a decision to the effect that "wireless telegraph apparatus and wireless broadcasting sets" are to be classified under No. 193 of the Tariff, the general duty being at the rate of 20 per cent., from which British goods are allowed a rebate of 3 per cent.

Vacuum Cleaner Prices.—The Electric Appliances Co., Ltd., have issued notice to the trade reducing the prices of their Eureka vacuum cleaners.

Installation Work in Paris.—The last issue of the weekly report of the French Minister of Labour on the labour market states that in the Department of the Seine the activity of the electrical installation firms is being maintained, and the available labour is insufficient to meet the demand.

Indian Trade.—His Majesty's Senior Trade Commissioner in India (Mr. T. M. Ainscough, O.B.E.) has forwarded to the Department of Overseas Trade a brief review of the September issue of the monthly trade returns issued by the Government of India, with regard to the import trade of the first half of the statistical year—April 1st to September 30th, 1922. It is stated that the total imports for the six months declined from 124 crores of rupees in 1921 to 110 crores in the corresponding period of 1922. It is, however, most satisfactory to note that, although shipments from the United Kingdom declined slightly from 69 to 66½ crores, the British share of the total rose from 55 per cent. to 60 per cent., as contrasted with a reduction of the share of the United States from 10.3 per cent. to 6.6 per cent., and that of Japan from 6.6 per cent. to 5.9 per cent., but the German proportion rose from 2.3 per cent. to 2.7 per cent., and the share of Belgium remains stationary at 0.9 per cent. It should always be remembered, however, that imports from British ports do not entirely represent British goods, as there is a certain amount of Continental cargo shipped from British ports by British export merchants.

Owing to the trade depression and the parlous state of many Indian industries, the phenomenal imports of machinery and millwork which were recorded last year have not been maintained during the first six months of the present year. The total imports fell from 17.8 crores to 11.43 crores. The British share was reduced from 14.18 to 9.62 crores. This reduction is, however, less severe than in the case of the United States, whose shipments fell from three crores to one crore. The only noteworthy increases are those of Germany from 29 to 39 lacs, and of Switzerland from three to nine lacs. The total imports of electrical machinery were 154 lacs (186), and of boilers 60 lacs (141).

The very heavy imports of electrical instruments and apparatus have not been maintained, and the total trade is reduced from 260 to 118 lakhs. The British share fell by more than half, from 175 to 82 lakhs, while that of the U.S.A. shrank from 62 to 11 lakhs. The only noteworthy increase is that under the heading of "Other countries," from 6½ to 12 lacs, and this probably represents mainly German electrical accessories.

German Heating and Ventilating Congress.—A heating and ventilating congress is to be held in connection with the 25th yearly meeting, in Berlin in 1923, of the Union of Central-Heating Industries.

LIGHTING AND POWER NOTES.

Alford (Lincs.).—Electricity Scheme.—The Urban Council has referred to the Lighting Committee a proposal by Mr. J. W. H. Cooper, of Grimsby, to institute an electric lighting scheme for the town.

Argentina. — Hydro-Electric Scheme. — The Argentine Ministry of Public Works has made a proposal to the Legislature of the Province of Mendoza for the installation of a hydro-electric plant and irrigation dam at the Nihuil Falls, on the River Atuel. There is a fall of 100 metres on a catchment of 500 metres, while the power is not more than 2,000 metres from the railhead point. The mean annual flow is 60 cubic metres per second, with up to 500 cubic metres during the rainy season. The proposed development of commercial energy amounts to 100,000 h.p.—*Board of Trade Journal*.

Ashford (Kent). Electricity Supply.—At a recent meeting of the Urban Council, the engineers appointed to report on the possibility of an electricity supply wrote stating that the Electricity Commissioners were not prepared to sanction an independent generating station for Ashford unless a supply of energy in bulk could not be obtained. The matter was referred to the Lighting Committee.

Australia. Western Victoria.—Plans for the supply of electric power from Yallourn to the larger centres of population in Gippsland have been submitted to the State Ministry by the Electricity Commission. The annual estimated cost of operating the scheme is £18,012. If authorised this year the project can be brought into operation in two years. The starting point of the proposed extensions will be the State Government's power station at Yallourn (Morwell). The works include a transmission line 90 miles long, *via* Traralgon, Sale, Maffra, and Stratford, to Bairnsdale, the estimated cost, including sub-stations, to be £77,720; a transmission line 49 miles long *via* Mirboo and Leongatha to Korrumburra, the estimated cost to be £32,300; and a transmission line six miles long to Moe, to cost £2,130, bringing the total capital cost to £112,150. It is pointed out that this is for the complete system of h.p. transmission only, and does not include the cost of l.p. distribution in townships or interest during construction.—*Reuter's Trade Service* (Melbourne).

Bedford.—Year's Working.—The accounts of the municipal electricity undertaking (Engineer: Mr. R. W. Phillips) for the year ended March 31st last show a total revenue of £72,709, as against £78,705 in the preceding year. Working expenses totalled £48,237, as compared with £54,572, leaving a gross profit of £24,472 (£24,133). The net result, after the payment of interest and sinking fund charges, was a profit of £1,736; the previous year's profit was £2,139. A total of 4,611,267 kWh of energy was sold, and the maximum demand was 2,680 kW.

Blackpool.—Loan.—The Corporation is applying to the Electricity Commissioners for sanction to borrow £33,000 for the following purposes: H.p. feeder cables, £7,400; l.p. feeder cables and distributors, £10,100; 10 new static transformer buildings, £3,500; ten 200-kW transformers, £2,000; switchgear, £4,000; and services, £6,000.

Continental.—France.—Power is being sought by the Société d'Etudes Saône-et-Marne to erect a transmission line to carry 30,000 V, 50 cycle current from Challandrey to Mirabeau and six secondary transmission lines to serve some eight localities in the Côte d'Or and Upper Marne districts. The Société Anonyme pour l'Eclairage par le Gaz is applying for a concession to distribute electrical energy in eight communes in the neighbourhood of the city of Rheims. A concession to distribute electrical energy in eleven rural communes in the department of the Somme has been applied for by the Société Cooperative Agricole d'Electricité de Sains-en-Amenois. The Compagnie d'Electricité Industrielle has applied for a concession to set up three e.h.p. transmission lines to serve a number of communes in the Haute Garonne and Basses Alpes departments. A syndicate, whose headquarters is at the town hall, Vignory, has applied for a concession to supply electricity to 24 communes in the valleys of the Marne and the Blaise.

Belgium.—The plant at the new Louis Lambert colliery of the Société des Charbonnages d'Hensies-Pommerœul is to be electrically operated, the plans including the establishment of an electricity generating station. An electric winding engine has been installed, and is already being used in connection with the shaft sinking work, and will be utilised later for coal-raising purposes.

East Ham.—Accident.—During the testing of a new rotary converter at the Council's generating station on December 10th, the machine flashed over, and four of the station employés received burns.

Eccles.—Price Reductions.—The Town Council has reduced the charge for electricity from 75 per cent. above the pre-war rate to 50 per cent. as from the quarter ending September 30th.

Greenock.—Fire.—While a large turbine was in operation at the Corporation electricity station on the night of the 8th inst. there was a "burn-out," and flames burst forth, igniting the roof and shattering glass. The Burgh Fire Brigade extinguished the flames. The main portion of the town was in darkness for some considerable time.

Guildford.—Price Reductions.—The following reduced charges have been adopted by the Town Council:—Lighting, up to 1,000 kWh per quarter, 9d. per kWh; beyond, 6d. Power and heat, up to 1,000 kWh per quarter, 3½d.; beyond, 2½d. The minimum charge for each quarter is to be 10s., plus meter rent. Theatres and kinemas, up to 100 kWh per week, 6d., beyond 3d.

India.—Madras.—The Municipal Council has been in correspondence with the Government electrical engineer regarding estimates for lighting by generating the necessary power with

oil-engines. The engineer has replied that the scheme may be worked at a cost of Rs 60,000.

Bombay.—The Andhra Valley Power Supply Company has commenced supplying power to cotton mills in Bombay to the extent of 2,000 h.p. The supply will be increased as mills are asserted to electrical power. By July next it is expected that Bombay will utilise the whole of the Andhra Valley supply.—*Indian Textile Journal.*

King's Lynn.—Year's Working.—The accounts for the year ended March 31st last of the electricity undertaking (engineer: Mr. C. W. Jackson) record a total income of £17,700, as compared with £16,650 in 1920-21. Working expenditure amounted to £11,261, as against £12,959 in the previous year, leaving a gross profit of £6,490 (£3,700). After the payment of capital charges a net profit of £544 remained, contrasting favourably with a net deficit of £106 upon the previous account. The sales of energy decreased from 882,314 to 837,067 kWh. The number of connections increased from 1,144 to 1,228. During the year 1,000 kW was added to the plant capacity—more than doubling it.

London.—Hackney.—The *Evening News* states that the borough electrical engineer (Mr. L. L. Robinson) is considering the illumination of market stalls by electricity. A standard with a meter would be erected in the market place, and the stalls would be connected up to this, receiving energy at a low cost, which would compare favourably with that of other forms of lighting.

Mexico.—Nonoalco.—According to the report of the Mexican Light & Power Co., Ltd., for the year 1921, a contract has been placed with the English Electric Co., Ltd., for a 5,000-kW steam turbo-generator for the company's Nonoalco station, to be ready for operation before the next dry season. The new plant will replace three old and obsolete machines.

Middlesbrough.—Extension of Supply.—The Corporation has decided to supply electricity to the neighbouring villages of Ormesby and Marton provided that for a period of six years a guarantee is given by the residents to pay 10 per cent. of the cost of laying the transmission lines. The Corporation has decided further that in the event of the necessary guarantee being given, the Town Clerk shall be instructed to apply to the Electricity Commissioners for sanction to the borrowing of £4,000 to carry out the work.

Newton-in-Makerfield.—Electricity Supply.—It was stated at a meeting of the Gas Committee last week that the Electricity Commissioners had considered a scheme for a generating station in the Council's area, and also an alternative proposal of obtaining bulk supplies from outside the area. They also had had under consideration a scheme submitted to them for a re-organisation of electricity supplies over a district in which Newton-in-Makerfield would be a part, but some time would elapse before it would become operative. The Commissioners therefore urged the Council to take bulk supplies from available sources.

Oakham. — Electricity Scheme. — The Urban District Council has appointed a sub-committee to consider the scheme of the gas company to supply electricity for heating and lighting purposes in the area.

Portuguese East Africa.—Beira.—Additions to the present power station amounting to 300 h.p. have been decided upon by the Town Improvement Commission. The additional plant is to improve the lighting system of the town and to provide electrical energy during the day for industrial and commercial purposes. Tenders will be called for in the near future.—*Commerce Reports.*

Rochdale.—Price Reduction.—The Corporation has reduced the charges for electricity by 10 per cent.

Rye (Sussex).—Proposed Electricity Scheme.—The Town Council has decided to appoint an expert to advise it upon an electricity scheme for the town.

Sleaford.—Price Reductions.—The charges for electricity have been reduced as follows:—Power, from 7½d. to 5½d. per kWh; lighting, from 8½d. to 5½d. per kWh; lighting, from 10d. to [illegible] per kWh; public lighting to be reduced for the current year to 10 per cent. on the full charges of £18 15s. for arc lamps and £3 for small lamps.

Southampton. — Year's Working. — The report of the borough electrical engineer (Mr. W. G. Turner) for the year ended March 31st last records a total income from all sources of £148,423, comparing with £143,216 in the preceding year. The working expenditure totalled £96,643, as against £110,654, giving an increased gross profit of £51,780 (£32,562). After the payment of capital charges, a net profit of £26,660—or more than twice that of the previous year, £10,587 remained. The capital account [illegible] expenditure of £108,815 during the year. Of this total new machinery accounted for £75,196, buildings for £17,[illegible] and mains and services for £12,657. The number of kWh sold fell from 10,916,989 to 9,335,592. The maximum load [illegible] from 5,111 to 4,986 kW. Southampton is one of the [illegible] which were not seriously affected, financially, by the miners' dispute; the increased price of coal during that period was more than counterbalanced by later reductions. The increased sales of energy were entirely due to the loss of industrial load; the consumption for private purposes increased.

Stafford.—Loan.—The Town Council has agreed to the recommendation of the Electricity Committee that an e.h.p. cable be laid from the works along Stone Road to the Sandon Road factory of Messrs. Lotus, Ltd., for the purpose of supplying electricity to the company's factories, and that application be made to the Electricity Commissioners for sanction to borrow £15,000 in connection with the scheme.

Swansea.—Price Reductions.—The Electricity Committee has recommended that the following reductions in the charges for electricity be made, commencing January 1st, 1923:—Lighting, from 6¾d. to 6d. per kWh; heating and cooking, from 2d. to 1d. per kWh during the summer quarters; power, a reduction of 25 per cent.

Wanstead. — Special Order. — The County of London Electric Supply Co., Ltd., is applying for an Order to enable it to supply electricity to Wanstead, Woodford, Buckhurst Hill, and Chigwell. The matter is to be considered by the Wanstead District Council in conjunction with the Woodford Urban District Council.

Wellingborough. — Extension of Supply. — The Rural Council has consented to the application of the Northampton Electric Light and Power Co. to extend its area of supply, so as to include the parishes of Mears Abbey, Ecton, Sywell, and Earls Barton.

Wimbledon.—Year's Working.—The accounts of the municipal electricity undertaking for the year ended March 31st last show a total revenue of £87,359, as compared with £81,459 in the previous year. Working expenses totalled £59,200, as against £66,642, leaving a gross profit of £28,159 (£14,817). The net result was a profit of £5,894, comparing favourably with a deficit of £3,699 in 1920-21. The number of kWh sold increased from 4,013,525 to 4,277,808, and the maximum demand from 2,501 to 2,725 kW. The plant capacity remained at 4,285 kW.

Hire of Domestic Appliances.—The Borough Council has authorised the expenditure of £200 for the purchase of electrical cooking appliances to be let out on hire.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Accident.—On December 10th a tramcar proceeding to Birmingham along the Handsworth route left the track and, after proceeding about 20 yards, overturned. There was no appreciable gradient at the place where the accident occurred, but the *Birmingham Post* states that there was a length of 4 ft. of rail which appeared to be considerably worn. Fortunately there were only five passengers in the car at the time, but these and the driver and conductor were all injured. Only the driver was detained at the hospital.

Chile.—Railway Electrification.—A commencement has been made upon the important Chilean electrification project to supply power for the railway between the capital, Santiago, and the port of Valparaiso. The stretch of 190 km. forms the first standard gauge railway in South America to be electrified.—*Reuter's Trade Service.*

Continental.—France.—The Conseil Général of the department of Ile-et-Vilaine has decided to purchase the tramway network of the Société des Tramways Bretons at a cost of 1,400,000 fr., with the view of handing it over to a company for conversion to electrical working, estimated to cost 2,500,000 fr. The tramways serve the towns of Saint Malo, Saint Servan, and Paramé. It is expected that the purchase will be completed by March or April, 1923, and electrification will be started by 1925.

Mexico.—Railway Electrification.—The survey of the section of the Mexican National railway between Monterey and Cerneros, which it is proposed to electrify, has now been completed and the signature of the President of the Republic is all that is needed in order to put the scheme into effect.—*Reuter's Trade Service.*

Newport.—Proposed Light Railway.—The Rural District Council has appointed a sub-committee to meet a committee of the County Council to consider the steps to be taken in connection with the proposed light railway between Newport and Four Ashes.

Pontypridd.—Sunday Cars Proposal Rejected.—The Urban District Council has decided against the running of Sunday tramcars at present, and the offer of the Rhondda Tramways Co. of £240 per annum for a working arrangement has been rejected.

West Hartlepool.—Railless Car Scheme Delayed.—Unexpected difficulties have arisen in connection with the Corporation's railless car scheme for the Foggy Furze route. It was announced at a recent meeting of the Council that the Ministry of Transport could not sanction the borrowing of £9,600 until the Council had obtained powers to carry out the work; also that the Ministry of Health had declined to confer these powers by Provisional Order, and had pointed out that it would be necessary to proceed by Bill. The cost of a Parliamentary Bill, it was stated, would be between

£500 and £600. The chairman of the Tramways Committee said that the machinery had been ordered, and if a special Bill were necessary the scheme would be put back practically for twelve months. It was decided that the Chairman, the Town Clerk, and the local member of Parliament should interview the Ministry of Transport with the object of obtaining powers by Provisional Order rather than by Bill.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Communication Service.—Figures relative to the operations of the Postmaster-General's Department for the year ended 1920-21 show that the total expenditure for all purposes was £8,268,725, against £6,649,432 for the previous year. The total revenue of the department for 1921 was £8,511,494, of which the amount received from the telegraphs was £1,401,606, and telephones £2,450,981. Telegrams despatched numbered 17,196,644 while cablegrams received and despatched totalled 950,670. With regard to the telephone service, there were at June 30th, 1921, 2,553 exchanges in the Commonwealth, to which were connected 240,507 instruments. The revenue earned was £2,450,981, and the expenditure on construction work £1,244,083.—*Industrial Australian and Mining Standard.*

Argentina.—Broadcasting.—The first broadcasting concession granted by the Municipal Government of Buenos Ayres is about to be exploited in Argentina. It has been given to a native engineer, and is confined to the provision of subjects of an educational and recreational nature. In this connection an installation of radio-telephone transmitting apparatus will shortly be required. The concession is in no way a monopoly, the Government reserving to itself the right to grant similar favours to other companies, although not upon quite the same favourable terms as those conceded to the first applicant.—*Reuter's Trade Service.*

Denmark.—Telephone Profits.—Owing to the amount of its profits, the Copenhagen Telephone Co. has decided to grant a bonus of 8 per cent. of the year's subscription to all subscribers who paid their subscription throughout 1922.—*Daily Mail.*

France.—Radio-Communication.—Communication by radio-telegraphy was established on December 6th between France, Algeria, and Tunis, on the one part, and Syria, Palestine, and Egypt, on the other part. The charge per word has been fixed at 1 fr. 30, and urgent telegrams at triple rates. Press messages and telegrams at deferred rates will be accepted.—*Reuter* (Paris).

Direct raido-communication between Bordeaux and Saigon was opened in the beginning of August, the tariff being 2 fr. per word, or less than the charge by cable. French colonies which are now equipped with receiving posts will shortly be fitted with transmitting plant. They are: Martinique, Guinea, and Rufisque (in West Africa), Djiboutil (in East Africa), Brazzaville (in Equatorial Africa), and Antananarivo (Madagascar). It is stated that in 1926, when these works are completed, two new stations will be built in the Pacific, which will complete the chain of stations linking up the 90,000,000 inhabitants of France and her colonies.—*L'Industrie Electrique.*

Japan.—Radio-Telephony.—According to *Commerce Reports*, an application for Government sanction to establish a radio-telephone system has been made by the Daido Electric Power Co. of Nagoya, Japan, which proposes to operate the system primarily for its own convenience in connecting the various stations of its electric power system, but its use may be extended eventually to the general public if sufficient demand should arise. The system will start from Okuwa, in Nagano Prefecture, on the Central Japan Railway line, from which point communication will be established through Nagoya and as far as Osaka, a distance of about 150 miles.

Radio-Telegraphy.—Imperial Chain Stations.—According to the daily Press, Mr. G. Isaacs, managing director of Marconi's Wireless Telegraph Co., Ltd., recently discussed the decision of the Cable and Communications Committee of the Empire Press Union to press the Government for a declaration of policy with regard to Empire radio-telegraphy, and to ask the Postmaster-General to receive a deputation before the end of the year. After pointing out that the Governments concerned had given his company concessions for the erection of radio stations in South Africa, Australia, and Canada, he explained that application had been made to the General Post Office for a licence to erect the necessary stations in this country. Licences had also been promised over two years ago by the late Government for the erection of stations in this country to communicate with foreign countries. Plans are ready, sites have been selected, and the work, upon which the company estimates to spend £2,000,000 sterling, can be put in hand within a few hours of receipt of the Government consent. Mr. Isaacs estimated that from the date of getting the necessary licences the Marconi Co. would complete the Empire chain in eighteen months.

Reception on Moving Vehicles.—The Technical Department of the National Railways of Mexico is engaged upon studies with a view to installing radio telegraphy upon the whole of the trains run by the Government.—*Reuter's Trade Service.*

Radio Telephony.—Travelling to Welwyn Garden City by train from King's Cross on December 7th, Mr. A. O. Joyce, of the British Thomson-Houston Co., listened-in for half an hour to the news broadcast from Marconi House. His receiving set measured only 12 in. square by 4 in. deep.—*Daily Mail.*

Russia.—Broadcasting.—Reuter's Agency learns that among the latest batch of telegrams received by the Russian Trade Delegation from Moscow is the following: "The systematic broadcasting of concerts, speeches, and lectures is being organised. A concert will be broadcast daily."

Indo-European Service.—The Indo-European Telegraph Co. has completed the repairs of the wires from Odessa to the Polish frontier, and a direct telegraph service between England and Odessa *via* Berlin and Warsaw is shortly to be established.—*The Times.*

South Africa.—New Radio Station.—Mr. McLellan, of the Marconi Co., has been charged with the construction of the new station, which will give a direct service to practically every country in the world. Work will start immediately the agreement has been ratified by Parliament, and it is expected that it will be completed in eighteen months' time. As far as possible the material will be purchased in South Africa.—*Reuter.*

The Telephone Service.—New Exchange.—A new telephone exchange has been opened at the Udny Post Office, and forms one of the links in the interconnection of rural districts in Scotland.

Uruguay.—Telephone Service.—The Montevideo Telephone Co. ("La Uruguaya"), acting under instructions received from its board of directors in London, will shortly bring an action before the Courts against the Uruguayan Government for having obliged it to increase the salaries of its personnel. The company likewise is said to have received instructions as to the attitude it has to adopt in the event of the Montevideo Post Office Department deciding not to proceed with the negotiations it entered into some time ago for the acquisition of the company's property.—*Review of the River Plate.*

Radio-Legislation.—Recent modifications of the rigid laws governing the installation of radio-telephone and telegraph stations have made broadcasting possible. Applications are pending which, if granted, should mean the opening of a splendid market for radio-telephone receiving apparatus in Uruguay.—*Commerce Reports.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Atherton.—December 20th. Urban District Council. Two 30-kVA, single-phase transformers and one 150-kVA ditto. (December 1st.)

Australia.—Melbourne.—January 24th. Tramways Board. 1,650 steel poles, either solid or in three sections.

March 7th. Electricity Commissioners. Ash and dust extraction plant. (See this issue.)

January 24th. Victorian Railway Department. Insulated copper wire.*

January 31st. Three-phase a.c. motors, starting apparatus, and accessories for the Newport workshops (17 enclosed squirrel-cage motor sets, 2 h.p. to 20 h.p., two enclosed slip-ring motor sets, 25 h.p. to 30 h.p.).—*Reuter's Trade Service* (Melbourne).

Sydney.—January 31st. New South Wales Railways Department. Four 1,000-kW rotary converter sets.

Newcastle (N.S.W.).—January 11th. Town Council. 750-kVA or, alternatively, one 1,000-kVA transformer voltage regulator.—*Reuter's Trade Service* (Melbourne).

Basford (Nottingham).—January 1st. Board of Guardians. Economiser. (See this issue.)

Belgium.—January 6th. Municipal authorities of Saint Gilles-lez-Bruxelles. 800-kW motor-generator; h.p. asynchronous motor, and d.c. generator. Service de l'Electricité, 40, Rue de Bethléem, Brussels.

Birmingham.—January 27th. Salvage and Stables Committee. Plant for the refuse destructor and salvage works.—One 3-wire balancer set and switchgear for lighting purposes; two 110-kW steam-driven generator sets, with switchgear and condenser; one 5-wire balancer set, with switchgear and charging panels, for electric vehicle charging; paper press; scrap-iron press; hydraulic accumulator and pumps. (See this issue.)

Bolton-upon-Dearne.—December 21st. Dearne District Light Railways Committee. Construction and equipment of the Dearne District Light Railways.—Rails and fishplates; points and crossings; permanent way road widening, and bridge works; overhead line equipment; feeder cables; sub-station plant; rolling stock; buildings. (December 1st.)

Cheadle and Gatley.—January 1st. Urban District Council. Sub-station switchgear and static transformer. (See this issue.)

Dublin.—December 18th. Dublin United Tramways Co. (1896), Ltd. Stores for six months. (December 8th.)

Dundee. — December 22nd. Electricity Department. Supply of .5 sq. in. and .2 sq. in. l.p. single lead-sheathed cable, also a quantity 2½ in. x 2 in. x 2½ in. fir-base troughing. (See this issue.)

France.—Paris.—January 3rd. Multiple town switchboard. Direction de l'Exploitation Téléphonique, 4, Bureau, 103, Rue de Grenelle, Paris.

Huddersfield.—December 18th. Board of Guardians. Electrification of laundry, Crosland Moor Institution. T. W. Armitage, clerk to the Guardians, Union Offices, Ramsden Street, Huddersfield.

India.—Madras.—January 18th. Corporation. Eight 30-kVA, 3-phase transformers; h.p. switchgear; 15,000-V testing set; 700 30-ft. steel tubular poles; 10 tons h.d. copper wire, No. 8 gauge; 6 tons g.i. wire, No. 8 gauge; switchboard instruments. Specifications, &c., Revenue Officer, Corporation of Madras (Rs.1 per set).—*Reuter's Trade Service* (Calcutta).

Manchester.—January 1st, 1923. Rivers Committee. Conversion of Davyhulme sewage works, Urmston, from steam to electric drive. Secretary, Rivers Department, Town Hall, Manchester.

New Zealand.—Wellington.—January 30th. Posts and Telegraph Department. 2,000 g.i. earth-rods, 5 ft. x ½ in.*

Nuneaton.—December 20th. Electricity Department. One balancer, complete with switchboard panels and accessories. (December 8th.)

South Africa.—Brandfort, O.F.S.—January 30th. Municipal Council. Water-tube steam boilers, steam engines and alternators, switchboard, boiler and engine-house auxiliaries, steel poles and overhead conductors (erected), transformers, house services and meters. Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.—*Reuter's Trade Service.*

Torquay.—December 18th. Electricity Committee. Two 400-kW rotary converters and one 300-kW rotary converter, complete with transformers, switchgear, and accessories. (December 1st.)

Uruguay.—Montevideo.—January 16th. State Electricity Works. 45,000 metres v.i.r. cable.*

December 29th.—L.p. armoured cable, telephone cable and accessories.*

Warrington.—December 19th. Board of Guardians. Supply of electrical goods for three months for Warrington Union. Mr. A. Bottomley, clerk to the Guardians, Bewsey Chambers, Warrington.

Wolverhampton.—January 17th. Electrical Engineer's Department. One 5,000-kW turbo-alternator, condenser and auxiliaries. (See this issue.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Aberdeen.—Corporation. The Electricity Committee recently invited offers for a 10,000-kW turbo-alternator, with condenser and pumps. Nine complete tenders were received—three for the turbine and alternator—and seven tenders for the condenser and pumps only. Three Swiss firms sent in offers. The highest offer (all British) for the combined set amounted to £46,500; and the lowest (all Swiss) £30,340. The lowest satisfactory combination of plant (all British) amounted to £31,[illegible]. It was stated that the main difference in price was in the steam turbine portion of the set, British offers, where they were disclosed, ranging from £21,000 to £17,500. [illegible] steam turbine of well known make, and one [illegible] to British, was offered at £15,[illegible].

Reporting on the tenders, the Corporation electrical engineer stated that if the Committee decided to place part of the order in Switzerland [illegible] a sum of at least £5,250, the most satisfactory [illegible] would be as follows:—

[illegible]
[illegible] £[illegible]
[illegible] £[illegible]
[illegible] £

THE ASSOCIATION OF CONSULTING ENGINEERS AND ITS CHAIRMAN.

Mr. A. M. Sillar, M.Inst.C.E., M.I.Mech.E., M.I.E.E., who presided at the annual dinner of the Association of Consulting Engineers, is the second electrical chairman that this organisation has had since its incorporation in the year 1913. The first electrical engineer selected for the position was Mr. Frank Gill, the present president of the Institution of Electrical Engineers, who held the office when he was a member of the firm of Gill & Cook, consulting engineers.

The chairmanship of the Association of Consulting Engineers is one carrying no small distinction, as may be understood from the fact that members of such very old-established consulting engineering firms as T. & C. Hawksley, Alexander Binnie, Son & Deacon, James Mansergh & Son, John Taylor & Sons, and Henry Rofe and Son have served on the Committee.

It is an office of electrical distinction, too, if only by reason of the fact that electrical matters occupy a considerable portion of the time of the Committee. Among other subjects dealt with during the present year has been the compilation and issue of a standard set of Conditions of Contract for use by members in connection with mechanical and electrical engineering contracts, and a similar set of conditions for export work is now practically completed. The Association has also been represented on various Committees convened by the Institution of Electrical Engineers, and on committees of the British Engineering Standards Association.

As the official representative of the consulting branch of the engineering profession, the Association is constantly in touch with Government Departments and with representative associations of manufacturers and contractors on matters affecting consulting engineers or their clients.



Mr. A. M. Sillar,
Chairman of the Association of Consulting Engineers.

The main aims and objects of the organisation include the association together for mutual co-operation and protection of those engineers whose work is of a purely consultative character, and members are bound by a set of rules set forth in the little grey official booklet wherein a consulting engineer is defined and his qualifications for membership are set forth. This little booklet contains a list of members, and deals, among other things, with the relations between client and consulting engineers, fees, and so on.

It will be remembered that the Association was formed in 1910, with Mr. A. H. Dykes as honorary secretary; that post he still retains, and it is to his untiring efforts that the Association mainly owes the prosperity and prestige which it has acquired.

Mr. Arthur Molyneux Sillar, whose election as Chairman took place in May last, has had a very prolonged and varied experience of electrical engineering work, as we show later in this article. He started his engineering career in the works of the "Jablochkoff" Co. in 1882, and was engaged on the Thames Embankment lighting and also in one of London's first electricity supply stations situated in Belvedere Road, Lambeth, from which, by means of cables across Waterloo Bridge, was effected the lighting of Covent Garden Theatre, the Gaiety Restaurant, and a number of buildings in the Strand. He remained with this company and its successors for 12 years, first as assistant and subsequently as chief engineer, afterwards entering into partnership with the late Mr. R. F. Venner.

In 1896 Mr. Sillar commenced practice as a consulting engineer, the firm being Lacey, Clirehugh & Sillar, and later Lacey, Sillar & Leigh, and since 1913 he has practised alone.

Amongst other schemes for local authorities and companies with which he has been connected are the original power generation and distribution systems, tramways or light railways, for the towns of Batley, Blackburn, Bournemouth, Bury, Colchester, Middleton, Ratcliffe, Rawtenstall, Rochdale, and Swindon, as well as the Corporations of Belfast and Salford, the Lancashire Power Co., the Trafford Power Co., and the London & North-Western Railway Co. He is also acting as consulting engineer to the Post Office for the equipment of its tube railway, and to a number of other electricity supply undertakings both in this country and in the Far East.

The members of the Association over which he presides comprise, of course, engineers practising in all the various branches of engineering — aeronautical, roads, bridges, docks and harbours, water supply, town sanitation, engineering chemistry, gas production, mechanical engineering, mining and metallurgy—in addition to electrical engineering.

It should be a source of satisfaction to electrical people to see that an Association which, as we have mentioned, comprises representatives of very old-established firms who have for several generations specialised in civil engineering works, has chosen as its chairman a representative of one of the younger branches of the engineering profession, for it is in some measure an indication of the position now held by electrical engineering.

On Wednesday last week the annual dinner of the Association of Consulting Engineers (Incorporated) was held at St. Stephen's Club; the chairman, Mr. A. M. Sillar, presided, and there were present over 100 members and guests, including Lord Queenborough, Sir Tom Callender, Col. T. C. Ekin, Mr. Frank Gill (President I.E.E.), Dr. Hele-Shaw (Pres. I.Mech.E.), Mr. W. W. Lackie (Electricity Commissioner), Sir Lynden Macassey, Mr. Justice McCardie, Rear-Admiral Monro, Brig.-General Magnus Mowat, Sir Evelyn Murray, Mr. A. C. Peake (Pres. Law Society), Sir Wilfrid Stokes, Sir John E. Thornycroft, and Sir Ellis Griffith.

After the toast of "The King," Mr. Frank Gill proposed "The Association of Consulting Engineers."

defining a consulting engineer as a man who gave unbiased advice and was free from business ties. Mr. A. M. Sillar, chairman, in responding, paid tribute to the labours of the honorary officers (Messrs. A. H. Dykes, secretary, S. R. Lowcock, treasurer, Cash, auditor, and F. E. Wright, solicitor), by which the Association had been brought to its present high position.

Mr. A. H. Preece proposed "Engineering Industries," laying stress on the importance of the personal element in engineering contracts, and the necessity of "playing the game." Sir Tom Callender responded, remarking that business was improving every day, though but slowly, and that the world-wide scope of engineering ensured it a great future both at home and abroad.

Mr. J. M. Mo[illegible]sed "Bench and Bar," with the members of which their relations were so cordial, and Mr. Justice McCardie replied with a humorous speech, while Mr. G. M. Freeman, also responding, lamented the days when hundreds of Bills were brought before Parliament in a single session, and the olive branch was less prevalent.

Mr. S. R. Lowcock proposed "Our Guests," who, he said, were in the majority; remarking that there were few engineers in Parliament, he said that if politicians paid as much attention to the laws of economics as engineers did to the laws of nature, the country would be much better off. Sir Evelyn Murray and Mr. E. Honoratus Lloyd responded, after which Sir Wilfrid Stokes proposed "The Chairman," and Mr. Sillar briefly responded.

THE LIVERPOOL ELECTRICITY AND TRAMWAY UNDERTAKINGS.

RECENT DEVELOPMENTS: AUTOMATIC SUB-STATIONS.

The Corporation of Liverpool purchased the business of the Liverpool Electric Supply Co. in 1896, and that of the Liverpool United Tramways and Omnibus Co. in 1897. Energy was furnished by four generating stations, equipped with Lancashire boilers and d.c. dynamos, coupled to Willans high-speed engines, the total capacity of the plant being about 3,000 kW.

The building of two new stations was commenced in 1899 and 1900. Gradually all the older stations were converted into sub-stations, and a new station, Lister Drive No. 2, was commenced in 1904, and was equipped with four 2,000-kW British Westinghouse horizontal turbo-alternators, and six 2,000-kW Curtis-British Thomson-Houston vertical turbo-alternators. The total output of this station when completed was 20,000 kW.

In 1911 it was decided to replace the whole of the original plant in the No. 1 station, and the plant now comprises one 10,000-kW British Westinghouse turbo-alternator, two 6,000 kW, fig. 1, and two 3,500-kW British Thomson-Houston turbo-alternators and two 2,000-kW British Westinghouse d.c. turbo-generators,

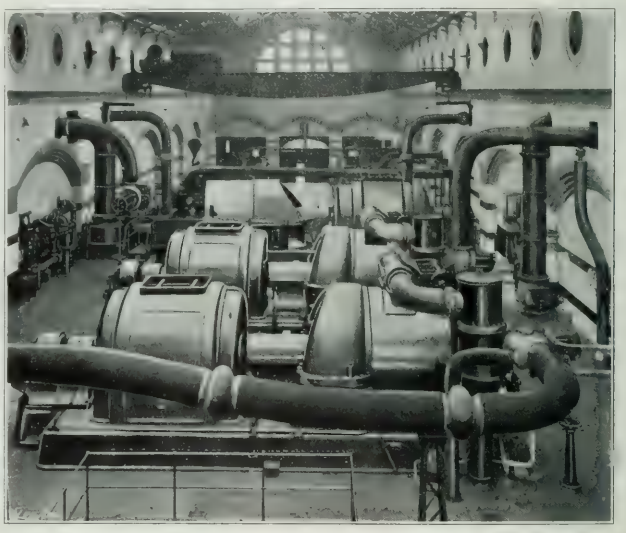


Fig. 1.—Engine Room No. 1.



Fig. 2.—[illegible] No. 1 Station.

the total output having been raised from 8,400 to 33,000 kW.

The No. 1 station boiler house, fig. 2, contains 24 Babcock & Wilcox 25,000-lb. boilers, each having a heating surface of 6,182 sq. ft., a pressure of 200 lb. per sq. in., chain-grate stokers, a superheat of 200 deg. F., and a Green economiser containing 192 tubes.

In 1919 it was found necessary to reconstruct the plant in the No. 2 station, and the four 2,000-kW British Westinghouse sets were replaced by two 12,500-kW Metropolitan-Vickers turbo-alternators, fig. 4, running at 3,000 r.p.m. with 25 per cent. overload capacity for two hours on a 0.8 power factor.

On December 14th one of the new 12,500-kW turbo-generators was officially set to work and, with the exception of a similar set previously installed in Liverpool, we believe this to be the largest turbo-generator set yet designed to run at 3,000 r.p.m.

The turbine is materially smaller than the generator. It is mounted directly over its condenser, which will deal with 162,000 lb. of steam per hour and maintain a vacuum of 27½ in. when supplied with cooling water at 84 deg. F., and the circulating water is supplied by a 24 [illegible] centrifugal pump driven by one of two 500-h.p. electric motors, the other being a stand-by. The cool-

ing surface is 23,500 sq. ft. 26-in. centrifugal pumps extract the condensate, and they are driven by electric motors of 30 b.h.p. running at 1,440 r.p.m. The air extraction is effected by ejectors.

The generator supplies 3-phase energy at a periodicity of 50 cycles and a voltage of 6,600. The temperature rise under full-load conditions is 40 deg. C., and with a 25 per cent. overload its efficiency is 95 per cent.; at full load, 94.5 per cent.; at three-quarter load, 94 per cent.; at half load, 90 per cent.; and at quarter load, 81.5 per cent. The machine is cooled by a flow of 50,000 cu. ft. of air per minute, which is passed through a water cooler to ensure that its temperature on reaching the alternator does not exceed 80 deg. F.



Fig. 3.—Walton Automatic Sub-station.

The turbine consists of one compounded velocity stage followed by ten Rateau stages and then by a multi-stage exhaust which is one of the novelties of the design. All stages have a mean diameter of 42 in., and with the usual type of design this would provide a "leaving" area of some 16 sq. ft., but by means of the multi-stage exhaust an effective "leaving" area of over 23 ft. is provided, so that the "throw away" loss to the condenser is said to be as small as if the exhaust end were on the double-flow principle.

The rotor embodies some unusual mechanical features. At the exhaust end the wheels are not much larger than the rotor shaft, and are made in halves and security against considerable centrifugal force is obtained by meshing collars turned on the wheels, and similar collars turned on the shaft; the whole being riveted together.

A 460-volt battery capable of giving a discharge of 1,000 amps. for one hour is available to be used in cases of emergency for auxiliary plant and station lighting.

The total output of this station, after alterations, is 37,000 kW, and the combined output of Nos. 1 and 2 stations after reconstruction is 70,000 kW in place of the original combined capacity of 28,100 kW.

The control board is situated in No. 2 station for the

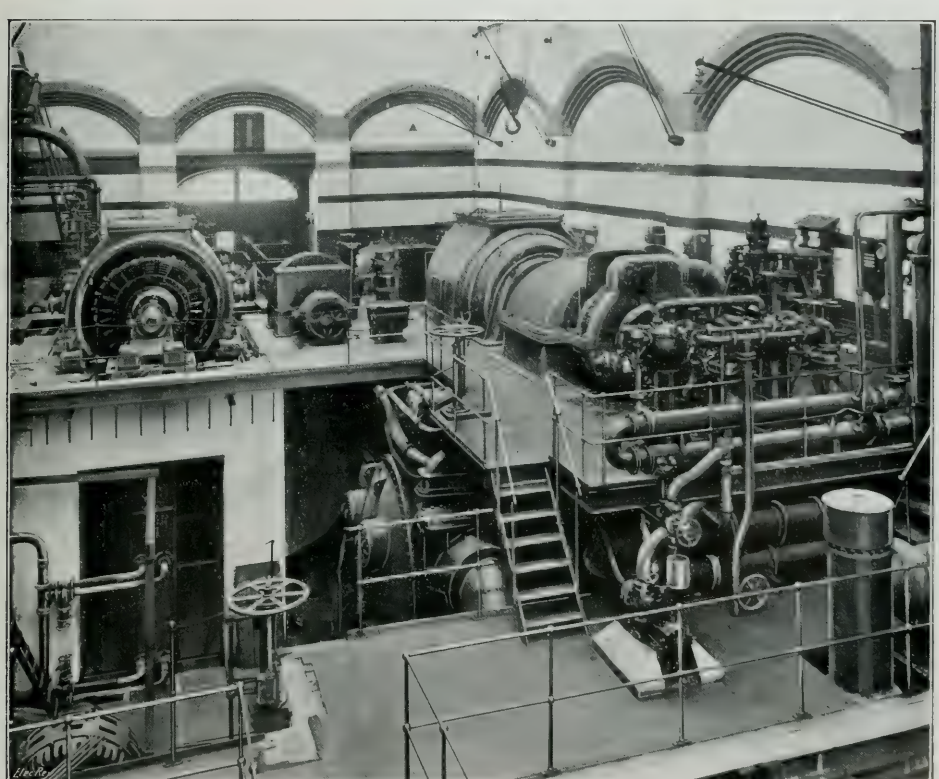


Fig. 4.—Engine Room No. 2.

whole of the h.p. plant. For the control of the two 12,500-kW turbo-alternators and works transformers a new switch room has been built on the roof of the station.

The outgoing feeders number 29, and each leads to a sub-station. Three-phase h.p. distributing mains are

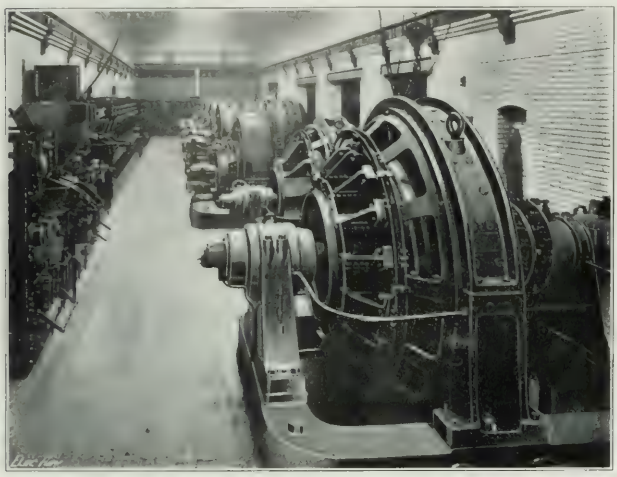


Fig. 5.—Paradise Street Sub-station.

run in multiple to 17 converting stations, figs. 3, 5, and 7, the plant in which may be summarised as follows:—

	kW
6 100-kW motor generators	600
33 200-kW	6,600
31 500-kW	15,500
14 1,500-kW rotary converters	21,000
2 500-kW	1,000
1 300-kW mercury rectifier	300
Total	45,000

This converting plant is supplied from the 6,000-volt 3-phase, 50-period a.c. system and delivers d.c. at from 460 to 550 volts pressure for lighting and power, or high-speed direct-coupled type has been erected, and d.c. is generated and fed into the l.p. network.

Automatic rotary-converter sub-stations, connecting to the lighting network, have been installed, one of which was also officially opened on December 14th—a fact of particular interest as being the first installation of its kind in this country. Similar sub-stations are in successful operation in the U.S.A., and it is claimed that they have proved to be more reliable than manually-operated sub-stations, and that the equipment is compact and economical.

The sub-station situated at the Walton Town Hall, fig. 3, is at the centre of the d.c. distribution network, and contains one 500-kW rotary converter, but space has been left for a second set when required. All the control apparatus is mounted on five panels; they are:—(*a*) The a.c. starting and running panel; (*b*) the relay and meter panel; (*c*) the d.c. contactor panel; and (*d*) two d.c. feeder panels.

The main a.c. h.p. breaker is mounted in a cell structure; it is electrically operated and functions automatically as a part of the automatic equipment. The converter is protected from overspeed by a device mounted on one end of the armature shaft. A motor-operated device mounted on the bedplate of the converter lifts the brushes off the commutator during the starting of the converter, and the bearings of the machine are protected from overheating by means of bearing thermostats.

The a.c. relays and contactors are operated from a small station transformer, the primary of which is connected on the line side of the oil circuit breaker. The d.c. contactors are operated from the d.c. voltage of the converter and the d.c. feeder contactors, normally closed at all times, are energised from the lighting circuits.

The following features of the equipment are worthy



Fig. 6.—Loops at Pier Head Tramway Terminus.

tramway purposes. In addition, there are 47 static transforming stations under the control of the Electricity Department (equipped with transformers of 35,550 kVA aggregate capacity, 6,000 volts to 400 and 230 volts) and 14 stations not under the Electricity Department's control (equipped with consumers' own transformers of 16,080 kVA aggregate capacity). The following special consumers are supplied in bulk:—The Mersey Docks and Harbour Board; Bootle Corporation Electricity Undertaking; and the British Insulated & Helsby Cables, Ltd.

To utilise the [illegible] the five Corporation refuse destructors, steam-driven generating plant of the

of note:—(1) It is purely automatic. (2) It does not need any pilot wires for distant control. (3) It is started up when the demand for d.c. power justifies the machine operating; this is effected by the d.c. voltage of the network falling to a predetermined value. The station is shut down when the demand on the system is such that the output of the machine drops to a predetermined value, but a time delay relay prevents the station shutting down until a pre-arranged period after the load has dropped to the correct value; this prevents the shutting down of the machine on a momentary reduction of load.

The machine is started by means of a series of low-voltage relays; if the network voltage falls below a predetermined figure a connection is made through a time-limiting device, which delays the action of the master relay for a certain period. This is necessary to prevent temporary drops in pressure starting the gear. The master relay then puts into operation relays controlling the following sequence:—(*a*) Lifts the brushes off the commutator; (*b*) closes h.p. switch which puts pressure on to the rotary transformer; (*c*) closes l.p., a.c., contactors on half voltage of transformer; (*d*) rotary runs up to speed; (*e*) polarity of d.c. is checked; if correct, sequence carries on; if not, polarity is corrected by field-reversing relay; (*f*) closes l.p., a.c., contactors on to full pressure of transformers; (*g*) lowers the brushes on to commutator; (*h*) d.c. contactors make circuit to d.c. bus-bars through resistances which limit the current that can pass; if this current is not excessive, contactors cut out limiting resistances and put rotary directly on to the bars; (*k*) d.c. contactors on feeders close.

Should the various relays installed for taking care of overloads on the d.c. feeders, excessive loads on the rotary, &c., or thermostats in the bearings operate, the plant is shut down and all the automatic gear locked out, so that an inspector must ascertain the trouble and reset the relay before the plant can again operate.

To shut down the plant automatically there is an underload relay, which operates if the outgoing current falls to a predetermined minimum and remains there for a given period, which is adjustable between about three and twenty minutes.

The whole of the automatic equipment has been supplied by the Metropolitan-Vickers Electrical Co., Ltd.

The underground distributing mains are, for the most part, laid according to the Callender solid system. The joint boxes fixed beneath the pavement are filled with heavy insulating oil.

The amount of energy sold during 1921 was 88,188,415 kWh, of which 26,413,265 kWh was for traction purposes.

The capital expenditure of the undertaking up to December 31st, 1921, was £3,092,134, and the total income for 1921 was £995,988. The total connections to the supply mains, excluding the tramways, are equivalent to 81,382 kW, the h.p. of motors connected being 66,674, and the number of consumers 23,202.

The Corporation took over the horse system from the Liverpool United Tramways and Omnibus Co. in 1897. The first section of the overhead trolley electric system was opened in November, 1898, and consisted of about 6½ miles double, and 9½ miles single track. The majority of the routes radiate in fan-like formation from the Pier Head, fig. 6. The record number of passengers carried in any one year is 220,219,091. The standard electric cars are fitted with two 40-h.p. motors, and the latest type with roller bearings. The tramcars are built and maintained at the Lambeth Road works, and new works are to be erected at Edge Lane.

Where the width of the roadway allows, the track is laid on sleepers in the centre of the roadway, and no other traffic is allowed to use this portion of the road. At the dead-end termini the trolleys are reversed without leaving the wires.

Since the inauguration of the undertaking, £1,016,662 has been paid in rates and taxes, whilst £1,062,899 has been contributed towards the relief of the city rates.

Fig. 7 is a plan showing the tramway and motor-omnibus routes, together with the positions of electricity stations, tramway depôts, &c. In conclusion, we have to express our indebtedness to Mr. H. Dickinson, M.I.E.E., &c., city electrical engineer, for providing the details and photographs reproduced above.



Fig. 7.—Map of Generating and Sub-stations, Tramway Routes, &c.

New Stobie Steel Furnaces.—An interesting new steel-making process has been put into successful operation at the works of Messrs. Edgar Allen & Co., Ltd., Sheffield, which promises a great revolution in electric steel-melting in the near future. The Stobie Steel Co. has installed in those works one 10-ton and one 3½-ton Stobie electric steel-melting furnaces, which are being worked together as a single unit under the Stobie patent duplex electric process. By this means, scrap steel is electrically melted and refined by oxidation in a continuous manner in the large primary furnace, and a third or more of the molten bath is transferred down a shoot at short intervals to the small secondary furnace for finishing. The advantages of the process are both electrical and metallurgical: Electrically, the load factor is greatly increased by the continuous working, and the power factor is much improved by the maintenance of, mainly, molten baths. Fluctuations of current are also less marked and of shorter duration. Metallurgically, the main advantage is the frequent supplies of small quantities of steel, of varying compositions if required, at the low cost of operating plant of large output. For ingots or foundry work this advance in practice is of considerable interest. Additional advantages of the new process over an installation of several furnaces working independently include the smaller space occupied by the plant; the reduced crane service required; the much reduced repairs to furnace linings for a given output of steel, and the freer choice of scrap for melting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week, we need the names of manufacturers or suppliers of :—

"CANADIAN" grinder for use in the tool-post of a lathe.
GOULD'S patent hingebelt fastener.
SIMPLICITAS switch.
"INVENTA" fire.
"JEFFARD" or "GEFFARD" lighting set.

FORTHCOMING EVENTS.

Institution of Electrical Engineers.—Informal meeting Monday, December 18th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Time Switches," to be opened by Mr. E. E. Sharp.

(Sheffield and District Sub-Centre).—Wednesday, December 20th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "The Possibilities of Transmission by Underground Cables at 100,000-150,000 V.," by Mr. A. M. Taylor.

Institution of Civil Engineers.—Tuesday, December 19th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "Extensions at Hilary Dock, 1912-17," by Mr. F. M. G. Du-Plat Taylor.

Saturday, December 16th. Students' visit to the Greenwich power station of the L.C.C. Tramways.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, December 19th. At Ruskine Hall, Glasgow. At 7.30 p.m. Ordinary meeting.

Chemical Society.—Thursday, December 21st. At Burlington House, W. At 8 p.m. Ordinary meeting.

Batti-Wallahs' Society.—Friday, December 22nd. At the Engineers' Club, W. At 8 p.m. Christmas smoking concert and re-union.

Edinburgh Electrical Society.—Friday, December 22nd. At the Philosophical Institute. At 8 p.m. Paper on "Common Telephone Faults," by Mr. G. E. Mackintosh.

Junior Institution of Engineers.—Friday, December 22nd. At 39, Victoria Street, S.W. At 7.30 p.m. Social evening.

NOTES.

Batti-Wallahs' Society.—The Society is giving a Christmas smoking concert and re-union at the Engineers' Club on Friday, December 22nd, at 8 p.m. Tickets, 2s. 6d. each, can be obtained from the hon. secretary, Mr. M. Whitgift, 34, Broadway, S.W.1.

Therm Inquiry.—The official inquiry that is being held at the request of the London County Council by the Board of Trade into the system of charging for gas by the therm instead of by volume, commenced at the Institution of Civil Engineers on December 12th, under the chairmanship of Sir Clarendon G. Hyde.

Appointment Vacant.—Sub-station engineer attendant, for the Hackney Borough Council electricity department. (See our advertisement pages to-day.)

Birmingham Electric Club.—Mr. C. G. A. Macdonald was on Saturday night last, appointed president of the club. The other officers elected were: vice-presidents, Messrs. F. Brown and P. Shaw; treasurer, Mr. A. Cunningworth; and secretary, Mr. T. Birkett. It was reported that the progress of the club had been well maintained during the year, and that there was in hand a satisfactory balance.

The British Empire Exhibition Inquiry.—Sir William Joynson-Hicks, Bart., M.P., who is making an inquiry on behalf of His Majesty's Government into certain aspects of the British Empire Exhibition, held a meeting on Tuesday, at the Board of Trade, with representatives of the Executive Council, the Management Committee, and the general management of the Exhibition, together with the High Commissioners for the Dominions and India. At this meeting, plans were made as to the procedure to be adopted in connection with the inquiry, which will now proceed immediately. The terms of reference governing the inquiry are as follows :—

To inquire into the following questions in connection with the British Empire Exhibition :—

(1) What steps are being taken to provide for full consultation with representatives of the Dominions and the Colonies in order to secure the use of Imperial produce in connection with the exhibition.
(2) The granting of concessions for entertainments and amusements.
(3) The criticisms of certain members of the Publicity Committee as to the limited opportunities afforded to that Committee to assist in the publicity work of the exhibition;

and to report thereon to the Colonial Office, the India Office, and the Board of Trade and to the Executive Council, and also in this connection to consider and recommend whether any further steps can usefully be taken to strengthen the control of the Executive Council over the general conduct and administration of the exhibition. Sir William Joynson-Hicks will be prepared to receive communications from any organisations or individuals who may desire to give evidence. Mr. R. W. Dalton, His Majesty's Trade Commissioner in New Zealand, who, as already stated in the REVIEW, is now in this country and will shortly proceed to Canada as His Majesty's Senior Trade Commissioner, will act as secretary, and communications in connection with the inquiry should be addressed to him at the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Mr. John F. P. Rawlinson, K.C., M.P., has agreed to advise Sir William Joynson-Hicks with regard to any legal questions which may arise out of the investigation.

Accident.—Whilst engaged in work on an electric feeder at North Brook Works, Keighley, on December 10th, Ralph Inman, an employé of the Corporation Electricity Department, received a shock and was rendered unconscious. The line on which he had been working all the morning had been "dead," but by some means still to be explained it became "alive" unexpectedly. Inman's hands and feet were badly burned, but at the hospital he regained consciousness.

The Electricity Supply Act, 1922 (South Africa).—At the recent Conference of Municipal Electrical Engineers (South Africa) Mr. T. C. Wolley Dod (City Electrical Engineer, Pretoria) read a paper and led the discussion on "The Electricity Act, 1922, Union of South Africa." The paper was not an exhaustive review of the Act, which now took precedence of the Provincial Laws and Ordinances, except where these were not over-ruled. After pointing out that the Act established two distinct bodies, which were responsible for its administration—an Electricity Supply Commission and a Board of Control—the author contended that in practice it would be found that the Commission had actually a monopoly with regard to new power stations. As far as practicable it must carry on at neither a profit nor a loss, and it was laid down in the Act that if there was either a surplus or a deficit on any year's working, allowance should be made in adjusting the charges for electricity to be supplied the following year. The author said: "It is futile to compare the Act under discussion, with the Electricity (Supply) Act in England. In the Union of South Africa there is so small a past and so great a future that we may say that it is the future and not the past that has to be dealt with. With one exception there is no power station of any importance selling electrical energy in the Union of South Africa except the municipalities.

"The main object of the Act is to ensure that the future supply will be developed in the general interest of the community, rather than to meet the expediency of the moment for one section of the community, and I submit that the Act substantially ensures this. The Commission will be in a position to raise capital at rates of interest below those that would be expected on the capital of the less-favoured private undertaker. The Commission is not a Government department, bound by Civil Service rules and red tape, but is in an equally favourable position with the private undertaker with regard to freedom of employment.

"Although the Commission has a practical monopoly of the future large generating stations in the Union it will be difficult for it to abuse that monopoly. Clause 49, which had frightened many people, stated: 'It shall not be necessary for the plaintiff to prove that the damage or injury was caused by the negligence of the defendant,' and 'damages may be recovered notwithstanding the absence of such proof.'

"At first sight," he said, "this looks very drastic, but if we are careful not to read into this clause more than it states, and if we realise that the defendant still maintains all rights that he is not specifically deprived of, we must realise that it is competent for the defendant to plead that he was not negligent. The clause only shifts the onus from the plaintiff to the defendant."

Mr. W. C. Gardener, ex-Mayor of Cape Town, who had taken a prominent part in connection with the Act, was glad to hear Mr. Dod's observations regarding Clause 49, as that was a matter which had caused some anxiety. They had all, more or less, got the idea that, according to the terms of the clause, it was not necessary for a plaintiff to prove anything in order to succeed. In the light of Mr. Dod's remarks, he thought the clause was satisfactory.—*Cape Times.*

The Electrical Trades Benevolent Institution.—Mr. F. B. O. Hawes, hon. secretary of the E.T.B.I., informs us that the Institution, prior to the last annual festival, had an invested fund of £18,717; in connection with the annual festival the sum of £831 was collected. Adding the available uninvested income in hand to this sum, the amount which can be invested before the end of the year is £1,100, which will bring the invested funds up to £19,817. "We felt confident," says Mr. Hawes, "that we should this year attain the milestone of £20,000, but as it will be seen from the above, we still need just under £200 to get to this point. I have had a promise from six gentlemen that if I can obtain this sum before the end of the year they will each contribute towards it the sum of £5. May I appeal to your readers to assist me to secure this gift by helping to make up this comparatively small amount now required?

"Should any of your readers hold the view, which I have heard expressed, that this Institution is building up an unnecessarily large invested fund, may I cite as an example another benevolent institution, which has existed for nearly sixty years, and gives help to persons in a somewhat similar walk of life to those whom we exist to help. That institution possesses invested funds exceeding £100,000, and yet the demand on its funds in the year 1921 exceeded the total

income. I have no doubt that when this Institution reaches the same age the demands for assistance will be greater than those on the fund to which I have just referred."

We cordially commend this most worthy Institution to the attention of our readers, for there is no question but that the fund is far too small to fulfil the objects for which it was established.

Aire and Calder Electricity District.—Sir John Snell (chairman) and Mr. Archibald Page (of the Electricity Commission) attended a conference at Bradford Town Hall on Friday last, of representatives of the municipal authorities in the Aire and Calder Electricity District, to consider proposals in connection with the matter of co-ordination and development of electricity supplies in those portions of the West Rding of Yorkshire covered by the inquiry held at Leeds in May, 1921. The chair was occupied at the meeting by Alderman Wilfred Turner, Deputy Lord Mayor of Bradford and Chairman of the Bradford Electricity Committee. As a result of the consultations, it is stated, the Commissioners hope to secure a basis common to all parties concerned. The conference was adjourned. Negotiations are to be resumed at an early date not yet fixed. For the Aire and Calder District, it will be remembered, there were submitted at the Leeds inquiry last year three alternative schemes by a consnsus of local authorities, led by Bradford Corporation, and known as the Conference Scheme; by Leeds Corporation; and by the Yorkshire Electric Power Co.

Electric Heating in South Africa.—At the recent Conference of Municipal Electrical Engineers (South Africa) an interesting paper on "Supply of Current for Electric Heating from Central Stations" was read by Mr. John Roberts, Borough Electrical Engineer of Durban, and member of the Council of the Association. The lecturer reviewed the present position of electrical development in South Africa, and gave convincing reasons why electric heating should be used extensively, pointing out its general advantages. Mr. Roberts contended that the supply of electricity for domestic purposes, including heating, to every consumer, was a practical proposition. There was a disposition among certain electricity supply engineers, he said, to discourage attempts to give electrical service in the home, and it was feared that the electricity needed could not be supplied at rates low enough to encourage people to adopt electric stoves.

Mr. Roberts demonstrated that electricity could be supplied to compete with any other form of heating, including gas. The efficiency of gas and electric heating on a calorific basis was compared, and the cost of the necessary electrical plant to supply every domestic consumer with heat was gone into. The lecturer worked out the cost of distribution for the case of an actual Durban residential area of about 63 acres, comprising 234 consumers. The maximum demand and consumption were calculated from recording ammeter charts of twelve firemen's quarters, in which electric cooking had been exclusively used for some years, and the system of transmitting and distributing the heavy load demanded was fully described. The cost, including capital charges, of supplying 15,000 consumers with electric heat was then determined, together with the revenue derived at present rates in Durban. The capital cost was found to be £1,080,000. Revenue was estimated at £237,800; cost of production, £215,700; and profit, £22,000. A number of charts taken from a recording ammeter of actual consumption were shown, also charts showing the system of transmission and distribution, as well as photographs of various forms of sub-stations.

Mr. J. M. Clark, of Johannesburg, stated that there was a great deal of domestic stupidity in connection with the use of electricity, greater than in the case of gas, and in this respect the work of the electrical engineer was to some extent handicapped.

Mr. F. T. Stokes, Chief Assistant Engineer, Electricity Supply Department, Johannesburg, stated that in Johannesburg they had 26,000 electricity and 600 gas consumers, but notwithstanding this statistical disparity, the town was proposing to spend £750,000 on new gasworks.—*Cape Times.*

Educational.—Royal Technical College, Glasgow.—The annual report, covering the 126th session, has been published. It is stated that the record of the year is again one of pressure and difficulty. The Governors have again been continually occupied in meeting increasing demands from limited resources, but owing to the co-operation of the staff, the work of the college has been maintained at the accustomed standard.

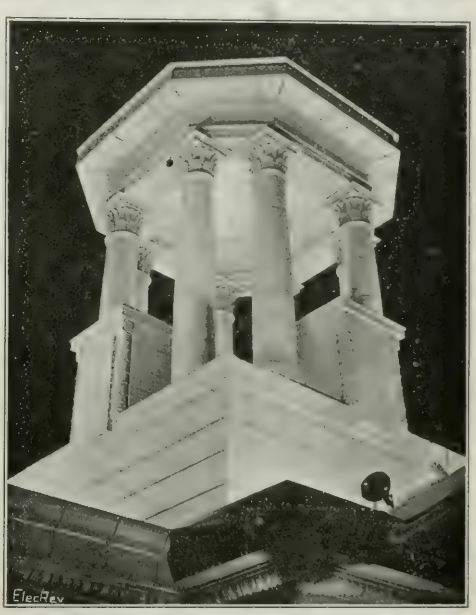
A Reversing Turbine.—Dr. T. M'C. Adair, of Belfast, has recently been considering the harnessing of the deep and narrow strait which connects Strangford Lough with the Irish Sea, and for this purpose has designed a turbo-generator set fitted with an automatic rudder which is intended to cause the set to swing round when the direction of the water current changes, to keep the turbine head-on to the flow. The turbine would appear from a correspondent's description to be a simple propeller device, and like so many previous inventions a model worked perfectly. It is hoped to utilise the power for "industries on the spot" or transmit it to Belfast. It is a pity that the Belfast station has been extended at so great an expense, but it will probably continue running in spite of the proposed development.

Radio-Control.—A new method of obtaining aerial photographs, in which the hand of the operator is replaced by radio-control, is being experimented with by the United States Army Air Service. A small kite-balloon carries up with it a camera controlled by an operator at a switchboard on the ground. Not only can the camera be made to take pictures of what lies directly beneath it, but the operator on the ground can turn the camera in any direction desired.—*Daily Mail.*

Electricity in Steel Works.—A paper dealing with the use of electricity in steel works was read on December 1st at a meeting in Glasgow of the West of Scotland Iron and Steel Institute by Mr. William MacFarlane, electrical engineer at the Mossend Steel Works. The lecturer referred to the possibilities of effecting considerable economies in the utilisation of electricity in steel-making. While they had not yet the superstations which were to produce cheap and abundant supplies of electricity for industrial purposes, the steel works, with the enormous quantities of waste heat and exhaust steam at their command, could utilise these to produce electrical energy for their own purposes cheaper than it was possible to obtain supplies from even a large power station like that of Glasgow Corporation at Dalmarnock.

South African Municipal Electrical Engineers' Conference.—The Annual Conference of Municipal Electrical Engineers and delegates was recently held in Cape Town. Mr. G. H. Swingler (City Electrical Engineer, Cape Town) was elected president for the ensuing year, and Mr. H. A. Eastman (of the Cape Town Corporation electrical staff) hon. secretary and treasurer.

An Example of Floodlighting.—Holophane, Ltd., has sent us a photograph, reproduced herewith, of an ex-



A "Holophane" Flood-lighting Installation.

cellent example of flood-lighting which has recently been carried out at the Ilford Super Cinema. The superstructure is illuminated by three 100-W "Holophane" projectors on each side, giving an average intensity of 6 foot-candles. The interior reflector is of prismatic construction, and is housed in a spun-copper casing, the whole being equipped with adjustable brackets and special fixing arrangements for the lamp. The scheme was planned in conjunction with the consulting electrical engineer, Mr. H. W. Sutton. The installation was carried out by Messrs. Harrison Bros., Middlesbrough.

Electricity from the Winds.—A scheme to harness the winds and make them produce cheap electricity for rural districts is being considered by the Ministry of Agriculture. Investigations are to be carried out to see how much electrical power can be obtained in this manner.—*Daily Express.*

Damages for Telephone Inefficiency.—A Minneapolis attorney, Mr. George S. Grimes, has secured a verdict for £210 from a jury for damages sustained by an inefficient telephone service. He sued for £630 for time lost between 1917 and 1920 through getting the wrong numbers, waiting for the exchange, and answering calls not intended for him. The North-Western Bell Telephone Co., U.S.A., is appealing against the verdict on the grounds that it is not liable for damages when it gives as good a service as it can in the circumstances. Mr. Grimes says: "At least 20,000 business men of Minneapolis, I am sure, have as good cases as mine against the company."—*Daily Mail.*

Society of Technical Engineers.—Mr. Norman Wyld, director of the Society, in addressing a meeting of the Bristol branch on December 1st, remarked that the more the future of the Society was considered the more important did its work appear to be. Its functions were threefold. First, to contribute to the better understanding on the part of the governing bodies of this country of the limitless importance of the application of science to industry. Secondly, to obtain such an improvement in the conditions under which that kind of work is carried on as would make it more efficient. And, thirdly, to create some machinery for the relations between organised administrative and technical workers and organised employers on the one hand, and organised manual workers on the other hand, such as would lead to a fuller appreciation by each group of the work of the other groups, and thus promote smoother working, greater efficiency, and greater prosperity. Their immediate business, however, was to strengthen their own organisation, so that it would be more fully representative of the technical and administrative staffs in engineering. With that end in view they must provide definite benefits for their own members. As a first step in that direction they should all combine to put into thorough working order the unemployment insurance scheme for technical engineers which had recently been started. They should also do their best to make the Employment Bureau effective, so that not only the member seeking a post, but the firm seeking an official, would be aided. Each branch council should make it its business to get every member of the branch to join in the unemployment insurance scheme, and to make a thorough investigation, for the information of their own national executive, of the circumstances which were specially characteristic of the conditions in its area.

A general meeting of the Stretford branch was held on December 7th. Following the election of officers for the ensuing year, an address was given by the chairman of the executive council (Mr. L. H. A. Carr) on the work accomplished by the Society, with particular reference to the past year's working. In this address reference was made to the improvements in conditions and terms of employment which had resulted in the past, both directly and indirectly, from the Society's activities. The speaker also described the steps which had been taken in connection with the second group of the Society's objects, namely, those covering the advancement of the British engineering industries, and pointed out that this group of objects could not be entirely dissociated from the objects connected with the advancement of the individual, since a sound, healthy industry was essential if the status, salary and position of the technical engineer were to be improved to the requisite level.

The address was followed by a discussion on the immediate steps in front of the Society, many useful suggestions being made by members present.

In the course of this discussion Dr. Hankey (chairman of the Manchester branch of the British Association of Chemists), who was present by invitation, gave a brief outline of the activities of his society. He emphasised the similarity of the two organisations, and expressed the hope that some closer co-operation between the two bodies would be possible.

INSTITUTION NOTES.

Institution of Electrical Engineers.—At the ordinary meeting on December 7th, the President read a letter from Col. Crompton, who has recently returned from the meeting of the International Electrotechnical Commission, referring to the good work performed by Sir Richard Glazebrook and Mr. Roger T. Smith at that meeting. The President then introduced Dr. Fleming, who was recently elected an honorary member of the Institution, and Dr. Fleming, in acknowledging his appreciation of the distinction conferred upon him, said that he had been an ordinary member for 47 years, ever since the infancy of electrical engineering. He expressed the hope that conditions would return in which electrical engineers could [illegible] with greater ease.

INFORMAL MEETINGS SECTION.—At the meeting of the Informal Section of the Institution on December 4th, Mr. F. A. Sclater opened a discussion on "An Electric Installation at a [illegible] Farm," [illegible] plant he had installed some two years ago in the dairy farming quarters of a large estate in the South of England. His lantern slides showed the scrupulous cleanliness of the milking and feeding barns with [illegible] the absence of dust, usually associated with farms, and the studied convenience of the lighting with its 2-way controls. Notable, too, was an ingenious and rapid self-starting device (Sclater's patent) for the 17-h.p. engine—by motoring the generator from the storage battery and drawing to the engine waste heat from the regulator coils.

Mr. R. Borlase Matthews congratulated Mr. Sclater on his success but [illegible] the farm was model and not a commercial farm. He said the careful lighting of the milking barns could be justified on [illegible] for he had found good light could be got for [illegible] paid for by milk formerly spilt. He also showed lantern views and described many applications of electricity to the farm. The German Government was so alive to the importance of this subject that South German farmers had been notified that they must avail themselves of electrical methods within the next three years or vacate their farms. He also announced that the British authorities had just agreed to broadcast weather reports by wireless telephone instead of the ten words a minute Morse system now employed.

Mr. J. F. Ayila was in the chair, and 19 members took part in the discussion.

On Monday next a discussion on "Time Switches" will be opened, by Mr. E. E. Sharp.

Junior Institution of Engineers.—On Tuesday last the new president, Capt. H. Riall Sankey, C.B., &c., delivered his inaugural address at the Royal United Services Institution. Mr. C. H. Wordingham, the retiring president, occupied the chair during the first part of the proceedings.

Royal Institution.—The arrangements for the early part of next year include two lectures on "The Water Power of the Empire," by Mr. Theodore Stevens, and six lectures by Sir Ernest Rutherford on "Atomic Projectiles and their Properties."

Institution of Heating and Ventilating Engineers.—In a recent paper before the Institution, Mr. C. G. Huntley dealt with the sources and beneficial effects of ozone. He asserted that more than half of the ills from which we suffered were due to the bad effect of foul air upon the nervous system. This was so generally realised that ozone was now being generated for employment in the ventilation of offices, workshops, &c.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. T. HESKETH, manager of the Folkestone Electricity Supply Co., Ltd., has been appointed a director of the company.

Mr. L. J. Kettle (Dublin City Electrical Engineer), Mr. McKeown (Works Engineer), and other leading officials, attended a presentation to MR. WM. NOLAN by his colleagues in the Corporation electricity works on his retirement through ill-health. The gift took the form of a gold Waltham watch.

MR. JOHN L. NEWLAND, for many years the managing director of the Electrical Contracts & Maintenance Co., Ltd., has joined the board of the Synchronome Co., Ltd., and is to take an active part in its management.

It has been announced that the next to occupy the position of president of the American Institute of Electrical Engineers will be PROFESSOR HARRIS J. RYAN, of Stanford University. Professor Ryan has been prominent in electrical engineering for many years, both in the United States and abroad.

MR. G. W. ERSKINE LODER has been elected chairman of the London, Brighton & South Coast Railway Co. in succession to the late Mr. Chas. Macrae.

Swansea Corporation Electricity Committee has re-elected COL. A. SINCLAIR chairman, and Councillor G. H. COLWILL vice-chairman for the ensuing year.

At the head office of the Manx Electric Railway Co., Douglas, MR. BERTRAM KELLY, A.M.I.E.E., who recently resigned his position with that company to take up the appointment of electrical engineer to the Douglas Corporation, has been presented by the officers and staff of the Electric Railway Co. with a solid silver tea service and tray.

LORD FARRINGTON has been elected deputy chairman of the London & North-Eastern Railway Co.

From among the five candidates who were selected by the Salford Electricity Committee for the post of borough electrical engineer, Mr. S. J. WATSON, of Bury, has been unanimously chosen for recommendation to the Council. Mr. Watson has been at Bury for 26 years. The salary at Salford is to be £1,250 per annum and bonus. There were 50 applicants for the position, and the above recommendation comes before the Salford Council at its January meeting.

MR. W. FENNELL, engineer and secretary of the Northwich Electricity Supply Co., has been elected as a representative of the employers on District Council (No. 3) North-Western Area, Electricity Supply Industry, in the place of Mr. J. H. Tonge, who has resigned, being now ineligible for the position.

MR. PERCY N. EVERETT, Assoc.M.Inst.C.E., late chief Diesel engineer with Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle, has now joined the staff of Messrs. Hick, Hargreaves & Co., Ltd., of Bolton, as manager of the oil engine department of the company.

MR. H. STANLEY DEACON, whose connection with Cryselco, Ltd., of Bedford, began in 1895, when the electric lamp industry was in its infancy, has just retired from the managing directorship, but he will remain associated with the board in

an advisory capacity. Mr. Deacon's son will continue to act as sales superintendent.

With reference to the paragraph in our last issue regarding Mr. Sawtell's appointment in the South of Scotland, we are asked to state that the appointment of that gentleman was quite distinct and separate from the positions of Messrs. Lamb and Reid in the Dundee electricity department, who were not promoted to fill the vacancy caused by the resignation of Mr. Sawtell.

Obituary.—M. Louis Prat.—We regret to learn from *Engineering* that M. Louis Prat, managing director of the Société des Cheminées Louis Prat (a company formed a few years ago to operate his mechanical draught patents) passed away at Paris on November 20th, aged 71 years.

Col. J. M. Denny.—The death occurred on Saturday last of Col. John M. Denny, C.B., chairman of William Denny and Bros., shipbuilders. Col. Denny was associated with many shipbuilding, industrial and railway enterprises, and was prominently connected with some of the engineering institutions.

Lieut. J. N. Wilkinson.—With feelings of deep regret we record the death, on December 2nd, in Springfield ex-Officers' Hospital, Knotty Ash, Liverpool, of Lieut. James Nathaniel Wilkinson (R.A.M.C.), at the early age of 39 years, after an illness extending over four months. Lieut. Wilkinson was an assistant installation engineer in the Manchester Corporation Electricity Department, joining the staff of that department so far back as 1897. A member of the R.A.M.C. (Territorials) for many years, at the outbreak of war he was called upon for service, and served with the 42nd Division throughout hostilities. His service in the Army resulted in his being a victim of malaria, which undoubtedly assisted in the undermining of his constitution, and finally he passed away with acute Bright's disease, dropsy supervening. He has left a widow and three children. The funeral, of a full military character, took place at the Southern Cemetery, Manchester, on December 7th, and was attended by many old friends and a large number of colleagues from the department.

Mr. R. Bone.—The death is announced, at the age of 45 years, of Mr. Robert Bone, partner in the firm of J. E. C. Else, Ltd., electrical engineers, of Duke Street, St. Helens (Lancs.). He had been associated with the firm for 26 years, and had been a partner for about six years.

Mr. Ernest William Shaw, electrician to Captain Gerard Leigh, at Lees Court, Faversham, met with a fatal accident on November 30th. Whilst motor-cycling he collided with a motor lorry, and died from his injuries the next day. He was 57 years of age.

Mr. B. S. Broadhurst.—We regret to announce the death of Mr. B. S. Broadhurst, which occurred on Monday last. As managing director of the Brush Electrical Engineering Co., Ltd., with a total period of service in that company in various capacities extending over 40 years, Mr. Broadhurst was held in universal esteem, and to his many friends the untimely death of a man of such apparent robust constitution must come with a shock. His health had been giving anxiety for some three or four months, and unfortunately the diagnosis of a deep-seated internal growth was such as to make any successful operation impossible.

Mr. A. R. McCallum.—We deeply regret to record the death of Mr. A. R. McCallum, which occurred on Monday night, as the result of an accident on the railway near Chesterfield. He was visiting Sheffield and other towns in connection with the operations of the firm of C. P. Sandberg, which he joined last year.

NEW COMPANIES REGISTERED.

Pressland Electric Supplies, Ltd. (186,248).—Private company. Registered December 6th. Capital, £1,100 in 1,000 10 per cent. cumulative participating preference and 100 ordinary shares of £1 each. To enter into a contract with C. Pressland, and to carry on the business of electrical, mechanical and general engineers, technical advisers, contractors, agents and manufacturers, dealers in and suppliers of electric, magnetic, galvanic and other apparatus, &c. The permanent directors are A. W. Matton, Broadmead, Marlborough Road, Hampton-on-Thames (director of Foot and Mouth Diseases Cure, Ltd.); C. Pressland (managing director), The Sun, Gloucester Road, Hampton-on-Thames. Remuneration: £100 each per annum. The directors shall not be entitled to receive any remuneration until the preference dividend of 10 per cent. has been paid. Registered office: Old Drill Hall, London Road, Hampton-on-Thames.

Hutchison Phenophane Co., Ltd. (186,310).—Private company. Registered December 5th. Capital, £50 in 1s. shares. To carry on the business of manufacturers, importers and exporters of and dealers in electrical and radio machinery, instruments, apparatus and supplies, &c. The first directors are E. R. Jones (Jesmond Dene, Shipperton, H. W. Packer, 26, Cedar Road, Cricklewood, N.W.; F. H. Fallows, Norfolk, Conn., U.S.A.; R. H. Redmond, 37, The Drive Mansions, Fulham Road, S.W.6. Secretary: H. W. Packer. Registered office: Davis House, Dean Farrar Street, Westminster, S.W.

Midland Flexible Metallic Tubing Co., Ltd. (186,177).—Private company. Registered December 4th. Capital, £25,000 in £1 shares. To carry on the business of manufacturers of and dealers in flexible metallic tubing, armourers of electric cables, wire drawers, rollers of metals, electroplaters, manufacturers of and dealers in rubber and rubber goods, engine and carriage builders, millwrights, metal workers, makers of cables in iron, steel or other metals, &c. The first directors are: G. A. Eastwood, Brambling House, Chesterfield; G. Clark, The Cedars, Newbold Road, Chesterfield; T. G. Mellors, Fern House, Mapperley Road, Nottingham. Qualification: £250. Solicitor: H. Hanson, New Square, Low Pavement, Nottingham.

Dagno, Ltd. (186,200).—Private company. Registered December 5th. Capital, £3,000 in £1 shares. To adopt an agreement with J. H. Noble, to acquire, work, develop or otherwise deal with certain letters patent or like rights [illegible] and to carry on the business of [illegible] and to enter into arrangements with companies, persons or firms for the [illegible] of the same, or the granting of licences or other rights to use the same, or otherwise turning the same to account, and to carry on the business of engineers, [illegible] and manufacturers of and dealers in [illegible] and other apparatus, &c. The first directors are A. M. Hare, Pepperell, Tye Green, Waltham Abbey; J. W. Spencer, 169, Ingate Road, Jarrow; J. Daglish, East Villa, The Green, Wallsend; J. H. Noble, 74, Bede Burn Road, Jarrow (all permanent, subject to holding the necessary qualification). Qualification: £200. Remuneration (except managing director) not to exceed £5 per week. Registered office: 14, Grey Street, Newcastle-on-Tyne.

Wholesale Wireless Co., Ltd. (186,130).—Private company. Registered December 1st. Capital, £1,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers and contractors, manufacturers of and dealers in electric lighting, power and transmission plant and wireless apparatus, &c. The first directors are: L. S. Alexander, "Durane," Ickenham Road, Ruislip, wireless instrument manufacturer; S. B. Graham, 113, King's Cross Road, W.C., solicitor. Registered office: 103, Farringdon Road, E.C.

Magniphone Co., Ltd. (186,262).—Private company. Registered December 7th. Capital, £300 in £1 shares. To carry on the business of wholesale electrical suppliers, electricians, electrical, mechanical, motor, telephone, telegraphic, heating, ventilating and general engineers, &c. The permanent directors are: A. Fontana, 58, Gordon Square, W.C., engineer; J. S. Smith, 58, Gordon Square, W.C., produce broker. Secretary: C. Hering. Registered office: 317, High Holborn, W.C.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Luminor Signs (British), Ltd.—Particulars filed of £100 debentures (second series) authorised November 3rd, 1921, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £75.

CITY NOTES.

Anglo-Argentine Tramways Co., Ltd.

With further reference to the proposals for the modification of the rights of the second preference shareholders, we have now received copies of circulars issued to the shareholders explaining the scheme and calling meetings of the company and of the second preference holders for Tuesday next, December 19th, at Winchester House, E.C., at which resolutions will be submitted, having for their object the cancellation of the arrears of dividend on the second preference shares. The directors, in giving the reasons which have induced them to submit these resolutions, state:—The company's annual earnings prior to 1914 enabled it to pay regularly, over and above debenture interest and other standing charges, the dividends on the two classes of preference shares, and on the ordinary share capital of £3,250,000. The last distribution on the latter was at the rate of 6¾ per cent., out of the profits of the year 1913. The prosperity of the company is largely determined by the cost of electric traction, and this in its turn is dependent on the price of fuel. In 1913 coal cost about 30s. per ton delivered in Buenos Aires. Under the company's power contract the charge for electric energy advances with the price of fuel when the latter exceeds $7.50 gold or 30s. per ton. By the end of the year 1918 the cost of energy had been increased by nearly 160 per cent. Working costs, which in 1915 were 65 per cent. of the gross receipts, mounted rapidly, and reached in 1919 about 80 per cent., fuel alone accounting for an increase in traction expenses averaging during the four years 1916-1919, £340,000 annually in excess of the charge under that heading in 1915. Hence it became impossible to meet the cumulative dividends on all the preference share capital, payments in respect of which had been continued on the first preference shares up to the half-year ended June 30th, 1917, and on the second preference shares up to the year ended December 31st, 1915.

Although, after the conclusion of peace, operating expenses, other than wages, began to decline, the burden already imposed by the abnormal circumstances resulting from the war continued to press severely on the company's revenue. Further, the company's obligations under the new pensions law absorbed in a great measure the benefits of the increased tariff sanctioned by the municipality of Buenos Aires in January, 1920, which came into effect in April of that year. Despite these facts, however, the company, by means of drastic economies and favourable rates of exchange, found itself in a position to commence paying off in that year the accumulated arrears of dividend on its preference share capital. Since then the whole of the arrears on the first preference shares, together with current dividends, amounting in all to £880,000, have been paid, whilst, on the second preference shares, the sum of £343,750 in respect of the 2½ years ended June 30th, 1918, has been paid. It is now proposed to make a further cash payment of the arrears for the six months ended December 31st, 1918, leaving £550,000, or four years' dividend, which will have accumulated on these shares by December 31st next.

In view of forthcoming necessary expenditure of a capital nature, and other obligations imposed on the company, both by the terms of its last concession and the progressive requirements of the city of Buenos Aires, such, for example, as

an increase of rolling stock to cope with the enormous growth of traffic, and the construction of nearly 20 miles of line connecting up outlying districts to meet the demands of an ever-increasing suburban population, it is deemed to be in the interests of the company that the arrears of second preference dividend, for the accumulation of which the war was largely responsible, should be disposed of, and the coming year commenced free of such liability. To enable this to be done, the Compagnie Generale de Tramways de Buenos Aires, which holds the whole of the issued ordinary shares and the majority of the issued second preference shares, has put forward proposals which, shortly stated, are that all such arrears of dividend shall be cancelled, but that the second preference shareholders shall receive the full amount of such arrears in further fully-paid second preference shares ranking *pari passu* with the existing shares, and that the dividend on the second preference shares as from January 1st, 1923, shall be increased from 5½ per cent. to 6 per cent. per annum.

As the company cannot itself issue further fully-paid preference shares in satisfaction of the arrears of dividend, the Compagnie Générale has agreed to provide such shares out of the existing ordinary shares, 110,000 of which are for this purpose to be converted into second preference shares ranking *pari passu* with the existing second preference shares and to be transferred by the Compagnie Générale without payment to the existing second preference shareholders, as at the date of the confirmation of the special resolutions. At the same time, so as to preserve as closely as possible the existing balance of voting power as between the second preference shares and the ordinary shares, the remaining 540,000 issued £5 ordinary shares and the 150,000 unissued ordinary shares are to be sub-divided and reconsolidated into 862,500 £4 ordinary shares. As the result of the above proposals, if carried out, every second preference shareholder will, in return for giving up the arrears of dividend on his shares, receive from the Compagnie Générale the full equialent of such arrears of dividend in fully-paid second preference shares, *i.e.*, 11 further shares in respect of every 50 shares now held, and in the same proportion for other holdings, and all such shares will for the future carry dividend at the increased rate of 6 per cent. per annum.

Ferranti, Ltd.

The report of the directors for the year ended June 30th, 1922, which was presented at the annual meeting at Winchester House, E.C., yesterday, showed a net profit of £24,371, after making provision for general establishment charges, bad debts, repairs and renewals, interest on debenture stock, notes, and loans, and making the usual allocation to depreciation reserve, and providing for taxation. The balance standing to the credit of the profit and loss account is dealt with as follows:—Balance at June 30th, 1921, £25,730, less preference dividend for three years, paid December 30th, 1921, £9,607, leaving £16,123, plus the net profit for the year to June 30th, 1922, £24,371, leaving £40,495. £50,000 has been transferred from depreciation reserve account to general reserve account, leaving a balance of £56,912, which is considered ample, as the book figures of land, buildings, plant, and machinery are based upon independent valuations obtained in 1919. The general reserve account, after making the above transfer, now stands at £152,630. The results of the trading for the year were affected by the lock-out in the engineering trade in the spring of this year. During the year £27,500 five-year 7 per cent. notes were repaid, and the balance of £4,500 will be paid on maturity at December 31st, 1922. The directors have carefully reviewed the position and prospects of the company, and they consider that the reorganisation of the company's capital, which has been delayed for some time, should now be carried out. Full particulars of the scheme were to be considered yesterday at extraordinary general meetings following the annual meeting.

The scheme of arrangement has been framed in order to deal with the arrears of dividend on the 6 per cent. cumulative preference shares to June 30th, 1922, to provide a share bonus to the ordinary shareholders to compensate in some measure for the absence of dividends, and to increase the deferred shares to an amount more commensurate with the value of their interest in the company. It is proposed to deal with the arrears of dividend, which at June 30th, 1922, amounted to 10½ years, by the payment for five years of 30 per cent. in cash, less income tax, and for the balance of 5½ years of 33 per cent. by the distribution of one fully-paid preference share of £1 each, free of deduction in respect of income tax, for every three preference shares now held. The ordinary shares of £1 each are entitled to a non-cumulative dividend of 7 per cent. out of the profits earned in any year. It is proposed to change the description into 7 per cent. non-cumulative second preference shares of £1 each, and to distribute to the holders, by way of bonus, one such 7 per cent. non-cumulative preference share for each four ordinary shares now held. The deferred shares (£1 each) are entitled to all surplus profits, after payment of dividends on the preference and ordinary shares, and it is proposed to change the name into ordinary shares, and to distribute to the holders by way of bonus five fully-paid ordinary shares of £1 each for every deferred share now held. For the purpose of carrying out these proposals it will be necessary to capitalise £ 2,792 out of the amount standing to the credit of general reserve account, leaving an amount of £69,838 in that account. It will also be necessary to increase the authorised amount of each class of shares, and it is proposed that they should be increased to £100,000 in each case. When the scheme has been carried through, the authorised and issued capital of the company will be as follows:—

	Authorised.	Issued.
6 per cent. cumulative preference shares of £1 each ...	£100,000	£71,166
7 per cent. non-cumulative second preference shares of £1 each	100,000	75,000
Ordinary shares of £1 each	100,000	60,000
	£300,000	£206,166

Cape Electric Tramways, Ltd.

Mr. Ludwig Breitmeyer, chairman, presiding at the annual meeting on December 6th, said that the results obtained were very satisfactory. The Cape Town system had carried 1,325,844 more passengers and the Port Elizabeth system 184,485 more than in the previous year, representing a total increase of £17,446 in the receipts. Expenditure, however, had increased to a greater extent, owing to the making up of arrears of maintenance caused by the war. The expenditure in this connection during the past year had been £33,000, and there was still a considerable amount of work to be done; they expected to complete this in two years. Reductions in wages had enabled them to reduce the price of monthly tickets. As this only occurred in June last, the effect was not seen in the past year's accounts. So far as could be judged by the current year's working, there was every indication that another successful year lay before the company, and the chairman trusted that nothing would occur to prevent the maintenance of the same dividend—6 per cent.

Italian Electrical Companies.

The excessive drought of the past year, compelling resort to heat-driven plant, gravely affected the balance of the *Dinamo Società Italiana Imprese Elettriche*, resulting in the distribution of only 5 per cent. on its capital of 25,000,000 lire. The new plant on the Iselle river station started working in May.

The *Società Pugliese per Esercizio Imprese Elettriche*, of Geno, closed its working year to the end of June with a balance of 29,705 lire, which was disposed of in part to cover the loss of last year, and the remainder to reserve.

The *Società Distribuzioni Elettriche Zambellini* made a net profit of 561,926 lire.

The report of the *Unione Esercizi Elettrici*, of Milan, for the year to June 30th, 1922, showed a net balance of 6,666,307 lire, from which a dividend of 13 per cent. was distributed, 303,315 lire being placed to the credit of the reserve fund. It was decided to raise the capital from 75,000,000 lire to 80,000,000 lire by the issue of 100,000 50-lire new shares.

The following companies have raised fresh capital: *Società Idroelettrica Bòintea di Lecco*, from 1,000,000 to 6,000,000 lire; *Società Anonima Consorzio Idroelettrica Monte Aiona*, from 10,000,000 to 15,000,000 lire; and the *Società Lucana per Imprese Elettriche*, of Naples, from 3,500,000 to 10,500,000 lire.

The *Società Elettrica Alto Milanese*, of Busto Arsizio, realised for the year to June 30th, a balance of 247,748 lire, from which a dividend of 12 lire per share was distributed.

A dividend of 3.75 lire per share on its capital of 1,000,000 lire was distributed by the Società Elettrica del Pellino, located at Borgo Manero.

The profit balance of the *Società Mineraria Elettrica del Valdarno* (Florence) of 3,512,776 lire, after writing off the loss of the foregoing year, permitted the distribution of 6 lire per share on its 50,000,000 lire of capital.

Spanish Companies.

During the past working year the *Electra de Occidente S.A.* realised a profit of 35,308 pesetas, allowing of a dividend of 4 per cent. to the shareholders, the contribution of 5,000 pesetas to the reserve, and the apportionment of sundry sums to the sinking fund account.

The results of the past year's working of *Los Tranvias de Vigo* showed increased receipts from passenger traffic, the passengers carried being 1,200,000 in excess of 1920. After making the usual allotments, a sum of 225,000 pesetas was set apart for dividends upon shares, as against 160,000 pesetas in 1920. In the past year the company has carried out the lengthening of sundry lines, and is now considering the construction of new ones to link up Vigo with Bayonne, Gondomar, and Redondela, the works to be taken in hand shortly.

The accounts of the *Sociedad anonima Aguas de la Coruna* for the year 1921 showed income 478,339 pesetas and expenditure 240,054 pesetas, leaving a balance of 246,284 pesetas, which was raised by the balance brought forward from the foregoing year and repayment of certain shares to 274,643 pesetas, divided as follows:—Reserve, 12,314 pesetas; sinking fund 12,314; emoluments of the board, 12,314; bonus to staff, 4,925; dividend upon shares, 162,500; and taxes, 39,657; leaving 617 pesetas to be carried over. The dividend is equal to 6.50 per cent.

The report of the *Tranvias y Electricidad de Bilbao*, which is a Belgian concern and consists of a number of separate companies combined, showed, for the year 1921, net profits of 1,672,041 fr., which it was decided to dispose of as follows:—To reserve, 83,566 fr.; 4½ per cent. on the shares, 337,500 fr.; to board of management, 125,025 fr.; second dividend of 5 fr. per share, 375,000 fr.; *bonos de disfrute*, 750,000 fr.; and carried to new account, 949 fr.

The accounts of the *Electricista Toledana Compania Anonima* for 1921 showed an available balance of 128,064 pesetas, from which a dividend of 10 pesetas per share, absorbing 75,000 pesetas, was declared. As an extra measure of precaution, the sum of 35,855 pesetas was transferred to reserve.

Greengate & Irwell Rubber Co., Ltd.

Capital Reduced. The Manchester correspondent of the *Financial Times* states that in the Lancashire Chancery Court at Manchester on Monday, assent was given to reduction of the capital of the above company, which was incorporated in December, 1919, taking over I. Frankenburg & Sons and the Irwell and Eastern Rubber Co. The capital was £800,000, divided into preference shares and ordinary shares of £1. 375,000 of each class had been issued and paid up. Losses were incurred through the depreciation of stocks and the cancellation of contracts taken over from the vendor companies and other factors attributable to the trade depression.

Had the two companies continued to carry on their business they would have been entitled to a refund of £74,000 in respect of payments made for excess profits. The original companies, however, were now defunct, having ceased to carry on operations, and the Board of Inland Revenue authorities refused to refund to the new company. The company now recognised that it was impossible to maintain the claim. If that had been known before, the capital would not have been fixed at £800,000, and the purchase price would have been less. It was intended, therefore, to make an equivalent reduction in the capital by writing down to 16s. the ordinary shares held by the shareholders in the two companies that had amalgamated.

Burmah Electric Tramways and Lighting Co., Ltd.—At the annual meeting on December 6th, the chairman (Mr. C. O. Webb) said that the working profit for the year was £16,546, as compared with £14,907 for the previous year. It had been found impossible again to pay a dividend on the ordinary shares, but the preference shareholders had received 11 per cent. for the year. This still left arrears of 30 per cent. on the preference shares, which it was hoped to pay off shortly. The value of the ordinary shares would then improve rapidly.

Fuller's United Electric Works, Ltd.—At an extraordinary general meeting held on December 6th at Winchester House, Mr. George Fuller presiding, resolutions were unanimously carried reducing the capital in accordance with the reconstruction scheme. After a further meeting on December 21st a petition for sanction to the scheme will be presented to the Court. Mr. Fuller said that there was already evidence of improved trade. Judging from the results of the last few months there was every reason to believe that they had entered upon a more successful period.

Brompton & Kensington Electricity Supply Co., Ltd.—An extraordinary general meeting is called for December 22nd to confirm resolutions for the division of each of the ordinary and preference shares of £5 into five shares of £1 each and to alter certain of the articles. A further resolution will authorise the capitalisation of £90,000 of the reserve fund and £4,740 of the depreciation fund and its distribution by the allotment of one fully-paid ordinary share for every two ordinary shares held, such bonus shares to rank for any dividend declared for 1922.—*Financier.*

Manx Electric Railway Co., Ltd.—At the annual meeting on December 6th, the Chairman (Sir W. H. Vaudrey) stated that the income for the year was £64,963—a slight increase. Out of an available balance of £13,497, the directors proposed to pay the preference dividend for 1917 and 4 per cent. on account of the 1918 preference dividend, amounting to £12,369; the balance was carried forward.

Armstrong-Whitworth Development Co.—According to the *Financial Times*, the board recommends a dividend of 6 per cent. per annum, less tax, on the preference shares for the half-year, making 6 per cent., carrying £16,675 forward. Dividend 12½ per cent., free of tax, paid on the ordinary shares.

Companies to be Struck off the Register.—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary:—

Caerphilly Electric Supply Co., Ltd.
Cyclettic Cookers, Ltd.
Marlborough Electric Supply Co., Ltd.
Reineke's Wireless Telephones, Ltd.

British Thomson-Houston Co., Ltd.—The half-yearly dividend on the seven per cent. cumulative preference shares is being paid next week.

Chile Telephone Co., Ltd.—Dividend of 3s. per share, free of tax, for the half-year ended September 30th.

Manila Electric Corporation.—Dividend of 2 per cent. on the common stock for the current quarter.

Canadian General Electric Co., Ltd.—Dividend of 1½ per cent. on the common stock for the quarter.

Mackay Companies.—A dividend of 1¼ per cent. on the common stock for the quarter is announced.

American Telephone and Telegraph Co.—Quarterly dividend of $2.25 per share.

Brazilian Traction, Light and Power Co.—Quarterly dividend of 1½ per cent. on the cumulative preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The most interesting feature in the Stock Exchange markets, from the point of view of those who follow electrical companies, is the announcement made by the Anglo-Argentine Tramways Co. of its proposals for meeting arrears of dividends that have accrued on the second preference shares. The broad outlines were published here in advance, and the company's circular confirms the directors' intention, subject to the shareholders' approval, to issue new preference shares in payment of the arrears, and thereafter to raise the rate of dividend from 5½ to 6 per cent. The shares had risen sharply on announcement in advance of the details, and no further changes are marked this week. The 5 per cent. debenture stock is easier.

Trade, stretching lazy arms, and giving indications of reawakening from its post-war sleep, begins to demand capital which hitherto has lain invested, for want of better employment, in gilt-edged securities. Consequently, the tendency amongst the prices of the latter is to give way. This has its effect upon a good many of the other investment stocks. On the other hand, shares in the iron, coal, steel and allied companies are advancing. The curious part of it is, that in at least half-a-dozen cases where dividends have lately been passed, the shares now stand higher than they did before the announcements were made. The Stock Exchange market is, as usual, going in front of events. Amongst shares which have benefited (although, of course, the company continues to pay first-rate dividends), are Babcock & Wilcox. The shares have been up to 71s. 3d., and, although a slight reaction reduced the price to 70s., this still shows a rise on the week.

Amongst the manufacturing shares, Metropolitan-Vickers ordinary and preference are both a good market, while Armstrongs rose sharply. The electrical manufacturing issues have moved but little. Further rises have occurred in the shares of the home electricity supply companies. City of London, County of London, St. James and South London are 1/16 to ¼ up. New County ordinary have hardened to 5s. 3d. premium. The shares are still 5s. paid. The new preference remain unaltered at 1s. 10½d. premium.

The only shares in the list to show any dullness are London ordinary, which have gone back to 2⅜. Apparently the prospect of the company taking on the supply of current to the South-Eastern Railway, in addition to its Brighton railway contract, does not appeal particularly to those who realise the peculiar circumstances which surround big contracts of this kind. In order to make these of particular importance to an electric supply company, it is well for the latter to have very extensive private connections, for naturally enough, the profits available from supply of power to railways is cut fairly fine. It may be worth mentioning to holders of the shares that Kent Electrics are in demand, without any noticeable supply being available. If shareholders wish to get a good price for their holdings, they will probably be able to do so by giving the necessary instructions to their brokers. Shares in the preference group are also better.

The railway market itself is quiet, in spite of the close approach of the dividend season. Activity in Districts has given way to a placid state of affairs, while Metropolitans drooped to 59½. After the rise which both these stocks have enjoyed, the ordinary course is for the market to find itself with many selling limits at prices a trifle higher than the current quotations, on behalf of people who just missed getting the top figures, and who, now that the demand has slacked off, want to take advantage of the best figures reached.

Amongst cable and telegraph stocks, further improvements in West India and Panama shares are the outstanding items of interest. The ordinary at 10s., the first preference at 50s. and the seconds at 30s. show further gains, and the company's 5 per cent. debentures advanced to 80. The buying is based, as previously noticed, on the hope that, under the new scale of rates which the company has now permission to charge, a brighter era may be regarded as at hand for this unfortunate company's affairs. The Eastern group is steady, holding its recoveries of last week. Great Northerns are 5s. higher at 28⅜; Anglo-American deferred rose 12s. 6d. to 23¾. United River Plate Telephone, after their dramatic jump, reacted to 7½. The wireless group is very quiet, a noticeable movement being a fall to 2⅜ premium in Marconi debentures, due to selling by some of the stags who wants to realise their scrip rather than pay the call due this week.

British Columbia Electric stocks have gone back a little after their boisterous rise, and the tendency amongst foreigners is dull as a whole. Mexico Tramway 6 per cents. are a point up at 56¾, and Mexican Light and Power second bonds at 81½ have also improved. But the first 5 per cent. bonds, together with the common and preferred shares, are both lower. At home, British Electric Traction ordinary

advanced to 64, attention being directed to the stock by reason of the yield which it offers the speculative investor.

Cable manufacturing shares are better. Rises have occurred in Callenders and British Insulated ordinary. The improvement in Bullers & Wilcox has already been noticed. In a quiet way, substantial business is being done in the ordinary shares of the Electric Supply Corporation, which have come up from 14s. to 16s. and may quite possibly move up to the neighbourhood of £1, following the examples set by Edmundsons and Urban. In both these last-named companies, the shares went to rubbish prices, but within the past few months, substantial recoveries have taken place, and the issues are easier to sell than they are to buy. Urban ordinary are quoted at 22s. 6d., the preference at 3¾ and the 4½ per cent. debenture stock at 70. Edmundsons ordinary stand in the neighbourhood of 39s., the first preference at 4¾, and the non-cumulative preference at 3¾, while the 4½ per cent. debenture stock is about 75. Companies of this nature have had a good deal in their favour of late, much the same factors operating to assist them as have brought about the material improvements in the shares of the electricity supply undertakings.

Reports from the United States indicate that the Americans are doing what they can to secure forward contracts for rubber deliveries, on the basis of the present improved price of 1s. 2d. per lb. for the produce. While the market in rubber shares is far from active, the strength of the list is being fortified by a considerable amount of buying on behalf of people who, in the great majority of cases, take up their shares and are prepared to keep them for the better times which appear to be coming into sight.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Dec. 12. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	10½	—	£5 17 1
Charing Cross Ordinary	8	9	7½		5 16 0
do. do. do. 4½ Pref.	4½	4½	4¼	+ ⅛	5 9 1
Chelsea	6	6	6¼	-	4 9 0
City of London	14	14	2⅛	+ ½	6 7 10
do. do. 6 per cent. Pref.	6	6	22½	—	5 4 4
County of London	8	8	1⅞	- 1/16	5 6 8
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7⅜	—	6 7 0
London Electric	2¾	4	2⅛	— ⅛	4 4 3
do. do. 6 per cent. Pref.	6	6	5⅛		5 17 1
Metropolitan	7	7	6¾		5 7 8
do. 4½ per cent. Pref.	4½	4½	4¼	- ⅛	5 9 1
St. James' and Pall Mall	12	12	9⅞	- ⅛	6 6 4
South London	7	7	4⅞	+ ⅜	5 18 0
South Metropolitan Pref.	7	7	1/16		5 18 0
Westminster Ordinary	10	10	7⅛	—	6 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102		5 17 6
do. Def.	1½	3 1-6	23/32	⅛	6 6 4
Chile Telephone	6	6	6¼		4 16 0
Cuba Sub. Ord.	7	7	8	—	8 15 0
Eastern Extension	10	10	19½		5 4 0
Eastern Tel. Ord.	10	10	19/16		5 5 0
Globe Tel. and T. Ord.	10	10	19½	—	5 4 0
do. do. Pref.	6	6	11⅛		5 7 10
Great Northern Tel.	24	22	28⅝	+ ½	7 13 0
Indo-European	10	10	35/8		7 1 0
Marconi	25	15	2⅛	—	7 1 2
Oriental Telephone Ord.	12	12	2⅝		*5 4 0
United R. Plate Tel.	8	8	7/16	+ ⅛	*5 6 8
West India and Panama	Nil	Nil	1/16	- ⅛	Nil
Western Telegraph	10	10	19⅜		*5 4 7
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 6
Metropolitan	1½	2½	50½	- ⅛	3 15 8
do. District	Nil	1	4½	- ⅛	2 4 0
Underground Electric Ordinary	Nil	Nil	2⅛	— ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	3⅝		7 2 0
do. do. 2nd Pref.	Nil	5½	4⅜		5 19 0
do. do. 5 per cent. Deb.	5	5	81½xd	1	6 2 8
Brazil Traction	Nil	Nil	48	—	8 6 8
British Columbia Elec. Ry. Pce.	5	5	74⅛	1/2	6 7 5
do. do. Preferred	5	93/8	76½	1	*6 3 6
do. do. Deferred	3	12d/-	18½	1	*6 19 4
do. do. Deb.	4½	4½	7/2	1	5 7 7
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½		6 2 8
do. 6 per cent. Bonds	Nil	Nil	65½		Nil
Mexican Light	Nil	Nil	22½	1	Nil
do. Pref.	Nil	Nil	61½	1	Nil
do. 1st Bonds	Nil	5	67/8	- 1½	7 8 2
Manufacturing Companies.					
Balkan Trading	15	16	3⅜	+ 1/16	4 11 5
British Aluminium Ord.	10	5	16/3		6 3 1
British Insulated Ord	15	15	2½	+ ⅛	6 13 1
Callenders	15	15	2⅛	+ ⅛	6 17 0
do. 6% Pref.	6%	6%	1⅛		5 15 7
Crompton Ord.	10	5	15/8		6 13 4
Edison-Swan	10	Nil	2/6		Nil.
do. 6% Pref.	5	5	6¼		7 16 1
Electric Construction	10	10	1⅝		7 5 6
English Electric	5	5	15/9	+ 9d.	6 7 0
do. do. Pref.	6	6	18/3		6 10 6
Gen. Elec. Pref.	6%	6%	21/9		5 19 6
do. Ord.	5	5	17/9		5 17 8
Henley	15	15	2⅜		6 11 3
do. 4% Pref.	4	4	4⅛		5 2 10
India Rubber	—	—	11/8	⅛	
Metropolitan Proj.			2⅜	+ ⅛	6 11 2
Siemens Ord.			1⅜	⅛	
Telegraph Con.			2⅜	—	*1 11 6

* Dividend and interest for 1 year.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, December 13th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	6½d.	½d. dec.
a Ammoniac, Sal	per ton £62	...
a Ammonia, Muriate (large crystal)	£48	...
a Bisulphide of Carbon	...	...
a Borax	£30	...
a Copper Sulphate	£26 15s.	...
a Potash, Chlorate	per lb. 5d. to 5½d.	...
a ,, Perchlorate	7½d.	...
a Shellac	per cwt. £17 15s.	5s. inc.
a Sulphur, Sublimed Flowers	£9	...
a ,, Lump	£9 2s. 6d.	27/6 inc.
a Soda, Chlorate	per lb. 3½d.	...
a ,, Crystals	per ton £6	...
a Sodium Bichromate, casks	per lb. 5d.	...
METALS, &c.		
b Aluminium, Ingots	per ton £100	...
b ,, Wire	per lb. 1/9 to 2/6	...
b ,, Sheet	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I	per ton net £166	£1 inc.
Grade II	£122	...
Grade III	£68	...
c Brass (rolled metal 9" to 12" basis)	per lb. 9½d.	...
c ,, Tubes (solid drawn)	11¾d. to 1/-	...
c ,, Wire, basis	9¾d.	...
c Copper Tubes (solid drawn)	1/1½	...
c ,, Bars (best selected)	per ton £96	...
c ,, Sheet	£96	...
c ,, Rod	£96	...
d ,, (Electrolytic) Bars	£69 10s.	5s. dec.
d ,, ,, Sheets	£145 10s.	...
d ,, ,, Wire Rods	£79 10s.	5s. dec.
d ,, ,, H.C. Wire	per lb. 9½d.	...
f Ebonite Rod	3/6	...
f ,, Sheet	3/-	...
n German Silver Wire	2/6	...
h Gutta-percha, fine	12/6	...
h India-rubber, Para fine	1/1½	½d. inc.
l Iron Pig (Cleveland Warrants)	per ton 92s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual.	£24	...
g Lead, English Pig	£27 5s.	5s. dec.
g Mercury	per bot. £12 to £12 2s. 6d.	2/6 inc.
e Mica (in original cases) small	per lb. 3d. to 3/-	...
e ,, ,, medium	4/- to 8/-	...
e ,, ,, large	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	1/1	...
p ,, drawn bars and rods	1/3	...
p ,, rolled strip & sheet	1/2½	...
p ,, wire	1/8½	...
o Platinum	per oz. £23	...
d Silicium Bronze Wire	per lb. 1/0¾	...
r Steel, Magnet, in bars	10d.	...
n Tin, Block (English)	per ton £175 10s. to £176	£2 inc.
n ,, Wire, Nos. 1 to 16	per lb. 8/2	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p O. Clifford & Son, Ltd.
r W. F. Dennis & Co.

An American Automatic Sub-station.—An automatic sub-station at Kansas City for dealing with a high-pressure a.c. supply was recently described in the *Electrical World*. This station has two incoming 4,000-V three-phase lines, each with a transformer stepping down the pressure to 2,300 V and feeding a three-phase, four-wire circuit. During a "peak" each line, through its transformer, feeds a four-wire circuit independently of the other, but, when the load decreases, it is required to make one transformer carry the whole load and supply both four-wire circuits. This is accomplished by a contact-making ammeter on one of the lines. Upon making contact at a pre-determined low-current setting, this ammeter energises a motor driving a controller-drum. As the segments of the drum come into contact with their contact fingers, the various oil switches operate in the proper sequence, so as to transfer the group of feeders fed by the line "No. 2" to the other line and disconnect line "No. 2" and its transformer. When the load again rises above the limit the contact-making ammeter on line "No. 1" puts another source of power into operation and reverses the operation of the oil switches. Arrangements are also made so that in case of trouble on one of the lines the groups of distribution feeders affected will be thrown over to a spare line and transformer. Each group of feeder circuits and equipment forming a three-phase group is separated by barriers from adjacent groups. Included in these groups are three feeder regulators, oil switches, the control panel, and a group of compartments fed by a spur bridged from the main bus-bar. In case of opening of a single-phase feeder switch it is re-closed; if it again opens it is re-closed but if it opens a third time and will not stay in, it is locked out and line conditions are investigated.

THE POSSIBILITIES OF UNDERGROUND TRANSMISSION AT 100/150 kV.

By A. M. TAYLOR, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

The object of the paper is to consider how electricity can be cheaply and efficiently transmitted over long distances in cases where the use of overhead lines at high pressures, *e.g.*, from 100,000 to 150,000 volts, are not considered advisable. If underground cables could be employed at voltages of the same order as those of overhead lines, it might be possible to obtain wayleaves along trunk railway lines over great distances, and in such a case the cost of transmission might be reduced to a figure as low even as that with overhead lines. The paper is primarily a plea for the use of single-phase cables.

The author has developed a system on the separated-phase principle, which permits of the pressure between the outermost core and earth being reduced to some 18,000 volts while still obtaining 100,000 volts for transmission, coupled with certain other advantages of moment. In what follows it is to be understood that the amount of power to be transmitted is 50,000 kW, the load factor 40 per cent., and the distance 30 miles.

It is practicable to keep the plain copper-voltage drop (*i.e.*, excluding the lead-sheath loss) over a separated-phase 100,000-volt single-core system down to 2½ per cent. of the total power, or 2.75 per cent., including lead-sheath loss. The lead-sheath loss is, thus, at 50 periods, only 0.25 per cent. of the total power transmitted on a 30-mile line.

Armoured cables might be desirable on long lines laid along railways. By increasing the amount of copper by 10 per cent. the iron wire loss can probably be compensated for by the reduced copper voltage-drop, and may then be neglected. The effect of separating the cores is considered, both in its relation to easing the potential gradient and in relation to eddy currents induced in the lead sheathing.

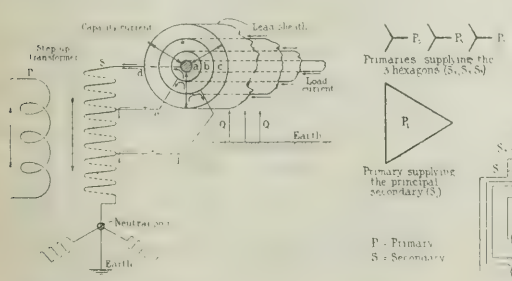


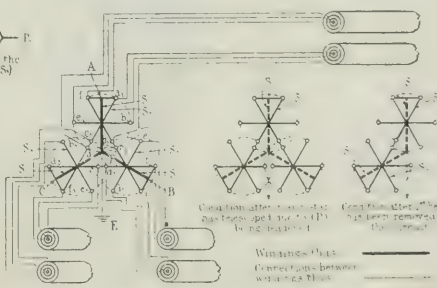
Fig. 1.

The volume of the slice of insulation immediately contiguous to the core is of the order of 1/40th (per unit length of cable) of that at the extreme circumference, and the amount of heat developed is over 20 times, consequently the heat developed per cubic centimetre is of the order of 800 times that generated in the section at the extreme circumference. The watt loss, due to the purely ohmic insulation resistances of the different sections and the true leakage current which passes through them, follows a precisely similar law, and is, again, 800 times the heat developed per cubic centimetre.

The author is quite satisfied that the power factor, representing partly, as it does, the energy lost by dielectric hysteresis, plus the true leakage loss, must be much greater in the inner layers of insulation, which are at a much greater temperature than the outer layers; and this would still further strengthen his argument.

The greater amount of heat liberated in the sections close to the core has enormously greater difficulty in reaching the circumference of the cable, therefore any method that tends to relieve the potential gradients in the sections next to the core, even if this occur at the expense of the sections nearer to the circumference, is a very potent factor indeed in easing the situation. The author has shown the remarkable effect upon the diameter of the cable of introducing metallic inter sheaths and forcing them to work at such potential differences between each consecutive pair that the maximum voltage gradient is maintained more or less constant throughout. The result is that the whole 69,200 volts are absorbed within a radius of 4-1/6 cm. Such a result can be obtained only at the expense of having continually increasing capacity currents in successive layers as we work outwards, the current being no longer constant from the centre to the circumference, and a practical arrangement for dealing with this is the use of intersheaths, and the author proposes to obviate the disadvantages of intersheaths by combining them with a 6-phase transmission system. Fig. 1 shows what takes place in a single phase of a three-phase system embodying one single-core cable per phase, each such cable having intersheaths.

The half-wave of e.m.f. in the secondary is in a downward direction through the secondary winding, "sucking" the principal or "load" current of the central core of the cable and carrying it through to the neutral point of the transformer winding. The current *f* arrives through the outermost conducting core. Finding a path leading to the tapping of the transformer, the "surplus" current of the outermost section of the insulation, instead of going through the successive layers of insulation to the central core and heating up the innermost layer in the way just described, now takes a short cut across to the tapping of the transformer. The "surplus" element of the current *e*, which has passed through the insulation from the outermost core to the intermediate core, similarly takes a short cut across to the corresponding tapping, with the result that the insulation next to the innermost core is called upon to carry only the capacity current *d* due to its own capacity. The author believes that by adopting this principle the potential gradient on the outermost layers could be raised considerably. For one reason, these layers being close to the lead sheathing, would be the coolest in the whole cable, and consequently the power factor of the dielectric would be the lowest and the restivity by far the highest, since the latter varies enormously with the temperature.



Sequence of Operations on Reduced Load

(1) Oil switch of transformer P is tripped (and, if faulty, the hexagon of the faulty circuit is disconnected).
(2) Earth switch is kept from neutral point of hexagons to earth.
(3) Hexagon No. 1 is removed.
(4) Hexagon No. 2 is removed.
(5) Hexagon No. 3 is left in.

Fig. 2.

In all probability the operation of dielectric hysteresis is very similar to that of magnetic hysteresis, and the loss (*i.e.*, the power factor where the leakage loss is low) is therefore proportional to a function of the potential gradient, and the loss by pure leakage conductance through the dielectric is proportional to the square of the potential gradient, and both of these (and particularly the latter) depend to a very great degree on the temperature obtaining in the dielectric.

Referring now to the author's six-phase three-phase system, one—say the top—of the three small six-phase systems or "hexagons" shown in fig. 2 (which gives the general scheme) and reproduced by itself in the upper part of fig. 3, consists of a "bank" of the secondaries of a step-up transformer coupled in double star to give voltages which are in six-phase relation. This bank is connected to two cables (fig. 4) at the top of fig. 3. The lower half of the latter diagram is the inverse of the upper half. To the right are two single-phase "major" transformers, the secondary of each of which is wound for 120,000 volts and its mid point earthed. The voltage between the innermost core of each cable and the intermediate core is 30,000, as is also that between the intermediate and outer cores, while the voltage between the outer core and the lead sheathing is only 17,800 volts (if desired, only 15,000).

The cable shown in section in fig. 4 has been so designed that the maximum voltage gradient on the innermost core under these voltages will not exceed about 38,000 V cm, the potential gradient at which three-phase, three-core, non-concentric cables work at the present day. On the middle and outermost cores it will be 29,000 V cm and 20,000 V cm respectively.

Power is transmitted both by the two six-phase systems and

by the single-phase (or equivalent) system, and reconverted at the receiving end in the form of a joint three-phase supply on to the l.p. bus-bars, so in fig. 2 the three six-phase systems each transmit power in conjunction with the "major star" system, the latter working at from 100,000 to 150,000 volts, according to whether it is decided to risk a maximum potential gradient of 60,000 V/cm (as is, the author understands, at present under consideration with three-phase cables) or of only 40,000 V/cm.

The author has developed a simple arrangement which he thinks would be very valuable on long lines for reducing the drop due to capacity current. By the establishment of one or two sub-stations of comparatively small capacity along a long line (from which power would be supplied for commercial purposes for traction or lighting), it is quite practicable to "feed in," at the sub-stations, the capacity currents for the different insulation "rings" of the cable, and to transmit this current at the full 100,000 volts, re-transforming it to the local voltages required.

The arrangement proposed greatly reduces the amount of capacity current to be passed out from the central station through the intermediate and external cores, because we can feed into the line at as many points as may be found desirable (the maximum length to be fed varies inversely as the number of feed points) and therefore the central station has to supply only the capacity current for the said cores for the first quarter-section of line (if there is a mid-way sub-station).

The transmission system represented by the upper six-phase hexagon in fig. 3 could be started, in the first instance, by itself, having its bottom point directly earthed, and thus the initial capital expenditure would be reduced. Under these circumstances the system would operate at 60,000 volts. Later on, when the load developed, the second or lower six-phase system could be added, in such a sense that its instantaneous

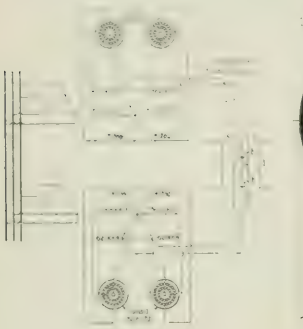


Fig. 3.

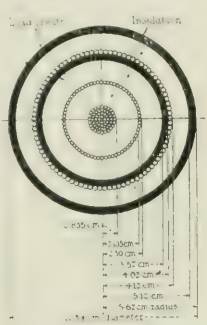


Fig. 4.

diametral e.m.f. would run upwards (on the diagram) at the same time as that of the upper hexagon. Its highest point, however, as well as that of the lowest point of the upper hexagon, being at earth potential, it would how be practicable to add a single-phase transformer and transmit over the same lines a single-phase superposed current at 123,000 volts, which could be similarly transformed at the distant end, and would considerably increase the carrying capacity of the two six-phase systems. Lastly, when the load of the system warranted it, the balance of the three-phase network, shown in fig. 2, could be added and the vector relations of the e.m.f.'s could be easily altered so that the 123,000-volt single-phase supply could be replaced by a 100,000-volt three-phase supply.

With suitable precautions to avoid "current resonance," the author believes that the necessary charging currents may be fed into the line at convenient points in such a way as to avoid passing any charging current along the central cores, thus opening up the possibility of removing the disability under which a.c. now labours as compared with d.c. transmission.

On such a line, loads having a power factor of only 0.7 would be invited, and a.c. railway electrification with single-phase motors at 25 periods might, in some cases, be employed if otherwise found desirable.

For reasons of economy it appeared to be a necessity that 10 cables should be employed, on the assumption that it was undesirable to make the cables of greater sectional area than 0.25 sq. in. per core. There is, however, the alternative point of view whether the additional waste of energy involved by using only five cables would not cost more, when capitalised, than the difference in price between five cables and ten cables. In other words, it would pay to invest £58,300 in extra copper in the transmission line in order to save 1 per cent. of the total power generated.

To make it pay to use five cables in parallel instead of ten the difference in capital outlay would need be of the order of £653,000 plus, say, £50,000 (to allow on account of induction regulators, making a total of, say, £700,000.

The system proposed offers, as compared with 3-phase, 30,000-V single cables or single-core cables, the following advantages:—

(1) The separation of the (principal) phases carries with it a much greater freedom from complete short-circuits.

(2) The virtual elimination of all faults except those to earth, and the reduction of interruptions caused by the latter to such a degree that the working of the system is not seriously affected.

(3) The penultimate lead sheath renders it possible to continue working even with a damaged cable.

(4) The double reliability offered by having two cables per (principal) phase; being approximately equivalent to one spare, and, in the case of a single-core 100,000-volt system, to two spare cables.

(5) The capacity current neutralises the lagging component of the load current (on a 30-mile line), and completely eliminates the reactance drop in the line at full load, due to this component traversing the same (the power factor of the load = 0.8).

(6) The gain effected in the performance of the insulation by the use of intersheaths.

(7) The reduction in the capacity current at light loads, or when starting up.

(8) The improvement in step-up and step-down transformer and line "regulation."

(9) The improvement in the hysteresis loss at lighter loads.

(10) The limitation of initial capital outlay to the natural growth of the load.

(11) No waste space in the centre of the cable.

(12) Assuming that the line can be made self-exciting, the difficulty in connection with feeding the capacity currents to the line disappears, and very much longer transmissions can be attempted than would otherwise be practicable. In fact, the disadvantage, as compared with direct current, largely disappears, and the two appear on a substantial equality—at any rate as regards line regulation.

As compared with 30,000-volt three-core cables there are the following disadvantages:—

(1) Owing to the separation of the phases the power factor of the load is more marked on line regulation at any voltage less than 100,000.

(2) The induced currents in the lead sheathing are considerably increased where the cable centres cannot be kept within 6 or 7 in.

(3) The cost of the cable is higher, for equal copper section, due to the extra lead sheathing required and to the triple impregnation needed for the three insulations.

The comparative costs of 30,000 and 100,000-volt schemes are:—

Scheme A.—(30,000 volts).	£
Buildings	10,000
Oil switches (including bus-bars)	26,000
Transformers	60,000
Station cables and bus-bars, &c.	3,000
Trunk cables, (including laying, excavating and re-instating streets	...1,000,000
Total	£1,099,000

Scheme B.—(100,000 volts).	£
Buildings	25,000
Oil switches	30,000
"Major star" transformers	52,800
"Hexagon" transformers	60,000
Station cables, bus-bars, &c.	5,000
Trunk cables	400,000
Total	£572,800

Note.—If the sub-station load be used to feed the capacity current, the above total cost will be reduced to £535,000.

Discussion in London.

Supplementing his paper at the Institution on December 7th, Mr. Taylor said that three firms of cable manufacturers had undertaken to make, lay, and guarantee for a year cables to conform with the requirements set out in the paper.

Mr. C. P. Sparks characterised the paper as highly controversial. Transmission over long distances was becoming more frequently necessary owing to the development of water-power resources, and deposits of fuel which could not be transported economically. The author, in his comparisons, did not mention overhead transmission, but analysis would show that the advantages of the overhead system would preclude the use of underground cables. Referring to the progress of these cables, he said that the dielectric of Ferranti's 10,000-V cable in 1890 was ⅛-in. thick; in 1913 the same thickness was employed in 20,000-V cables. Hysteresis losses had been halved in the last few years, and to-day 33,000-V cables, with the same thickness of dielectric, were in use. He thought that cable makers were able to make and guarantee cables for transmissions of more than 40,000-V pressure, and they were not at the end of possible developments. In his opinion armoured cables were essential. In long lines a regulator was justifiable, both from the points of view of capital and running costs.

Dr. Fleming said that in view of the coming electrification of main-line railways when h.p. underground transmission would be adopted the paper was very opportune. The important part of cables was their dielectric. The dielectric strength of air increased with its pressure; could not compressed air be used as a dielectric for long-distance lines, employing sealed copper tubes? Or would the ionisation of the air by the high pressures used finally break down the insulation? Here was a field of investigation which he would like to see some enterprising manufacturer take up.

Mr. C. J. Beaver said that the use of intersheaths was suggested in 1906 by Doctors Morris and Russell, and since then useful research in this direction had been carried out by Mr. Atkinson and other members of the Institution. The author had increased the commercial value of intersheaths by considering them as current carriers, and not merely as potential distributors. The author's demands upon cable makers, although of unusual form, were not exorbitant. With regard to impregnation, there was always a doubt as to the interior condition of a cable after treatment. The "prior" method of impregnation did away with this. The paper was impregnated before its application, and to prevent future occlusion of air it could be applied under compound. British cable makers did not accept Clark & Shanklin's limits; 50,000 V per cm. of dielectric was being employed. He hoped that he had said enough to prove that British cable makers would not stand in the way of the developments outlined.

Mr. P. V. Hunter said that British cable makers had progressed on definite and stereotyped lines with regard to the form of conductors. dielectric stresses, &c., and the result had been perfect stability. Mr. Taylor wished to break away from these traditions, but he (the speaker) could not help feeling that Mr. Taylor had not done justice to the British manufacturers. A 66,000-V, 3-core cable run at 2½ times greater current density could not be more speculative than the cable proposed by the author. The latter seemed to have given up the idea of attempting to increase the dielectric capacity and endeavoured to progress by a re-arrangement of circuits. He did not think the suggested schemes were practicable. The complication, the number of bus bars, and the amount of switching equipment would be appalling. The author had apparently been unable to usefully employ the intersheaths without using six points, otherwise he would have been content with three.

Mr. J. S. Highfield said that the paper showed once again how advantageous it would be to be able to generate, transform, and transmit direct current. He mentioned that there were in existence single-core cables working at 100,000 V with a dielectric of ½ in. thickness. Referring to Dr. Fleming's suggestion, he said that experiments on these lines had already been carried out. With a ½-in. conductor inside a 4-in. dia. iron tube, with air insulation at a pressure of 120 lb. per sq. in., it had been found possible to transmit energy at 60,000 V. The scheme had not been tried for more than one core in a tube. Was he not correct in stating that the author could carry out his system by the use of a 6-phase transformer and two concentric three-core cables?

Mr. P. Dunsheath criticised a number of features in the scheme outlined in the paper. He said that single-core cables had great possibilities, but they were not the most suitable in this instance. The system was not exactly novel, as his (the speaker's) firm already held a patent for a similar but simpler system. It had not been proved that a cable always broke down at the point of maximum potential; there was material for investigation in this direction. He was of the opinion that intersheaths were useful to distribute the heat of the dielectric but not to increase the potential gradient. He had found that three 3-core, 37/.090 cables would be used to carry the load specified in the paper. The speaker displayed tables showing that the use of ordinary cables involved a much smaller annual kWh loss than the author's system.

Dr. Cramp considered that the use of lead-covered single-phase cables for long-distance transmission was now a certainty. The loss in single-phase armoured cables was less than would appear from calculations. Experiments were now in progress which would show that the author, in his figures, had kept on the safe side. If small gaps were left at joints of a partial conductor or insulator carrying a capacity current there would be discharges sufficient to cause serious trouble.

Mr. Taylor, in replying to the discussion, said that although suggestions for improved methods of dealing with his load had been made the speakers had carefully avoided the question of the value of the copper in the cables. No doubt the alternative schemes could deal with the load, but at what cost? He had found that to obtain the same potential gradients and losses eight cables would be required. If Mr. Beaver could improve the cables as he stated the pressure could be put up to 130,000 V immediately. Mr. Hunter need not be alarmed about complication; rotary converters, with their numerous phases, were quite as complicated. The scheme would be very easy to carry out; the basis of it all was the keeping down of annual losses to a reasonable figure. He did not agree with Mr. Highfield that a 6-phase transformer would serve the purpose. The advantage of the hexagon arrangement was that the potential was limited to 60,000 V. The consideration behind the paper was that 1 per cent. of the power transmitted was worth £80,000 when capitalised.

NORTH-EAST MIDLANDS ELECTRICITY DISTRICT.

Resumption of Commissioners' First Inquiry.

At the Town Hall, Sheffield, on December 5th, the members of the Electricity Commission, who are inquiring into a proposal by the Sheffield Corporation for the establishment of a Joint Electricity Authority for the above-named district, resumed their sittings, which were adjourned indefinitely on October 21st.* The area proposed to be covered by the authority is roughly 1,030,000 acres, having a population of 1,320,000, and includes Sheffield, Rotherham, Chesterfield, and Doncaster, and stretches from Buxton to Scunthorpe and Matlock and Retford to Doncaster. The proposal of the Sheffield Corporation is supported by the Rotherham Corporation, but is objected to by various other interests in the area.

The case for the Lincolnshire Ironmasters' Association was put before the Commissioners by Mr. Arthur Crook, one of the managers of the Fordingham Iron & Steel Co. and of the Appleby Iron Co., Ltd., who said that the members of the association generated their own electricity from the available waste gases and waste heat. This supply would be sufficient for their requirements for many years to come, and the plant at present installed was of 24,000 kW capacity. A good deal of waste heat in the district, which was not now being utilised, could be sold to the proposed authority, but the cost of the lines and mains would be considerable.

Mr. F. Beverley, on behalf of the Ironmasters' Association of Scunthorpe, opposed the proposed scheme, first, on financial grounds. The figures given by the promoters were fallacious, and if and when the proposed Authority was set up, it would not be able to supply energy in bulk at the prices which the promoters had suggested. The suggestion that if there was such a station energy might be used by the farming community in the surrounding district, was not correct, because it would not be a paying proposition. Too much land would be lost on the headlands, and that loss would be accentuated because of the large number of dykes and ditches in Lincolnshire. Again, the promoters could not tell them where the scheme was going to benefit Scunthorpe.

Mr. W. P. Donald, on behalf of the Frodingham Urban Council, agreed with the Lincolnshire ironmasters' view of the matter. It was a case of industrial and electrical development of necessity taking place from within, and not from without. If they were included in the area, then there would be interposed a body between the Electricity Commissioners and themselves. They were able to give a cheap and abundant supply to the area themselves without having to put their proposals through the medium of another body.

Mr. F. Abady, on behalf of the Sheffield and Rotherham Manufacturers' Electrical Supply Committee, strongly supported the setting up of an efficient Joint Electricity Authority. In 1917 the manufacturers had come together on their own initiative and had asked that such an authority should be set up

Mr. Harker, opening the case for the Derbyshire and Nottinghamshire Electric Power Co., said that no case had been made out against the company regarding failure to carry out its obligations and, therefore, it would be unfair to make the Order asked for. He submitted that the Commissioners in law could not accede to the request of the Sheffield Corporation unless they made it a condition of their order that its generating stations at Blackburn Meadows and Neepsend were transferred to the Joint Electricity Authority. Unless Sheffield was prepared to accept such a condition he submitted that in law the Order could not be made.

Mr. Bidder, on behalf of the railway companies, said that another scheme had been outlined to him, and he was anxious to know what he was to do with regard to his witnesses.

The Chairman (Sir John Snell) said that what purported to be a scheme had been submitted by the power companies the previous week. The Commissioners could not deal with that scheme, as no notification had been given of it. Plenty of time had been given the power companies to produce a scheme if they wished. It was not really a scheme, but a proposal as to representation.

Mr. Harker suggested that, in the event of the Sheffield scheme not going, on his alternative should be put forward.

On December 6th Mr. R. Harker rebutted the suggestion that the company had been asleep, and pointed out various preparations which had been made by the company to supply a greatly increased demand in the future, including an arrangement with the Yorkshire Electric Power Co. for the purchase of the Spondon station and the conversion of the Ilkeston station. The present issued capital of the company was about £371,000 and the authorised capital was £2,100,000. it had further entered into commitments to the extent of £560,000 in respect of the Spondon station and other works. He claimed that it was in the position to raise the necessary finance for its developments. The company was now controlled by the Midland Counties Co. and so far as the further expenditure, which would be necessary with respect to the present electricity district was concerned, another factor was the Power Securities Corporation, which had an authorised capital of £1,000,000. This company was ready, willing, and

*Elec. Rev., October 27th, 1922: p. 607.

able to supply its area and the whole of that area should be excluded from the control of the proposed Authority.

Mr. William Sheaths, managing director of the Power Securities Corporation, said that his Board would be able without the slightest difficulty, not only to assist the Midland Counties Co. in raising money, but temporarily to put funos at the disposal of other companies pending their own issues. The price of the Swanson station was £325,000.

Witness was shown by Sir Harry Haward it he considered "the difficulty in arriving at what was the real position of the different undertakings" (the Power Co., the Midland Co., &c.,), was an advantage when they were dealing with such a public matter as the supply of electricity. The whole of the share and loan capital of the Derbyshire and Notts. Co. was owned by the Midland Counties Electrical Supply Co. and that company was not a supply company, but entirely a finance company, and made its profits out of the raising of money for different concerns.

Witness: No. It makes profits from dividends and interest it receives from the companies.

Sir Harry: Who owns the bulk of the shares of the Midland Counties Co.? The public.

Sir Harry: Are any owned by the Power Securities Corporation?

Witness: There may be 5,000, not more; a management agreements exists between Messrs. Balfour, Beatty & Co. and the Midland Counties Co, and in certain cases they manage the underlying companies. There is an independent Board of the Derbyshire & Notts. Co. and of the Midland Counties Co., &c.

Sir Harry: The independent Boards of the Derbyshire and Notts. Co., the Midlands Co., the Power Securities Corporation, and Messrs. Balfour, Beatty & Co., have to be paid for their services?

Witness: We have to live, Sir Harry.

Sir Harry: The ultimate result is that the consumer of electricity in the area of the company has to pay in one way or another for all those services?

Witness: Certainly not. The Power Securities Corporation does not get paid for any services.

Sir Harry: The impression one gets from the interworking of these companies is that there is a great deal of work to be done and paid for in connection with the supply of electricity.

Mr. J. H. W. Laverick, Vice-President of the Institute of Mining Engineers, managing director of the Tinsley Park Colliery Co., and a director of Messrs. J. & G. Wells, colliery owners, and the Renishaw Iron Works near Chesterfield, said his company (Renishaw Iron Works) had been in negotiation with the Derbyshire & Notts. Power Co. for some time for supplying it with electricity from the waste gases of the blast furnaces, through the medium of steam turbines. No orders had yet been placed for the erection of generating plant, but the two Boards of the companies concerned had each approved of the scheme going forward, *i.e.*, to form a company near Chesterfield with a capital of £50,000 to install turbines and water-tube boilers and generate electricity. The proposal was, first, to supply his own iron works and then supply collieries belonging to Messrs. J. & G. Wells. Any surplus would be sold to the Derbyshire & Notts. Co. At Renishaw they had rebuilt a blast furnace and contemplated putting down another. The original scheme was for an output of 2,000 tons of iron per week, which would have given 9,000 b.h.p. Owing to the depression in the iron trade they had to postpone the bigger scheme with regard to the generating plant, but as trade improved they hoped to go back to it.

The Town Clerk of Chesterfield said that the proposal to group Chesterfield with Doncaster for representation on the Authority was impossible.

On December 7th Mr. H. F. Bidder, representing the Derbyshire and Nottinghamshire Coal Owners' and Ironmasters' Committee, said the Cannock Chase district was a small one not electrically developed and there were no linking-up systems. The Cannock Chase Colliery Co. was at present promoting an order for itself; he would not oppose any scheme that would tend to further development, but did not believe the method put before them would assist in their development. To a Joint Advisory Board he had not the slightest objection, providing the members were properly chosen. They had been in negotiation with the power companies in order to develop electricity supply and there was a [illegible] considered was practical.

Sir Harry Haward: I thought the evidence was all the other way.

Mr. Bidder said his Association would have more confidence in dealing with the power companies about which they knew all there was to be known, which depended for their life on being run on a commercial basis, than it would if faced with a body not dependent on the [illegible] economically successful and dealing with public money. The Sheffield scheme, he suggested was [illegible] brought forward because the authority was afraid its undertaking was going to be taken over by some Joint Authority under the Act.

Mr. A. G. Tupton, of [illegible] & Co., Leeds, a director of the North-Eastern Railway Co., and chairman of the Yorkshire Electric Power Co., opposed the scheme. Any interference with the powers granted to his company would be detrimental.

Mr. William B. Woodhouse, engineer and manager of the Yorkshire Co., objected to the area in which he had powers being divided. The dividing line in that district ran through a number of collieries which his company supplied. If two parts of his areas were to come under different control the question of mains would be a difficult one, and it would very substantially discourage development across the boundary line. He had undertaken to supply 30,000 kW in the Rotherham, Doncaster, and Stockbridge districts, the power therefore being obtained either by extending his own plant or from Sheffield or Rotherham. He had been hampered by the uncertainty of what the position was going to be and could not indefinitely promise to make extensions unless he knew he was going to be permitted to develop his undertakings on the lines he proposed.

Sir John Snell: The time will come when the available sites at Sheffield, Rotherham, and near Doncaster, even including the scheme at Mexboro', may not be sufficient to meet the industrial demands of this district.

Witness: We are all agreed upon that.

The Chairman: The suggestion has been made that at some future date the district may be given to the River Trent?

Witness: Yes. The distance from the River Trent to Sheffield is about 30 miles and from Mexboro' to Ferry Bridge approximately 15 miles. The Ferry Bridge station would develop 135,000 kW.

Mr. J. B. Feltham, engineer of the Mexboro' Urban District Council, did not think there was any necessity at present for a new station at Mexboro', which site was good enough for about 90,000 kW.

Mr. R. A. Sheppard was prepared to assist in the formation of a Joint Committee, but objected to recommend the co-ordination of the various organised undertakings and the imposition of a Joint Authority for which mere establishment charges for clerks, offices, &c., a sum of £19,000 of £20,000 would be required. It was assumed that the duty of the Commissioners was to appoint a Joint Authority. It was nothing of the sort; that body had no authority to break contracts and could not promote a company to do what it could not do itself.

Sir John Snell: Our legal adviser informs me that your remedy, if you have a remedy, is in the common process of law. The Commissioners are very fully advised on the facts of the case; there is an agreement between the Sheffield Corporation and the Yorkshire Power Co., dated 1918, an agreement is to be made between the Rotherham Corporation and the Power Co., and an agreement was made at the time the Rotherham Corporation was making the Bill. We shall take these facts fully into consideration when dealing with the administration of this district.

Mr. W. B. Woodhouse, on behalf of the Electrical Distribution of Yorkshire, Ltd., submitted that the proposal for a Joint Authority should not be approved. There had been no attempt to show that the distribution could be carried on more cheaply than his company could do it.

Mr. W. Bagshaw, town clerk of Doncaster, said that nothing had ever at any time been either said or done to justify Sheffield Corporation coming to the conclusion it had with regard to Doncaster. Sheffield and Rotherham had made it perfectly clear all the way through that they intended to have 50 per cent. of the representation and the natural inference to be drawn was that those two Corporations intended to have the controlling influence over the Joint Authority. Doncaster was opposed to the scheme because it was not the most effective method of dealing with the electricity supply. The needs of the district would be better met by an Advisory Committee, and it would be more advisable to make an endeavour by voluntary co-operation to bring about the result aimed at.

The inquiry was concluded on December 8th. Sir Harry Haward was in the chair, and stated that the Greasborough U.D.C. approved of the Sheffield Corporation scheme as amended. He understood that Doncaster was in favour of some kind of an Advisory Board.

Mr. Windle: That is so.

The Chairman: An Advisory Board has to do more than give advice; it has to take certain action.

Mr. W. P. Donald, addressing the Commissioners on behalf of the West Riding District Councils Association, asked whether the promoters intended to transfer their stations to the Authority to be set up, or to rent those stations? If so, at what price? What price would the respective areas have to pay for electricity? It would require a good deal of faith to convince him that Mr. Woodhouse (Yorkshire Electric Power Co.) was prepared to hand over his plant as a free gift. The proposals which the promoters put forth for the first five years of the scheme were nothing more than the linking up and extension of existing stations. There was nothing in the proposals which could not be done by a Joint Committee. His clients preferred the Yorkshire Power Co. and the Electrical Distribution of Yorkshire. If a Joint Authority was set up, the Yorkshire Power Co. should be part and parcel of that authority.

Mr. W. E. Hall, Town Clerk of Sheffield, then summed up the case for the promoters. The real question was the interest of the consumers, and he claimed that his proposals had successfully withstood criticism. The principal objection

was with regard to the transfer, either by sale or lease, of the existing stations—at Sheffield and Rotherham especially—to the Authority. Sir John Snell had made a suggestion on the matter, and he (the Town Clerk) had lost no time in calling together the sub-committee, which was instructing him to prepare a full report on the whole question.

Up to the present the promoters had looked upon representation as vital, and felt it would be more helpful to Sheffield and Rotherham in considering the fate of their stations if they knew the general ideas arrived at by the Commissioners on the main proposals. Sheffield and Rotherham had responsibilities for supplies to some of the largest consumers in their districts, and they would hesitate if they were asked to transfer those stations to an Authority on which they had inadequate representation.

Objection had been taken to the sum of £20,000 proposed as the cost of administration; a smaller sum would have been criticised as inadequate. He did not think the £20,000 would be spent. There was reasonable ground for anticipating, before very long, a considerable demand for railway power. The colliery owners' opposition was a direct challenge to municipal administration. Sheffield and Rotherham still thought they should have a 50 per cent. representation on the Authority; an Advisory Board would not be effective in an area like that.

In closing the inquiry the Chairman said the Commissioners very much appreciated the public spirit of Sheffield in promoting the scheme, but the parties had set up a very difficult problem to unravel.

HIGH-POWER THERMIONIC VALVES.

Recent Developments.

At the Institution of Electrical Engineers on December 7th, 10-kW thermionic valves and parts, representing recent developments of the original thermionic rectifying valve made by Dr. J. A. Fleming, were exhibited on behalf of the president, Mr. F. Gill.

The valves are used for radio transmission and are of two types—namely, the rectifier (2 electrodes), and the oscillator or amplifier (3 electrodes). The difference between the two types is that in the rectifier the third electrode (the grid) is omitted. A special feature of the tubes, which are reproduced in the accompanying illustrations, is the water-cooled anode, consisting of a copper tube, which is fused to the glass bulb by means of a special copper-glass seal. This joint is perfectly gas-tight and is unaffected by the heating and cooling occurring both during manufacture and operation. When in service, the tube is mounted so that the anode is surrounded by a metal jacket through which cooling water circulates.

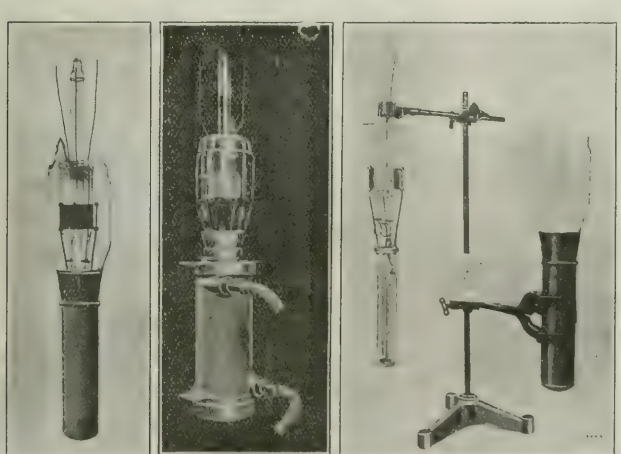


Fig. 1.—A 10-kW Thermionic Valve.

A further exhibit showed the detailed assembly of the filament, grid, and anode, the nature of the copper-glass joint upon the latter being readily seen. The above-noted features can be well seen in the reproduced photographs which show (*a*) the 3-electrode 10-kW value; (*b*) the 3-electrode tube mounted in its water jacket; and (*c*) the filament, grid, and anode before final assembly.

The following are the characteristics of the valve: Normal filament current, 24.5 amps.; normal filament voltage, 32 volts; normal plate voltage, 10,000 volts; power taken by tube (including losses in tube), 15 kW; and output power delivered from tube, 10 kW.

A new thermionic valve, which requires a 250-h.p. engine to supply it with electrical energy, is referred to in the *T. & T. Age*. It is 3 ft. long and from 4 to 6 in. in diameter, and it can be used to generate high-frequency oscillations, to detect and modulate them, and to act as an amplifier. When used to generate h.f. oscillations, it is capable of an output of fully 100 kW. It is explained that several years ago Mr. W. G. Housekeeper, of the Bell Research Laboratory of the Western Electric Co. in New York City, became interested in cheapening the manufacture of telephone switchboard lamps; he aimed to eliminate the platinum wire used for the leads to bring the filament-heating current through the glass wall of the lamp. His study showed him that copper wire possessed one of the requirements necessary, *i.e.*, that the molten glass should "wet" or adhere closely to the wire. Copper and glass have quite different coefficients of expansion, and Mr. Housekeeper found that only by giving the copper wire a peculiar cross-sectional shape could he prevent the glass cracking.

As a result of experiments, a tube design successfully involving copper seals has been worked out. The plate takes the form of a large copper thimble with thin walls. This is attached by a vacuum-tight seal to a glass structure which supports the filament and grid and through which the lead wires are carried. The filament lies within the cylindrical grid and the whole structure is placed within the copper anode and concentric with it. Cooling water is circulated around the outside of the anode, but does not enter the evacuated space within. It is, of course, necessary that the anode be very free from minute holes which would tend to admit air or water vapour, a requirement which has led to the drawing of anodes from a single disk of copper.

At present the new water-cooled tubes are being constructed in two sizes, the large one capable of delivering 100 kilowatts, and a small one whose capacity is ten kilowatts. The anode is 14 in. long and 3.5 in. in diameter. The filament is of tungsten wire and is .060 in. in diameter and 63.5 in. long. The current required to heat the filament is 91 amperes and the power consumed in it is six kilowatts. The filament leads are of copper ¼ in. in diameter, and are sealed through the glass wall by means of a special disk seal. To those who are at all familiar with glass blowing, it will be apparent that the handling of the parts of this tube during manufacture presents a task of no mean magnitude, and numerous fixtures have been devised to assist in the work. The significance of this tube development to the radio art can scarcely be overestimated.

It will be recalled that at the first all-British Wireless Exhibition in October last the Mullard Radio Valve Co., Ltd., amongst its large and representative display of thermionic valves exhibited large silica valves, including a 4-kW rectifier and 1-kW and 4-kW transmitters. Mr. C. F. Elwell, in the course of a lecture in South Africa some weeks ago, claimed that the British Admiralty was the inventor of this type of valve, silica having been chosen for its heat-resisting qualities, for which his firm had made many hundreds of such valves. They were of two types: one dissipated 2.5 kW at the anode and 5 kW in the aerial, and the other 2 kW at the anode and 8 kW in the aerial. Their 8- and 10-kW types were only 4 or 5 in. in diameter and about 12 in. long. They had succeeded in making a 25-kW silica valve, which was being tested by the Admiralty.

The claim that a million-watt vacuum tube has been developed in the General Electric Research Laboratory in Schenectady, N.Y., by Mr. J. S. Payne, Junr., should also be mentioned. It is said to be a magnetron, involving the principle of magnetic control as developed by Dr. Albert W. Hull, of the laboratory. Its output is about 40 amperes at 25,000 volts, and it serves as a rectifier to change alternating to direct current and also to change direct to alternating current of any frequency or to convert low-frequency a.c. to high frequency a.c. It is thought that one tube will be sufficient to carry radio telephonic signals across the Atlantic.

According to the *Journal of Electricity and Western Industry*, the weight of the 1,000-kW valve is only 60 lb. Its filament is a rod of tungsten, and if it were drawn out into filament of the size used in the ordinary lamp it would reach a distance of 50 miles. The light given off during the operation of the tube would be about 40,000 c.p.

This magnetron consists essentially of a water-cooled cylindrical anode 30 in. long and 1¾ in. in diameter. In the axis of the anode is a tungsten filament 0.4 in. in diameter and 22 in. long, excited by 1,800 amp. at 10,000 cycles, requiring about 20 kW. The magnetic field is produced by this large heating current from the cathode to the anode during a por-

tion of each half cycle of the current passing through the cathode, this action taking the place of that of the grid in the three-electrode tube. The electron current to the cathode is thus interrupted [illegible] times per second. By the use of properly-tuned [illegible] can be used for the production of high-frequency [illegible] or radio or any other purpose. This particular type [illegible] supply 1,000 kW of 20,000-cycle power at an efficiency of 70 per cent., operating with an anode voltage of 20,000 volts d.c.

For radio purposes efficiencies of 70 and 80 per cent. are eminently satisfactory, but for other engineering purposes they are not as high as would be generally desired. Another line of development is, therefore, in progress, *viz.*, the production of tubes of higher efficiency as well as tubes of larger output. The progress in this direction is more difficult, and is apt to be slower than in the direction which has thus far seemed more important.

PARLIAMENTARY NOTES.

[By our Special Parliamentary Reporter.]

Extension of Finsbury Park Tube.—On December 5th Major Malone asked whether with a view to finding employment for a great number of men, facilities could be granted for the extension of the tube from Finsbury Park through those districts where a large population, through their district councils, were asking the Minister of Transport and the Minister of Labour to receive deputations pressing for the extension of this tube. Colonel Ashley replied that he had agreed to receive on December 11th, in conjunction with the Parliamentary Secretary to the Ministry of Labour, a deputation from the Councils concerned.

Deposits of Telephone Users.—On December 5th Mr. Short asked the Postmaster-General whether he was aware of the excessive charges claimed in the form of deposits on the accounts of users of the telephone; and whether these charges could be revised. Mr. N. Chamberlain said that the deposits required from telephone users were sufficient to cover approximately two-thirds only of the credit given. Under the previous tariff local calls were paid for in advance, usually annually, and trunk calls monthly in arrear; deposits in respect of trunk calls were generally required to cover the total credit. Even allowing for the increased deposits the subscriber received more credit under the new system than under the old, and he was not in a position to reduce the scale of deposits now required.

The Empire Wireless Chain.—On December 5th, Mr. Hurd asked the Postmaster-General to state the present position of negotiations with the governments of Canada, Australia, and the other Dominions, and India on the subject of co-operation in the imperial wireless chain scheme of the British Post Office. Mr. N. Chamberlain replied that the Government had not yet had an opportunity of considering the present situation in regard to the Imperial Wireless Chain, and he was not in a position to make any statement on the subject.

Electrical Power in Agriculture.—On December 6th, Lieut.-Col. Murray asked whether investigations were being made into the utility of windmills, with a view to providing cheap electrical power for agricultural purposes, Sir R. Sanders, Minister of Agriculture, replied that investigations were being commenced, but he feared that no definite results could be expected for some time.

Special Orders.—On December 6th, on the motion of Lieut.-Col. Ashley, Parliamentary Secretary to the Ministry of Transport, a number of Special Orders made by the Electricity (Supply) Acts, 1882 to 1922, were approved.

Damming the Severn.—On December 7th, Mr. D. Grenfell asked the Minister of Labour whether he had considered the proposal for utilising tidal energy by the construction of a barrage across the mouth of the Severn; and whether he was prepared to introduce a scheme to give effect to this project in the interests of the profitable employment of labour and capital.

Col. Ashley replied that the Water Power Resources Committee had considered the subject and had expressed the view that the technical information available was not sufficiently precise to enable it to express a final opinion. The Committee recommended that a Technical Commission should be set up by the Board of [illegible] in connection with the Ministry of Transport, to investigate the possibility from a commercial standpoint, but owing to the financial position and the necessity for drastically curtailing the expenditure of Government Departments, it had not yet been practicable to set up the proposed Commission.

Party-line Telephones.—On December 7th, Mr. Gardiner asked how many applications had been granted for party-line telephone services under the scheme entitled "Special terms to farmers and others," in England and Scotland, respectively.

Mr. N. Chamberlain said that [illegible] the beginning of this month there were 5,200 subscribers in England and 660 in Scotland.

Lerwick Wireless Station.—On December 7th, Sir Robert Hamilton asked the Postmaster-General whether he was aware that the wireless station at Lerwick was in a bad state of repair; whether it was intended to maintain this station for meteorological purposes only; and, seeing that such purposes could be equally well served by the station at Wick, would he have the station at Lerwick closed. Mr. N. Chamberlain replied that the wireless station at Lerwick was taken over from the Admiralty by the Post Office at the termination of the war in order that it might be available for maintaining communication with the mainland during interruptions of the Shetlands cable. It was subsequently transferred to the Air Ministry, who desired to use it as a meteorological station, but the right was reserved to take it over for P.O. purposes when the cable was interrupted. The purposes for which a meteorological station was required at Lerwick would not be served by a station at Wick. Repairs at the Lerwick station had recently been carried out by the Air Ministry.

Insurance by Industries.—Mr. D. G. Somerville asked the Prime Minister whether the Government intended to consider in the Session of 1923, the introduction of insurance by industries; and whether, in that case, it intended first to establish a public inquiry as to the best procedure to be adopted. Mr. Bonar Law replied: "I do not think there is any possibility of dealing with this subject next year, but it is one with regard to the examination of which preliminary steps are now being taken."

West Indian Cables.—On December 8th, Mr. N. Chamberlain, Postmaster-General, moved that the agreement dated November 29th, 1922, between the British Government, the Canadian Government, the Crown Agents for the Colonies, and the West India & Panama Telegraph Co., Ltd., be approved.

The resolution was agreed to.

Gravesend-Tilbury Tunnel.—On December 11th, Mr. William Thorne asked the Minister of Labour whether he was aware of the necessity for the construction of a tunnel under the Thames between Gravesend and Tilbury; and whether, in view of the fact that the scheme would provide useful employment both upon the construction of the tunnel and upon the building of a length of new railway, he would take whatever steps were necessary to get the scheme commenced.

Col. Ashley, Parliamentary Secretary to the Ministry of Transport, said that the question of constructing such a tunnel was one for the consideration of the railway companies and local and other bodies concerned. Statutory authority would be required for the work and he was not aware that any detailed scheme had at present been formulated.

The Beachley Power-House.—On December 11th, Mr. Wignall asked the First Commissioner of Works if he was aware that the Government power-house at Beachley, Gloucestershire, generated electricity at a cost of 2¼d. per kWh, supplied it at the same figure to the Chepstow Electric Power Co., and that the latter company then retailed it to the consumer at 10d. per kWh, thereby making a profit of 7¾d. per kWh; if he was aware that this company had no expenses save the cost of collecting; and if he would take steps to ensure that the consumer be supplied from the Government power-house at a much cheaper rate. Col. Ashley said he had been asked to reply. He understood that the price now charged for electricity generated at Beachley was 4d. per kWh, and not 2¼d. This supply represented only a small supplementary supply to that generated by the Chepstow Company itself. The price charged by the company for lighting was the same for the whole of its area, and he understood that its operations during the last two years had resulted in a loss.

Electricity in Mines.—In reply to questions raised during a discussion upon a paper on the above subject, read before the Yorkshire Branch of the National Association of Colliery Managers, Mr. John Bentham said that generally the transmission of large horse-powers in mines by d.c. was rendered prohibitive by the size and cost of cables. Direct-current motors appeared to be more in favour with some people on account of their better starting torque and speed regulation. At the same time, the use of a.c. cascade motors had good speed regulation, and in some respects were preferable. Direct-current was preferred for tramway systems, although this often involved the conversion of a high-pressure a.c. supply. If they could keep a reasonable power factor he thought that an a.c. plant was as efficient as a d.c. system, if not better. Regarding the sizes of switchgear, Mr. Bentham said that, with a h.p. supply on the main board of the power house, it was best to standardise all the cubicle units, if possible, and generally 150/200-A sizes were quite suitable, although circumstances might necessitate larger sizes. In the case of medium-pressure supplies, say 500 V, dealing with currents up to 2,000 A, the only thing possible, if it was desired to keep one universal cubicle spare, would be to take the largest size and change the series overload coils in the switch to suit the circuit.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Holophane "Filterlite."

A new development of the "Holophane" principle of lighting is announced. This is the "Filterlite," illustrated in fig. 1, a totally-enclosed, semi-direct decorative bowl fitting in two parts. The exterior surface is smooth and plain, control of the light rays being effected by an interior prismatic construction which is designed to minimise glare and give wide distribution. The top diffuser, besides protecting the lamp and the prism surfaces from the accumulation of dust, diffuses the upward rays and eliminates the sharp

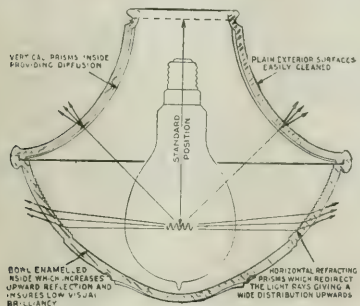


Fig. 1.—The Holophane "Filterlite."

bright ring of light usually attendant upon semi-indirect fittings. The lower diffusing zone has a permanent enamelled inner surface with an ornamental exterior design which gives a pleasing effect whether the bowl is illuminated or not. The "Filterlite" should be very suitable for large rooms, offices, restaurants, &c. The makers are Holophane, Ltd., Elverton Street, Vincent Square, S.W.1.

The "Angelus" Dual-reflector Fire.

Fig. 2 illustrates the "Angelus" dual-reflector fire made by British Brass Fittings, Ltd., 26 & 27, Hatton Garden, E.C.1. It takes its description from the arrangement of the element. This consists of a number of coils mounted in a frame of nickel-plated steel, and lies horizontally in the front of the



Fig. 2.—The "Angelus" Dual-reflector Fire.

fire. Beneath the coils is a polished detachable plate which reflects the rays on to a polished coppered parabolic reflector which forms the back of the fire. The appliance is made with elements ranging from 1,500 to 3,000 W. and the larger sizes are fitted with three-heat switches. The fire is 26.5 in. high, 21 in. wide, and 12 in. deep; it weighs 17 lb.

A Battery-Charging Rectifier.

A compact form of current converter is made by Mr M. W. Woods, 146, Bishopsgate, E.C., specially designed for battery charging. The machine (fig. 3), consists of a synchronous motor fitted with a two-part commutator which acts at such a point in the a.c. wave that sparking is practically eliminated. The rotor is excited by current rectified by the commutator, and synchronism is readily effected by closing the switch and giving the spindle a sharp twist in a clockwise direction. No other starting device is necessary. The

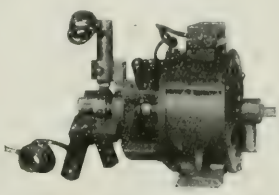


Fig. 3.—A Battery-Charging Rectifier.

rectifier is supplied with one brush for use direct from the mains, and complete with resistance, but two extra brushes and a small auto-transformer can be supplied to utilise both halves of the a.c. wave. If required a teak switchboard can be supplied, on which are mounted two cut-outs, a voltmeter, an ammeter, and two s.p. fuses, an auto-transformer, and a battery switch. The standard size is arranged to give an output of 3 A at 15 V from a 100/250 V, 50/60-cycle current.

A Burglar Alarm.

A simple and cheap device (fig. 4), has been evolved by Mr. W. S. Edwards, of 19, Smith Street, Goswell Road, E.C., for use as a burglar alarm. It consists of a couple of spring plungers of the type used in lampholders, mounted on an insulating block with the plungers in contact, the circuit being completed as usual with a bell and battery. The alarm is set

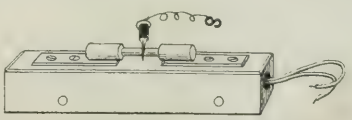


Fig. 4.—A Simple Burglar Alarm Contact.

by inserting a little insulating wedge between the two plungers, the wedge being attached by a cord and hook to any object, such as a window curtain or blind, or a door or window, which is to be guarded. Any movement of that object withdraws the wedge and springs the alarm.

Telephone Call-box Apparatus.

The firm of Manufacturers (Liverpool), Ltd., 18 and 20, Park Lane, Liverpool, has patented a new calling and prepayment apparatus for use in call boxes. It is stated that this can be connected to any existing telephone instrument in a few minutes, and it permits the use of halfpence, pence, sixpences, and shillings. The instrument is set for a certain "originating fee," and when this has been inserted and a pointer turned to "calling exchange" on a dial, the operator replies and indicates the cost of the call. As the coins are inserted in their respective slots, and the pointer turned to another position, the operator is informed by signals that the correct amount has been paid, and makes the connection; the coins then fall into a receptacle which can only be opened by the telephone proprietors. Should the call number be engaged, or the call rendered invalid by other circumstances, the pointer can be turned in the opposite direction, and this will allow the coins to fall out of their guides through slots, and they are thus returned to the caller. Upon the replacement of the receiver all circuits are rendered inert. Means are provided by which coins inserted in the wrong slots, or that do not coincide with the dimensions for which the instrument is adjusted are returned, and the usual devices for the prevention of fraud are embodied in the design.

The Unit-Ad-Shade.

An ingenious advertising device is being introduced by the Unit-Ad-Shade Co., of 133, High Holborn, W.1, which enables small interchangeable letters to be clipped on the edge of a lamp shade, giving an illuminated message, for use in shop-windows, &c.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1

32,145. "Electric signal apparatus." A. C. Knight. November 24th.
32,149. "Wireless [illegible]." L. Bircher. November 24th.
32,161. "Illuminated signs." W. H. [illegible]. November 24th.
32,179. "Crystal detectors for receiving wireless signals." J. V. Rushton. November 24th.
32,189. "Spark plugs." H. Fairbrother (Meaker Spark Plug Co.). November 24th.
32,206. "Galvanometers." E. Belin and Etablissements E. Belin. November 24th.
32,207. "Facsimile telegraphic systems." E. Belin and Etablissements E. Belin. November 24th.
32,208. "Transmitting and receiving graphic records by wireless signals." E. Belin and Etablissements E. Belin. November 24th.
32,218. "Systems of electric distribution." F. P. Whitaker and British Thomson-Houston Co., Ltd. November 24th.
32,223. "Radio [illegible]." A. S. Compare. November 24th.
32,228. "Electric [illegible]." L. I. M. Pennington. November 24th.
32,234. "Electric heating apparatus." G. L. Johansen. November 24th. (Norway, November 24th, 1921.)
32,240. "Electric lamps, &c." C. L. King. November 25th.
32,257. "Relay for automatic, &c., telephone systems." Coventry Automatic Telephones, Ltd., and C. C. Puckette. November 25th.
32,258. "Automatic, &c., telephone circuits." Coventry Automatic Telephones, Ltd., and C. C. Puckette. November 25th.
32,260. "Rotor windings." Ateliers de Constructions Electriques de Charleroi. November 25th. (Belgium, November 26th, 1921.)
32,278. "Thermionic valve circuits." A. W. Long. November 25th.
32,279. "Automatic accumulator switch." W. A. Jack. November 25th.
32,298. "Aerial masts for wireless telegraphy." T. G. Murray and C. E. Shields. November 25th.
32,318. "Electric starting switches." V. Breeze and A. West & Co., Ltd. November 25th.
32,342. "Railway, tramway, and road vehicles." C. E. Holdin. November 27th.
32,358. "Lamps for motor-cars, &c." H. I. F. Evernden, W. G. Hardy, and Rolls-Royce, Ltd. November 27th.
32,363. "Fire, &c., alarm." T. W. Shaw. November 27th.
32,370. "Selective switches for telephone systems, &c." G. Deakin and Western Electric Co., Ltd. November 27th.
32,372. "Electric combination lock." L. Cadenel. November 27th.
32,373. "Galvanic batteries or electric accumulators." Anglo-American Battery Co. and T. C. Rutter. November 27th.
32,374. "Electric motor control systems." Metropolitan-Vickers Electrical Co., Ltd. November 27th. (United States, November 29th, 1921.)
32,383. "Electric switch mechanism for advertising devices, &c." E. Lancaster and F. R. Smith. November 27th.
32,384. "Apparatus for making and breaking circuit of electric horn." Eural Patents, Ltd., and H. J. Waller. November 27th.
32,394. "Contact banks for electro-mechanical telephone systems, &c." H. Baron (F. Adenderff). November 27th.
32,395. "Telegraphic receiving apparatus." Creed & Co., Ltd., and J. R. Worthington. November 27th.
32,403. "Method of protecting rectifier installations." Akt. Ges. Brown, Boveri et Cie. November 27th. (Germany, December 14th, 1921.)
32,406. "Electric safety lamps for mines, &c." R. J. Plummer. November 27th.
32,421. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd. November 27th. (United States, April 5th.)
32,425. "Electric magnetos." J. Jarvis. November 27th.
32,426. "Radio signalling." R. E. H. Carpenter. November 27th.
32,439. "Automatic head-lamp control of motor vehicles." F. A. J. Green. November 28th.
32,442. "Trolleys for electric tramways." A. C. Fenwick. November 28th.
32,448. "Commutators for electric ignition systems, &c." F. W. Baker. November 28th.
32,452. "Thermionic valves, &c." E. S. Brown and G. E. Stubbs. November 28th.
32,470. "Electric batteries." G. N. Antonoff. November 28th.
32,476. "Illuminated signs for motor-omnibuses, &c." H. H. M. Shurlock. November 28th.
32,478. "Terminals for electric cells." T. W. Russell. November 28th.
32,484. "Method of securing periodic quenching in wireless receiving circuits." K. P. Hunt. November 28th.
32,492. "Radio receiving apparatus." T. L. Jones. November 28th.
32,493. "Variable resistances for grid leaks, &c." T. L. Jones. November 28th.
32,511. "Telephonic instruments." F. A. Fraser. November 28th.
32,515. "Casings for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). November 28th.
32,521. "Thermionic valves, &c." E. C. R. Marks (C. F. N. Wade). November 28th.
32,527. "Electrolysers and electrodes therefor." J. P. Scott. November 28th
32,536. "Method of electrical searching for ore." Svenska Radioaktiebolaget. November 28th. (Sweden, December 8th, 1921.)
32,544. "Illuminated advertising signs." A. J. Packham. November 28th.
32,546. "Electric coils and supporting frames therefor." Magneta Time Co., Ltd., and J. W. Wheeler. November 28th.
32,566. "[illegible] trans. wheels." R. [illegible]. November 29th.
32,577. "Supply of power to electric furnaces." W. E. Burnand. November 29th.
32,578. "Electric furnace arrangement." W. E. Burnand. November 29th.
32,579. "Electric furnace arrangement." W. E. Burnand. November 29th.
32,583. "Electric heater." H. Riley. November 29th.
32,[illegible]. "[illegible]." A. R. Vogus. November 29th.
32,[illegible]. "[illegible]." D. Siebe (1920). November 29th.
32,623. "Speed regulating apparatus." Metropolitan-Vickers Electrical Co., Ltd., and [illegible]. December 7th, 1921.
32,627. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). November 29th.
32,628. "Electric heating devices." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). November 29th.
32,633. "Repeating systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 29th.
32,634. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 29th.
32,642. "Illuminated signs." W. J. Beville. November 29th.
32,672. "[illegible]." [illegible] and C. F. Myer. November 29th.
32,676. "Switching of circuits for charging accumulators of wireless reception sets." C. Pressland. November 30th.
32,[illegible]. "[illegible]." [illegible]. November 30th.
32,694. "Fittings for electric wiring." R. B. Matthews. November 30th.
32,703. "Colliery tram." D. J. Belben. November 30th.
32,720. "Lamps for [illegible]." W. A. H. White. November 30th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

13,182. "Generation and modulation of continuous waves for wireless telegraphy and telephony." A. Boudel and M. Touly. May 9th, 1921. (188,678.)
13,336. "Spring plug, having a packing in its upper part subjected to pressure from below." R. Bosch Akt. Ges. June 17th, 1920. (165,080.)
13,665. "Magnetic clutches, and the like." J. W. Hall. May 13th, 1921. (Cognate application 1,756/22.) (188,682.)
13,794. "Magnetic material." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 17th, 1921. (188,688.)
13,801. "Automatic exchange telephone system." H. Baron (F. Adenderff) May 17th, 1921. (188,689.)
13,961. "Method of electrically butt-welding, apparatus for and tubing produced thereby." A. E. White (Elyria Iron and Steel Co.). May 18th, 1921. (188,690.)
14,163. "Means for regulating the speed of electrical machines." Ges. für Drahtlose Telegraphie and W. Schaffer. August 9th, 1920. (167,744.)
16,156. "Artificial cables for duplex telegraphy." F. E. Pernot and Eastern Telegraph Co., Ltd. June 11th, 1921. (188,697.)
16,363. "Electric telegraphy." F. E. Pernot. June 14th, 1921. (188,701.)
16,869. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). June 18th, 1921. (188,707.)
18,661. "Electrical transmission or reproduction of sound." S. G. Brown. July 9th, 1921. (188,709.)
18,868. "Electrical heating devices." P. Grant (R. F. Zimmermann). July 12th, 1921. (188,714.)
19,041. "Circuit arrangements for automatic or semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. July 14th, 1921. (188,718.)
21,040. "Regulation of asynchronous dynamo-electric machines." Siemens-Schuckertwerke Ges. August 7th, 1920. (167,505.)
21,346. "Mine-rescue and like telephone apparatus." R. L. Murray and Telephone Manufacturing Co., Ltd. August 11th, 1921. (188,744.)
21,595. "Shade carriers for electric lamp holders." S. Coxon and F. M. Soulsby. August 15th, 1921. (188,757.)
21,705. "Sound transmitters and reproducers." L. De Forest. August 16th, 1921. (188,763.)
21,742. "Means for use in connecting electric conductors to railway and like rails." British Power Railway Signal Co., Ltd., and H. E. Cox. August 16th, 1921. (188,768.)
21,755. "Magnetic detents for revolution counters." Evershed & Vignoles, Ltd., and J. C. Needham. August 16th, 1921. (188,769.)
21,761. "Means for increasing sound transmitted by telephone and the like instruments." W. H. Higgs. August 16th, 1921. (188,771.)
21,814. "Apparatus for testing magnetos, sparking-plugs, and the like." F. J. Davis. August 17th, 1921. (188,775.)
21,858. "Sparking plug." F. Scott. August 17th, 1921. (188,781.)
21,954. "Construction of winding for dynamo-electric machines." W. E. M. Ayres. August 18th, 1921. (188,789.)
21,986. "Method and means for dimming the electric lamps of automobiles." G. E. Webb. August 19th, 1921. (188,792.)
22,051. "Apparatus for projecting light and other electro-magnetic radiation." O. H. Pieper and A. F. Pieper. September 15th, 1920. (169,150.)
22,084. "Automatic excitation regulator for dynamo-electric machines." J. T. Irwin and A. Rushton. August 20th, 1921. (188,795.)
22,148. "Electric meters." G. A. Cheetham and Metropolitan-Vickers Electrical Co., Ltd. August 20th, 1921. (188,797.)
22,583. "Magnetic separators." J. S. Atkinson and Powdered Fuel Plant Co., Ltd. August 25th, 1921. (188,814.)
22,606. "Self-induction coil pair for loading telephone lines." Felten and Guilleaume Carlswerk Akt. Ges. January 17th, 1921. (174,320.)
22,614. "Apparatus for transforming the crystal structure of wires, filaments, and the like." General Electric Co., Ltd. (Patent-Truhand Ges. für Electrische Gluhlampen). August 25th, 1921. (188,815.)
22,716. "Cooling and ventilating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. August 26th, 1921. (188,819.)
22,756. "Switch fuses." C. W. McDowall and Norwest Electrical Manufacturing Co., Ltd. August 27th, 1921. (188,820.)
23,020. "Holders for thermionic valves." General Electric Co., Ltd., and C. G. Eden. August 30th, 1921. (188,823.)
23,149. "Electrodes for electric welding cutting and the like." W. H. Flood, D. T. Smout and A. C. Cutting & Welding Co., Ltd. August 31st, 1921. (188,824.)
23,253. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 1st, 1921. (188,827.)
23,954. "Electro-magnetic regulating or controlling devices for dynamo-electric machines." Vickers, Ltd., and J. Etchells. September 8th, 1921. (188,834.)
24,761. "Electric lead terminals and the manufacture of the same." W. Preston and W. Horton. September 19th, 1921. (Cognate application 16,837/22.) (188,843.)
26,168. "Sparking plugs of internal-combustion engines." W. H. Shute. October 20th, 1921. (188,874.)
26,403. "Universally-adjustable electric lamp support." F. Chabloz. October 20th, 1921. (188,880.)
26,550. "Electro-magnetic brakes." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 7th, 1921. (188,881.)
26,746. "Electric ignition apparatus." E. H. Cardwell. October 10th, 1921. (188,884.)
27,045. "Supports for electrical busbars." A. H. Railing, C. C. Garrard, P. H. Coates and S. Darby. October 12th, 1921. (188,891.)
27,110. "Electric switches." British Lighting and Ignition Co., Ltd., E. O. Tierney and R. B. Tierney. October 12th, 1921. (188,893.)
27,230. "Brush holders for dynamo-electric machines." A. H. Railing, R. Orsettich and A. F. Angell. October 14th, 1921. (188,895.)
27,404. "Safety appliances for use in connection with passenger lifts or other lifts or elevators, hoisting machinery, and the like." F. H. A. Dore. October 17th, 1921. (188,897.)
27,435. "Relay circuit arrangements for use more particularly in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. November 17th, 1920. (Addition to 123,035.) (171,678.)
28,063. "Electric fly and insect killer." H. A. Thomas. October 22nd, 1921. (188,902.)
28,389. "Electric light ceiling fixtures." T. S. Turnbull. October 26th, 1921. (188,918.)
28,462. "Spark plugs." P. V. Carpenter. October 26th, 1921. (188,919.)
28,721. "Method of assembling and protecting the electric wires for contacts, the commutator and ignition coils such as are used on internal-combustion engines of the Ford and like types." H. G. Southard and V. W. Mosier. October 29th, 1921. (188,924.)
29,581. "Lightning or surge arresters for electric conductors." A. Reyrolle and Co., Ltd., and W. D. Owen. November 7th, 1921. (188,939.)
30,036. "Telephone instruments." J. E. Pollak (Siemens & Halske Akt. Ges. November 10th, 1921. (188,943.)
30,[illegible]. "Telephone receiver." Western Electric Co., Ltd. December 2nd, 1920. (172,291.)
31,067. "Electrodes or anodes employed in systems for the prevention of corrosion and scale formation in steam boilers, condensers, and other liquid containers." V. H. Cruikshank. November 21st, 1921. (188,957.)
31,[illegible]. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. December 7th, 1920. (172,623.)
32,059. "Instrument for the therapeutic treatment of the throat with rays from an arc." W. G. Moore. November 30th, 1921. (188,970.)

THE

ELECTRICAL REVIEW.

VOL. XCI. DECEMBER 22, 1922. No. 2,352.

ELECTRICAL REVIEW.

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A SUGGESTION AND A WARNING.

COL. ARMSTRONG in his review of the national industrial situation, which is abstracted on another page, though he indicates certain signs of industrial revival, declines to lay himself open to the charge of being an optimist, and perhaps that is as well, seeing that he is head of an industrial organisation which lives on orders and not on appearances.

There are two points of special interest that we select for mention here. One is his suggestion that strenuous efforts should be made to develop new markets within the Empire, carrying with it the recommendation that in the coming year (when, by the way, Sir Eric Geddes will be president) a strong committee shall assemble and consider whether a joint scheme (operated either by individual trades or by trades collectively) can be devised to stimulate our foreign trade. He goes so far as to invoke some support from His Majesty's Government, since assistance in such a cause would in a measure be reproductive and "would serve to lighten the burden of unemployment." Here there seems to be an opening for co-operation with the Trade Commissioners and a live Department of Overseas Trade. There were rumours current years ago that the F.B.I. preferred to go "on its own" in such matters, but whether they were correct or not, the spirit of the moment seems to favour a policy of co-operation.

Col. Armstrong's other point was a warning to his members that very strenuous competition would be coming from Germany. Lately German schemes have been perfecting for collective selling abroad and for jointly undertaking complete contracts. He added: "I am told that they have brought such organisation to a high standard of perfection and as soon as they can establish some stability in their finances, under conditions favourable to themselves, we shall find that they have organised to our detriment." The most natural observation in reply to such a forecast would be that "to be forewarned is to be forearmed." Surely if British manufacturers in so large an organisation know that Germany has organised to British detriment we are not going to be deficient in our own organisation measures! We are aware that there have been many consolidations of interests effected here which ought to be able to put up an effective opposition, and there have been many proposals advanced for electrical and other co-operative foreign trade movements. We believe that some of our large electrical companies are able to make a good fight against any comer, also that many smaller concerns making specialised lines know what they are about, but Col. Armstrong's warning may well serve to set electrical firms generally thinking whether they have done all that lies within their power, in comparatively impoverished times, to be quite ready. We hope that trade associations allied to the F.B.I. are not so occupied with less important matters that they will lay us open to the charge later on that we were apathetic while Germany was preparing. We hope also that Col. Armstrong's words will not pass unheeded by our municipalities which are tempted to place electrical contracts where they cannot benefit the British workman.

Christmas and Trade.

As we approach the Christmas season there is more of the spirit of hopefulness abroad amongst us than has been noticeable lately. The attractiveness of shop windows, the brightness of the stores, the purchase of Christmas gifts, and the atmosphere of goodwill have a healthy effect, but while that is so they are powerless to divert our attention from the unsatisfactory industrial situation, which deprives millions of our people of the full enjoyment of Christmas amenities; indeed, the merriment of the Christmas shoppers and the boisterous happiness of their juveniles do not harmonise with the instrumental and other appeals of those who ask an alms in almost every main thoroughfare. It were heartless to pass over this feature of the present position, for deprivation and distress are the inevitable consequences of unemployment as things exist to-day, and while we are reluctant to favour indiscriminate giving, we make an appeal to those who have enough and to spare to loosen their purse strings a little more than usual, thus doing their bit to reduce the prevalent suffering and discontent.

Unemployment is a matter that will inevitably remain with us in a considerable measure for some time. We sympathise with and cordially approve of every effort, whether by Government or by private interests, to deal with it practically by making useful work, but we should be acting altogether against our editorial conscience were we to hold out hopes which might have no actual foundation. There is plenty of reading-matter in the Press to indicate that trade is improving, and the placing of orders for railway electrification, for new ships, for power plant equipment, and so forth, should mean employment for additional thousands of workers in a very short time, but the Prime Minister's simple answer in Parliament in regard to the question of insurance by industries against unemployment was one which showed courage and a determination not to ignore the facts. He stated pretty definitely that the matter could not be settled by Parliament next year. It has been discussed at industrial meetings for years past as one of the solutions of the problem, but when trade is unsatisfactory and industrial companies are already so loaded with taxation that they, like Parliamentary candidates, don't know where they are, it would be madness to place upon them a new burden, the extent and effect of which are quite unknown. If taxation is reduced in the spring, as we trust it will be, and if trade continues to revive until then, with the prospect of further improvement as a direct result of taxation revision, the day for such schemes will be brought nearer. Information is being collected under Government auspices just now, but this is only a preliminary measure which is essential to the consideration of practical proposals by industrial experts and legislators. We hope that anybody who can help to make this study complete will not fail to contribute his quota, for, difficult as it is and must be, it seems to be as promising a *theory* as any that we have seen advocated consistent with the maintenance of the present industrial system.

The new work that has been put in hand, or is being placed out to contract shortly, will afford an immediate relief to the situation, and when house-building can again get on to an economic basis, hundreds of thousands of men should find work, but it is general trade activity which is required to cure idleness effectively, and we wish to repeat our recent advice that those who are responsible for the Governmental encouragement of our overseas trade should proceed with courage and expedition to carry out the duties and obligations that their positions impose upon them. The development of inter-trading relations between the Mother Country and the Empire must not be prevented by anybody who thinks more of his own Civil Service skin than of the stomachs of the community. Those who have it in their power to foster or direct the course of such trade should not be held by a leash of red tape, hands tied, initiative limited, and enthusiasm chilled when they see clearly enough that they could, if permitted, direct business to the Homeland in its time of industrial need. It is conceivable that the trading community would provide a new broom to sweep the hinderers into the Thames—and after rescue would adopt the British orthodox custom of promoting them out of harm's way!

We are pleased to see in *The Times* a letter from Sir Wm. Joynson Hicks, Parliamentary Secretary to the Department of Overseas Trade, in which he dwells upon the purchasing power of the Empire, and shows that he recognises the value of an extended Trade Commissioner Service in Canada and India for keeping the surplus purchasing power of the Empire within the Empire itself. Sir William pays a tribute to the wisdom of his predecessor, Sir Lloyd Greame, the present President of the Board of Trade, in arranging for these two additional Commissioners. We are glad to read that Sir William has been convinced during the short time that he has been in office at the Department of Overseas Trade that "in the extension of the Trade Commissioner Service lies one of the most practical methods of strengthening the economic links between the various portions of the Empire." We have expressed this view so frequently that it is needless to dwell upon it now, save to hope that Sir William will have adequate backing in high quarters in carrying out his ideas, so that the trade and industry of the Mother Country may be watched over by a Commissioner Service which shall be adequate in number of officials, and representative of British experience, personality, tact, freedom, and all the other good qualities which together produce a truly worthy Ambassador of British Trade. For ensuring satisfactory service from men of this class let Civil Service bands be snapped in the interests of the community which calls for work to yield employment and —bread!

The South American Market.

South America has long been regarded as a most promising market from the electrical and engineering standpoints. British prestige has stood very high for very many years; we were doing a large trade there when competitors were practically non-existent, and we were heavy investors in all sorts of enterprises which were essential to very early development. The various States felt in varying degrees the effects of the European war, and we could not provide many of the things that we had been in the habit of supplying, though they were sorely needed. Depression has hung over South America for several years past, but there are signs of most marked improvement, and before long there should be a considerable addition to the requisitions upon British manufacturers. Now, if there is anything that we regard as the paramount duty of this "Tranquillity" Government it is the stimulation of foreign trade; therefore it comes to us as a most welcome sign of practical Parliamentary interest in this connection that a number of members of the House of Commons who know the present position of affairs in South America, have come together in a group with the object of keeping in the forefront the possibilities of the Government doing something to help. According to *The Times*, a number of members paid a visit to Brazil during the recess, and they have returned with optimistic views as to the possibility of re-establishing and extending British trade with markets which had perforce to be abandoned during the war. Already they have put a number of suggestions before the Government, and we trust that something tangible will result. Speaking generally from experience, we think that it is sound advice for trade to put not its faith in governments, yet we believe that the large number of members of Parliament interested in trading development and in engineering and construction work have it in their

power to do much toward quickening the speed of revolution of the trade wheel. It seems to us that one of the best things that Labour members could do would be to bring the full force of their influence behind the movement and accelerate the rate of progress in the interests of the army of workers and workless whose future well-being, like that of most of us, is bound up with the incoming of contracts from the overseas markets. Members of Parliament might be well occupied during the present recess in studying the Electrical Review and other trade papers that have given attention to world markets for years past. How many members of Parliament get their information from specialised trade journals? If ever they needed to study them they need it now.

Domestic Electric Consumption in Canada.

A study of some of the figures given in the annual report for 1921 of the Hydro-Electric Power Commission of Ontario, reviewed elsewhere in this issue, reveals the very considerable increase which has taken place during the last five years or so in the average number of kilowatt-hours per month taken by domestic consumers in the various municipalities supplied by the Commission. A general survey of all the figures gives the impression that the average increase for all municipalities is in the neighbourhood of 100 per cent. for the five-year period, and if one looks back seven or ten years the increase is undoubtedly very considerably more. The causes for this great increase are the rapid growth in the use of all kinds of domestic appliances and, within the last year or two, of electric cooking ranges and water-heaters. There is little doubt, from all indications, that the growth in the domestic consumption will be much greater in the next five years than it has been in the past five on account of the rate at which ranges and water-heaters are being installed. In Toronto at the present time something like one hundred electric ranges per month are being connected up; taking diversity into account, these ranges probably add about 1.25 kW each to the load on the system.

Another fact gleaned from a study of these figures, and one which is worthy of notice, is the remarkable uniformity in the monthly domestic bills, no matter what the price of electricity may be, for while the net cost per kWh ranges at the present time in different municipalities from 13.2 cents to 1.4 cents, the maximum range of the average monthly bills is only from $2.54 to $0.82, and undoubtedly most of the bills are from $1.00 to $1.25 per month, quite regardless of the price charged per kWh.

A Reflection for Christmas.

The coming of Christmas will, this year, interrupt an industrial dispute in the electricity supply industry. Is it too much to see in this an augury of a happy settlement when the matter is again taken up? The pause will not be unfruitful if even a modicum of the seasonal spirit of goodwill is allowed to be carried forward.

Mr. John Drinkwater wrote recently: "Although what we call the Great War has stopped, there is still raging in the world a war upon the issue of which the whole hope of mankind depends. It is a war between two kinds of people. Into two kinds of people all the active thinking part of the world may be divided, and those two kinds are the people who want to dominate their fellows and those who want to understand their fellows"—and Mr. John Drinkwater identifies Christianity with the latter.

1919 saw a new era in the electricity supply industry; a new method was tried in conducting industrial relations, one which relied on *understanding* instead of *domination*. Mutual understanding is the keynote of the Whitley system. That the new method has been an outstanding success in the industry goes without saying. That it is the right way no one can deny. An occasion has arisen which is putting it to the strain. But the trouble can only be successfully and rightly settled by this same method of working towards a mutual understanding. Perhaps this pause of an intervening Christmas-time may signally help in that direction.

Public v. Private Ownership.

In view of the reorganisation of electricity supply in this country, the revival of the long-standing controversy regarding the respective merits and demerits of public as opposed to private ownership, by the "Murray" report and the reply thereto by the Hydro-Electric Power Commission of Ontario (reviewed elsewhere in this issue), has an interest reaching beyond the American Continent.

The Commission was accused by Mr. Murray of recklessness in its methods of development, both from the engineering and financial points of view, and the report did not possess a single word of praise for the undoubted good which the Commission has wrought for Ontario, and therefore the Dominion of Canada.

Impartiality would not appear to be one of Mr. Murray's strong points, and the report needs to be considered with this in mind. The National Electric Light Association, from which he received his commission, is strongly against public ownership—or ownership by public bodies—an attitude due partly to interest and partly to the poor showing made by public ownership in the United States. Mr. Murray himself is apparently in complete agreement with the Association's view, for he commenced his investigations with a statement that he had "never subscribed to governmental ownership of electric utilities in the United States."

The Commission deals in a categorical manner with the report, and shows that many of Mr. Murray's comparisons are fallacious, for the reason that facts material to such comparisons are forgotten or ignored. He is accused of deliberate misrepresentation in one or two instances, and figures are given to support the accusation.

In the circumstances, Sir Adam Beck, the chairman of the Hydro-Electric Power Commission, can hardly be blamed for refuting in the strongest terms Mr. Murray's claim that his report was "based on an impartial and exhaustive study."

The I.E.C. Conference.

The British National Committee is to be congratulated on the result of the meeting of the Advisory Committee on Rating of the International Electro-Technical Commission at Geneva, which is reported elsewhere in this issue. The rating of electrical machinery is a very difficult but very important subject, complicated by local conditions and by the divergent views of manufacturers in the countries most directly concerned. The method of rating by fixing the ambient temperature at a high conventional value, and thereby setting an absolute limit to the ultimate temperature attained, is somewhat artificial, but has the advantage that it is of universal application, ensuring that international competition shall be conducted on a fair basis. In this country, however, the long-established practice of quoting for machines with an overload rating proved too firm to be superseded, and though the British makers were willing to comply with the ultimate temperature limits they desired an alternative rating. This object, thanks to the courtesy of their foreign *confrères*, has now been attained.

Once more, therefore, the value of the I.E.C. as a means of securing international agreement has been demonstrated. The importance of its work cannot be questioned, and it is to be regretted that its activities are hampered by lack of funds. We hope that as trade improves this difficulty will be removed. In such a matter broad views should be taken, and it should be realised that whilst contributions to the funds will not produce an immediate return to the donor, they will bear fruit in the long run.

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ESTIMATING OFFICE ORGANISATION.—III.

By MAJOR J. C. CONNAN, B.Sc., A.M.I.E.E.

Labour Constants.—It has always been extremely difficult to estimate satisfactorily the cost of the labour to be expended on an installation. This is no doubt primarily due to the many external conditions affecting the work, but is also due to some extent to the prevalent practice of estimating for labour directly in £ s. d. rather than in hours of work and then pricing the hours. The former method, of pricing direct, may be satisfactory for certain classes of work, and is perhaps slightly more expeditious, but it pre-supposes that so many conditions are the same for all jobs that it is a wonder not more losses are made than is at present the case. It is very much more reliable, even if somewhat slower, and entirely to be recommended for all important work, to estimate the number of hours' labour to be expended on each item of work to be done, add all times together, and price, in order to obtain the total labour cost of the job. This can, however, only be done if certain standard conditions are assumed, allowances being made for all deviations from the standard, and labour units for each class of work, here called "Labour Constants," are used.

The time expended on a particular piece of work depends on: The man doing the work; the tools he uses; the conditions under which he works; and proper planning and inspection of the work to be done.

It is always pre-supposed that the man is skilled, an assumption which is not always well grounded. He may be a first-class conduit wireman, but extremely poor at casing and capping work, and if it is found necessary to use him for the latter work some allowance should be made for his lack of skill. It seems almost facetious to say that it is always assumed that the work will be done by British workmen. But in many of our Colonies this is by no means universally the case, and it is not safe to assume that the cost estimated for British workmen will cover the cost when Indians or natives are employed.

The tools should be in good repair, plentiful, and of the correct pattern for the class of work to be done. Although the workman is supposed to supply his own tools, it will often be found that his collection is by no means complete, and that in consequence a good deal of borrowing goes on. Wherever special tools or appliances are necessary, these should be provided by the firm in sufficient quantity to prevent any delay.

The conditions under which electrical work may have to be carried out are extremely various, more so perhaps than in any other trade. The building in which the work is carried on should be warm, extra time being given for work in unheated buildings in winter, cold storage rooms, &c., as well as in boiler rooms, heating rooms, or other places with excessive temperatures. It should be well lit, a point very often overlooked in electric lighting installations in winter, and allowances should be made for all work underground in mines, cellars, &c. It should be dry, free from steam which might obscure the workman's sight, and free from all noxious fumes such as occur in zinc works, chemical works, &c. The last condition should be specially investigated, as it might make continuous working for any length of time very difficult. The nature of the work should not necessitate that the workman has to get into cramped and awkward attitudes, nor that he should have to work in a dangerous position. On all country work, such as transmission line work, cable laying, or where the site of the job may be some considerable distance from the nearest town or even village, and the man may have a long way to walk, a certain allowance should be made for inclement weather, depending on the time of year. In the two former instances, the nature of the country, whether hilly or flat, will have to be taken into consideration. Interference from other contractors also frequently invalidates labour estimates. This can be avoided to some extent by careful planning, and in this respect much depends on the engineer, who should keep his gangs rightly proportioned to those employed by other contractors. Overtime should be avoided if possible. Apart from the fact that the quantity of work turned out is nearly always below normal, the quality is frequently below standard, and mistakes, with consequent re-working, common. When it is necessary to work overtime, it is preferable, though this depends on the class of work, to work the foremen overtime, letting them overlap into one another's shifts, but to employ a new gang of men.

Correct planning by the engineer responsible for the contract is extremely important. This not only means that standard methods of work, with which the workmen are fully conversant, should be employed, but that material and tools required should be ordered so as to arrive in the right quantities just when necessary. The happy medium between having a large stock on the site and none at all should be struck, for in the former case the losses due to wastage, exposure, and stealing are increased, whilst in the second case much time will be lost by the men being semi-employed. A condition which is also sometimes overlooked and which has a very considerable influence on the costs is the correct proportioning of the gang. This is of more importance on large contracts when the number of men is large, but in no circumstances should the number of foremen or leading hands be stinted. It is not only that there should be sufficient of them to efficiently supervise the men and prevent slacking, but also that one should be immediately available to give advice, where necessary, on difficulties as they appear, without neglecting his other duties. The proportion of labourers to skilled men should also be carefully watched to prevent skilled men wasting their time on unskilled work. Careful observation of the progress of other contractors and foresight on the part of the engineer will materially reduce labour costs and frequently prevent the necessity of overtime.

All estimating engineers should be given the opportunity of visiting the site and analysing the labour costs of work for which they have estimated. The procedure then adopted to formulate a service of Labour Constants is somewhat as follows:—The total number of hours as obtained from the time sheets (foreman's, wireman's, and labourer's time being kept separated) expended on a definite amount of work as obtained by measuring up, together with the general conditions under which the work has been done are noted. All hours (foreman's and labourer's) are then reduced to wireman's hours, giving the total equivalent wireman's hours for this piece of work. This is very simply done by increasing or decreasing the actual hours worked in direct proportion to the rate of wages as compared to the wireman's rate. Thus, the foreman's hours at 2s. 6d. per hour are equivalent to 12½ wireman's hours at 2s. The number of equivalent hours then required to do a unit of this class of work, say laying 100 yards of cable or running 100 ft. of 2 in. conduit, under the above conditions are then found and noted with full particulars on a card index. After some time a considerable number of these units will have been collected, but practically all for different conditions. By comparing these units with one another, making allowances to bring them into line with standard conditions, and plotting where suitable, a series of labour constants can be obtained. The analysis of further data should, however, not be given up on the completion of a series, but carried on, so that the series may always be checked and kept up-to-date.

An example may make the method clearer:

The following figures were obtained whilst running 20 miles of trunk-line telephone cable, 450 pairs, 0.6 mm. dia., in plain lead, through hilly country. The weather was dry, but very cold, when the data were taken. The gangs varied from week to week, depending on how far the nearest village was. A tramway along the road was available.

Marking off.—Two labourers were employed running the line for the trench and marking the route every 10 ft. with a pick. They completed 700 yd. each in 2 hours 55 minutes.

Digging trench.—This was in a macadam road with sandy loam below and was 2½ ft. deep × 1½ ft. wide. An average of 105 labourers in a week of 52 hours dug 2.08 miles.

Laying cable.—The cable was supplied on drums each containing 250 yd., which were dropped at approximately this distance along the road from motor-lorries. Five men spent 32 minutes getting loaded drum from the side of the road, placing over trench, and afterwards removing empty drum to other side of the road. In order to prevent damage to the cable whilst pulling out, the 100 labourers were taken from the trench and utilised for pulling and handing along. Time occupied by men going from trench-digging, laying 250 yd. of cable, and returning was 15 minutes.

Protecting cable.—This was done by throwing in loose earth around cable and laying a slab of concrete 2 ft. ×1 ft. × 2 ft. along the top of cable before filling in trench. Slabs were put in heaps of about 80 every 50 yards from lorry, and five men took 65 min. to throw in earth and lay 80 slabs.

Filling in trench.—On this stretch of road five men filled in and rammed 194 yd. each per 8-hour day.

Removing surplus earth.—The cable ran along country roads bordered with fields, and a good deal of surplus loam was thrown on to the fields, however; two carts were kept continuously busy carting surplus earth to dumps. For the length of cable under consideration the run was 480 yd., the labour expended was 104 hours horse and cart, 104 hours carter, equivalent to 95 labourer's hours, and 20 hours labourer's loading. There were four foremen superintending the labourers, these were provided with two caravans, one being used as an office and the other as a store.

If individual units are to be made for each operation, the foremen's hours should be added in proportion to the total labourer man-hours expended on the operation. The foremen are paid 25 per cent. more than the labourers, and consequently 4 × 52 = 208 foreman's hours are equivalent to 260 labourer's hours.

—	Labourer's Hours.	Labourer's Hours equiv. to Foreman's Hours.	Total equiv. Hours.	Equiv. Hours per 1.0 miles.
Marking off 2.08 miles ..	30.5	1.5	32	8.74
Digging trench	5450	198	5648	1543.2
Laying cable	39.5	1.5	41	11.2
Protecting cable ..	370	13.5	383.5	104.78
Filling trench .. .	755	27.5	782.5	213.8
Removing earth	155	4.5	159.5	43.6
Total	6800	246.5	7046.5	1925.3

Making joints.—The joints were not made by the firm laying the cable, and consequently the latter overlapped cable at the ends and filled in trench. About one month afterwards six gangs of jointers followed on, opening up and making joint. The gang consisted of three men, two jointers, and one assistant, and was equipped with tent and tools. Each joint took 49 hours to complete, and times were therefore 98 hours wireman's and 49 assistant's, equal to 135 jointer's hours per joint.

The figures given will be above standard on account of hilly road and very cold weather.

THE PROSPECTS OF THE COMMERCIAL ENGINEER.

By W. ANDER.

Many well-trained technical engineers are at present wondering as to the prospects in the commercial side of engineering. The work is hard, the competition very keen, and the necessary hours very long. In fact, no one works so hard as the commercial traveller. It should be distinctly understood that if the would-be commercial engineer does not remember that he is first and foremost a commercial traveller, and only incidentally an engineer, then disappointment and failure await him.

Each customer has his whims and foibles, and is a problem by himself; successful commercial work lies in understanding this fact and in working in such a manner that the customer can be persuaded that the plant one is offering contains all those little details which he has always sought, but never found; and that the sound design and skilled construction carried out at the firm's works render the plant the most serviceable on the market.

The prospective purchaser must never be contradicted flatly. Ask his opinion of the firm's methods as if you were asking a favour; then point out one by one the good points of the design, and request a summing-up from one who is an expert user. You will not only flatter his *amour propre*, but will gain a very keen insight into what he really wants; and that point understood is half the battle.

The largest incomes are made by men on commission, who pay their own expenses, and practically handle what goods they like. These men are born salesmen, and really work by getting to know the buyers or influential men in the firms they call on, and finding out what these firms require; they then offer them first-class goods in those lines, and will look at no firm who cannot give their friends the best of value. Such connections must needs start in a small way, and take years to work up. They often mean the handling of subsidiary goods, and not large impressive plants.

The most wretched returns are also made by men on commission, men who in most cases should not be out on the road at all, being temperamentally unfitted for such work. Between these two groups come the salaried men attached definitely to one firm. If that is a firm of standing their expenses are good, their work comfortable, and their standing undoubted. They seldom, however, net very large incomes. Such men are usually appointed from inside the firm's offices, or have served other firms in similar positions. An excellent method of training for such a position is to leave the works and drawing office by the time one is twenty, and take up a minor clerical position, study commercial law, the special theory on which the firm's and their chief rivals' products depend, and at least two foreign languages. By the time one is twenty-three a start can be obtained either with one's own firm or another doing similar work.

Before the war such men made from £400 to £800 a year by the time they were thirty or thirty-five. Much above the higher figure was quite unusual. Membership of certain clubs and societies must be maintained, and it is other than the rule for one's firm to pay these items.

Travelling in itself soon becomes monotonous and very tiring; many young engineers consider it a holiday; if they will but reflect for two minutes they will realise that if it is treated as a holiday there will be no time for business; and shortly after that, no room for the holiday-maker on his firm's staff.

Reports to one's firm have to go in every night, or at least three times a week; and this has to be done after one has called on people all day; that is, between, say 7 and 9 p.m.

Many firms who have insufficient trade in certain districts to warrant appointing one of their own staff as a resident agent, appoint an engineer to look after their interests along with his other work. This work is solely on commission, and should be entered into with some care. The fact that the firm is appointing an outsider to their own organisation shows that the possible returns are somewhat thin; thus, no work of this sort should be taken up unless an agreement is given to support the agent right throughout his district, and not to withdraw the agency without very considerable notice. Unless this precaution be taken, the agent may work hard for three or four years only to find that the connection he has built up is filched from him by the firm shutting down his agency and putting one of their own staff on the ground. Unpleasant as it may be to contemplate, this trick is by no means uncommon.

The agents and commission men can sell where and what they like as a rule. The salaried man cannot. The commission man may sell between two customers a steam crane, or an oil tank, and have the commission for himself. The salaried man dare not do this, as his time whilst out at his firm's expense is theirs, and any money he makes by cross sales of this description is the employer's, legally; most firms would insist on such commissions being handed over to them, and they could actually prosecute a man for failing to do so.

Another type of representative is often employed by the smaller firms and by makers of small speciality goods. They will offer a man, say, 15s. or £1 a week and a ridiculous commission. The salary will not cover two days' expenses at a decent rate of living, and the commission is too low to make up a reasonable income. Such a man is the firm's salaried servant, and must not forget the fact; an agent or a pure commission man can collect his principal's accounts, and deduct his agreed percentage before sending the money to the firm; the man on even 10s. a week salary dare not do so; he is a paid employé, and must not keep back his employer's money. A salary providing at least three days' decent living and travelling expenses, and nothing less than 10 per cent. commission, should be insisted upon if the goods are small articles.

This introduces the question of the commissions usually paid. Small accessory lines must carry a good commission, especially if new and not much advertised; in such cases not less than 25 per cent. should be paid to a man working on commission alone. If the goods are well-known, well-advertised, and used to a considerable extent, than 10 per cent. can be worked to, if the firm will grant exclusive areas to its travellers and agree to pay them on all orders coming from that district, whether through them directly or not.

One man known to the writer carried a very good and somewhat cheap soft gland packing; this was excellent stuff, especially for steam hammers; he also carried a proprietary belting. Before the war that man made over £1,000 a year clear profit. He worked solely on commission—on a 20 per cent. basis, paying all his own expenses.

Another man ran a well-known belt syrup, and would carry nothing else, though often asked to do so. He made £500 a year before the war, and whilst he was in the Army his firm paid him all commissions which came from his territory, and treated him excellently. Both men were good engineers, but were born sellers and knew the merits of their own and rival preparations from A to Z.

There is a class of engineering representative who has a very bad time of it: this man sells cheap jointing material, small electrical switches of the domestic type, of cheap and nasty design, lamps, or boiler compositions. Often he is refused a hearing and looked upon as a nuisance. Unless one can get the representation of the *best* in these small lines they should be left alone.

Large goods such as generators and motors, say of 100 h.p. and upwards, can be sold on commission on a 5 per cent. basis, and a good living made. If a plant costs less than £500 get 7½ per cent., if less than £100 get 5 per cent., and if below £50 insist on 10 per cent. Above £1,000, 2½ per cent. can pay, and 5 per cent. be very handsome.

The writer has sold boilers and generating sets on a 5 per cent. basis, and this allowed one money to save and invest; whilst 2½ per cent. in times of good trade gave a very comfortable living.

The "side line" is another snare for the novice. He thinks a side line will get him a sale where the main line is not wanted, and so will help to pay expenses. This is a fallacy unless the side line is offered at a good commission. Most side lines are put forward on absurdly low commissions.

Lines which will not pay a man to travel for all the year round will not pay him to take up. Every ten minutes spent on the side line is ten minutes robbed from the principal line, which can and does support one full time year in and year out. The writer has sold feed pumps and plunger pumps on a 5 per cent. basis when selling boilers, simply because people who use boilers also must use pumps. Boilers and generators, however, will not go well together; each is too big to allow adequate time for the other. Also, when a prospective buyer finds a man representing two or three lines not strictly cognate, he thinks that the man is no expert, and that he is not receiving expert advice and help in any of the matters handled. This, of course, is fatal to doing business.

The above notes have been put together from the records of a by no means unsuccessful experience in selling engineering plant. The plant handled comprised engines, dynamos, motors, boilers, air compressors, and even at times jointing and packing, and orders for special castings. Naturally much was picked up from other men on the road.

A representative must never be beaten, never pessimistic or complaining, and always ready to humour his customer. A man who lacks tact, who cannot stick at work day after day without supervision, or who is attracted by prolonged lunches, is better off the road.

Electric Vehicles in the United States.—An improvement in the demand for electric trucks was reported during October. The leading makers state that sales are slowly increasing, and leading authorities on automobile insurance recently granted a further preferential rate in favour of electric trucks. As a result, the cost of public liability and property damage insurance for electric trucks is now 25 per cent. lower than for other types of motor vehicles. Fire insurance rates also are much lower, depending on the class of service and on the company issuing the policy.

The electric vehicle show held in October in connection with the Electric Exposition at New York attracted wide attention. The electric truck parade was one of the most popular features of the show.

The "slogan" contest has aroused much interest throughout the country; replies have been received from every State in the Union. The most unexpected development in connection with the contest is the large number of testimonials, with slogans, received from large users of electric trucks.

The Electric Motor Truck Association of New York has established a school of instruction for drivers; the Association plans to issue certificates to those who pass the test at the end of each course.

The National Electric Light Association will hold a meeting in New York on June 4th to June 8th, 1923, and an exhibition of electric vehicles and accessories will be held at the same time.

Four electric truck and passenger cars, valued at 7,456 dollars, were exported during August.—*Reuter's Trade Service* (New York).

Photo-Telegraphy.—M. Edouard Belin, inventor of photo-telegraphy, gave an interesting lecture in Paris on December 7th, in which he demonstrated the possibilities of seeing at long distances by means of a telephone wire. His invention is based on the property of the metal selenium of varying its resistance to electric current according to the degree of light to which it is exposed.—*Reuter* (Paris).

A REMARKABLE PROBLEM.

By GEORGE E. MOORE.

I WANT to "utter a note of warning." The remarkable problem I am going to set forth is absolutely true in origin. I am telling you this because I have had a lot of trouble with people who simply will insist upon taking some of my lightsome technical efforts in too literal a vein, when many a character or situation is really a sort of composite one—a blended product of experience with, now and again, a little imaginative seasoning added. Not long ago I met a chap who insisted (and persisted) on a criticism of my "Warm Work on Meters." I let him go ahead because he's the only fellow I've ever met who honoured me by buying a copy of the ELECTRICAL REVIEW on account of an article of mine appearing therein. "Now," he said, "in your article (which wasn't at all bad) you talk about the Chief going 'on the prowl.' What I can't make out," he went on, "is, why your boss didn't boot you out when you wróte about him doing that!" A specific "*him*," mark you! My candid friend was considerably taken aback when I informed him that my Chief had immediately adopted the phrase in question.

While I disclaim any distinct local or literal meaning in my jocular efforts, I would like to make an exception of the present one, because the incidents are really true. The scene of action is laid in a boarding-house. This fact will at once rouse the understanding interest of all the past and present "rolling stones" of engineering—their name is legion, and a poet is yet to rise and pen an epic to their cast-iron digestions, stout hearts, and courage in the face of inhospitable new jobs. Let me now throw upon your mental screen the characters involved in "A Remarkable Problem":—

The Landlady.
Her Cat.
Abbey (an electrical apprentice and "billet-pal").
Myself; and
The ELECTRICAL REVIEW.

The chief parts are played by the cat and the ELECTRICAL REVIEW. I need not introduce the latter, but the cat requires a few words, and I cannot do better than quote the Landlady: "She's lovely, you know. She's more like a bairn than a cat. She sits on her little stool, and she looks at me, and she listens to all I've got to say, just like a little Christian. And I wouldn't give her away, no, not for a crown of gold I wouldn't." I might add that while I was in those "digs" no one ever knocked at the front door and offered a crown of gold (or even tuppence) for the cat; still, you may take it from me—that cat was certainly a remarkable feline.

To my friend Abbey belongs the credit for discovering the strange fact anent the cat and this journal. Really, it is astonishing how keen he is in spite of attending a technical college. This is what he found: *Whenever either of us began to read the* ELECTRICAL REVIEW *the cat at once and with remarkable decision ran from the room.*

There you have the problem. For a long time it baffled us. We never did solve it by theory. Abbey, who at that time was very keen on Differential Calculus, was hopeful of working it out mathematically, and thought that when he started on integral stuff he would make short work of the problem. In the meantime he was going to consider whether there was some sort of repulsion effect—he had not yet forgotten the catskin experiments at school. For a time we argued about the Johnsen-Rahbek effect, which had just been published. I was inclined to suspect a subtle connection between the cat and this journal; so far as I could discover, the animal had never been within two hundred miles of Ludgate Hill, and while the cover of the paper is blue, blue things, as such, had no effect upon the animal. Everything pointed to the cat being able to read (it was a very intelligent cat, remember), and it was possible that its tender feelings had at some time been upset—perhaps by that account of a tasty rat being shockingly treated by h.p. switchgear; its retirement from the room might even have been indicative of contempt.

Well, all these fanciful theories went by the board when we found out the annoyingly simple solution. It was in this wise: One day, after a short homily of twenty minutes or so on the cat's good qualities (with particular regard to its table manners), the Landlady, with due deliberation and a few parting shots, left the room, when the cat at once jumped on the table and began to chew the ferns there. The Landlady presently returned, spotted the cat, *picked up the* ELECTRICAL REVIEW, *and opened an offensive*, the cat at once retiring to a strategic position among the crockery in the kitchen. And there you have the solution to the problem which had baffled us. You see, the ELECTRICAL REVIEW was merely a crude weapon of offence, a handy form of corrective—nothing more.

However, we finally contented ourselves by finding it possible to introduce into the matter a little scientific theory. For it seemed that the problem, after all, brought in at least one of the principles of Relativity. (I am sure that Prof. Einstein will welcome this addition to his collection of figurative explanations.) There was the Landlady, full of ire and pounding along at the rate of four or five miles an hour, attempting to target an offending feline retiring at fifteen miles an hour with a projectile of variable stream-line and unknown velocity. From the Landlady's point of view it was highly desirable that the projectile should definitely reach the moving objective with considerable impact; the cat naturally considered such result to be by no means laudable, and endeavoured, by due acceleration, to obviate so disturbing a calamity; while the third factor—a rather weighty one, you know—was the ungovernable flight of the ELECTRICAL REVIEW. The impact duly took place, but it did not coincide with the impact calculated by the Landlady. While the cat continued its scot-free departure there would be heard the ominous crash of some cherished heirloom, and then the fluttering collapse of the ELECTRICAL REVIEW.

The ensuing domestic complications were of such a nature that dinner would inevitably attain an astounding degree of indigestibility, and as a discussion of the latter factor hardly lies within the realm of a journal like *this* one, I suggest that we now "take her off the bars" and shut down.

An Economical Wood Fuel Plant.—By the substitution of gas engines for steam engines at the Lonely Mine power plant, Southern Rhodesia, a saving of £3,000 a month has been effected. The boilers of the old steam plant were fed with wood from the local bush, requiring 3,000 cords per month. In this way the bush had been cleared to a radius of 11 miles. The cost of power production led the management to consider the employment of electricity supplied by gas-engine driven alternators. Three 300-b.h.p. "Premier" engines and a 225-b.h.p. engine were therefore installed, together with a 1,400-h.p. gas plant in four units. The three large engines were coupled to 250-kVA, 525-V, .8-p.f. alternators, and the other to an air compressor. During a test run of 24 hours under 80 per cent. of full load, the engines developed 239 b.h.p. each, and the alternators supplied an average of 477 kW. The fuel had an average moisture content of 13.5 per cent., and the consumption per kWh worked out at 3.575 lb., equivalent to 3.09 lb. of dry fuel, a figure about 4 per cent. below the makers' guarantee. As a result of installing this plant, the monthly fuel consumption has fallen 80 per cent. to 600 cords. The gas-producing plant was supplied by Messrs. Crossley Bros., Ltd., and the engines by their associated firm, the Premier Gas Engine Co., Ltd. The S.A. General Electric Co., Ltd., provided the alternators.

ELECTRO-FARMING.—III.

Requirements for Motor Design.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

As in any other problem, where the application of electricity is considered, the electro-farming question is one that must be dealt with in a sane and common-sense fashion. In the early stages there is a tendency to attempt to equip farms electrically very elaborately, regardless of cost, and without considering the temperament of the personnel, who are to use the machines. It is the author's experience that electrical engineers, who know nothing about the subject, sum up the problem as the very simple one of belting a standard electric motor to a countershaft, and then driving existing types of farm machinery (already arranged for belt drive) from this countershaft. A comparison with such businesses as the printing trade, or the cotton manufacturing trade, will show that in the course of years the electric drives have become very specialised, and call for the services of specialised electrical engineers. The author maintains that similarly it will be necessary to modify the design of the electric motors and also of the drives, specially to suit farming conditions and requirements. In point of fact, though sad to relate, there is not an electric motor made in England that is as suitable for work on a farm as many Continental makes. After all, this is easily explained by the fact that the English demand for electro-farming motors is not yet very great. Moreover, the English farmer who uses electric motors (and these are already a very considerable number) docilely takes for granted the type of electric motor that his friend the electrical engineer provides for him. As he finds out its drawbacks he ascribes them, for lack of better knowledge, as the necessary but unfortunate accompaniments of that strange beast "electricity." On the Continent, however, so many thousands of electric motors have been employed and have been in use for so many years that the farmer there really knows what is required, and consequently asks for it and sees that he gets it. In the course of a recent visit to the Continent, the author came across an electric motor on a farm that had been in regular operation for the last twenty-five years, and even then it was purchased second-hand. Twenty-five years' experience of electric motor driving on farms is a pretty considerable period, and one that is bound to test out the qualities and deficiencies of electrical operation.

A farm labourer is truly a jack of all trades, for he is continually changing his work with the seasons of the year, and even with the hours of the day. Hence a man just about gets used to keeping a belt drive in order, when he goes on to other work: on returning to the belt-driven machine after an interval of a few days, he finds the belt too tight or too slack, or it breaks down.

He seems then to forget almost all he had ever learnt about the care of belting. The result is delay, both to his own work and to the work of his fellow labourers. This simple illustration is indicative of some of the difficulties encountered in introducing new ideas on a farm. It is not generally realised that, even at the present time, it is one long fight to get any machinery used at all, the prejudice and lack of skill of the employés is so great. Again, as these men are not accustomed to machinery, they are apt to let it go to rack and ruin, all due to the neglect of the "stitch in time" which saves repair bills. In connection, the horse is largely a self repairing piece of apparatus, whose ordinary breakdowns are understood; when they are more complicated, the veterinary surgeon is an accustomed friend. On the other hand the repairing engineer is an unknown stranger, with a reputation for charges, if anything, on a greater scale than those of the proverbial plumber.

The foregoing reference to the conditions that have to be allowed for in the design and application of electric motors shows clearly that something a little out of the ordinary will have to be provided for by the designer.

The mechanical and electrical portions of electrically-operated farm machinery should be so designed and constructed that they will require overhauling only after long periods of working. Most farmers have had trouble with the ordinary agricultural implements, and are therefore rather prejudiced against trying new machines until someone else has proved them to be successful.

One of the most common troubles experienced with electric motors on farms is the damage due to moisture, whether in the form of rain or condensation. Only by special design can this defect be overcome. The motors should be drip proof, *i.e.*, shielded from vertically falling water or dusty material.

Ball-bearings should certainly be used on all motors intended for agricultural purposes. The ideal of simplicity is in general reached with well-designed motors of the squirrel-cage type, in which the stator windings have been properly protected both from mechanical injury and from moisture.

In most cases it will be found preferable to incorporate the starter as a part of the motor. If this practice accomplishes nothing else, it at least saves some wiring, an undoubted advantage, where the motor is to be installed in remote country districts.

The designer must at all times bear in mind the goal in view, or, in other words, the advantages that may be anticipated by utilising electricity in the greatest industry in the world. Judging from the experience of other industries and taking into consideration the difficulties of farm work, the benefits of electrically operating a farm may be summarised briefly as follows:—

1. Decreasing the production costs.
2. Increasing the profits.
3. Turning out more work with the same labour.
4. Simplifying operations.
5. Circumventing the adverse effects of weather.
6. Converting what would normally be losses into gains and eliminating waste.

Hence it will be gathered that the agricultural motor designer has no easy task before him.

Water and Water Power.—A paper bearing the above title was read by Mr. D. Halton Thomson, M.A., at a recent meeting of the Liverpool Engineering Society. Mr. Thomson, in the first part of his paper, reviewed the factors which influenced the flow of streams, and the way in which variation was modified by storage schemes. The relation of rainfall to run-off was shown not to be a constant, as was often assumed. The loss could not be treated as a single factor, but must be divided into its components: direct evaporation, transpiration by plant life, the amount and seasonal incidence of rainfall, and variations in natural storage, each of which should receive separate consideration. Stress was laid upon the necessity for uniformity in gauging methods. The advantages of the combination of a steam station with a hydro-electric scheme were briefly stated, the principal benefit obtained being a reduction in the necessary constructional work—reservoirs, &c. The incidence of rainfall in various parts of the country was shown by means of a map.

Electrical Depth Sounding.—The Paris correspondent of the *Morning Post*, *apropos* of the recent acquittal of the commander of the *France* which struck an uncharted rock and sank in August last, states that Professor Langevin claims in the *Matin* to have solved the problem of avoiding such accidents as that which brought the *France* to grief. His idea is to use sound waves, which could easily be tracked by radio mechanism. These waves would be launched into the sea at the rate of 1,500 metres a second. They are transformed into sound waves, and the apparatus receives an "echo" and turns it into electric oscillation detected by radio instruments. In this way it has been possible to sound fifteen feet at a distance of several thousand yards. The whole problem consists in calculating the time elapsing between the emission of the waves and their arrival after being reflected

THE OPERATION AND CONTROL OF STORAGE BATTERIES IN CENTRAL STATIONS.

By ABEL FASTMAN.

The storage battery has been, and is still regarded by many central station engineers as a necessary evil, inherent in direct-current supply systems; this is an entirely erroneous point of view to take of a portion of the plant, which, if properly operated and controlled, is an invaluable unit in respect of its proved assistance towards efficiency, economy, continuity of supply, and the other considerations in the direction of profitable working. It can be safely assumed that the chief reason for this prejudice lies in the excessive depreciation and consequent heavy repair charges, which occur often within a very limited period from the date of installation, and such trouble in most cases can be traced to lack of knowledge of, or carelessness in attention to, the elementary points on which satisfactory maintenance depends. Frequently, also, before actual trouble develops, the cells are allowed to drop into varying condition as regards state of charge and activity, with the result that no reliance can be placed on the capacity, which condition of affairs is invariably assumed by the central station engineer to be inseparable from battery working, and not a result of irregular treatment.

The most usual causes for unnecessary depreciation in all types of stationary batteries are irregularities in charging, chiefly of the nature of low rate inefficient and excessive charging. It is curious to reflect in this regard that in many central stations where costs are calculated to the decimals of a penny, these irregularities are persisted in not only to the detriment of the battery, but to the reduction of profits, for, as judged by the depreciation evident in many cases, the energy wasted must represent a very considerable number of units over twelve months' working. The results of over-charging include chiefly undue wear of positive plates, formation of troublesome negative sponge, rapid increase in depth of sediment, unnecessary loss of electrolyte, and possible breakdown of insulation through saturation of stands and wooden containers. These can all be avoided to a large extent by careful attention to the proper rate and duration of charge, which are comparatively simple matters in a three-wire supply station, where out-of-balance discharge is not excessive, and where the battery is charged in the usual way from the line through boosters on each side of the system, the battery being used only to assist on peak loads, or alone on all-night discharges, and charged at a convenient period during the day.

The makers usually specify a normal rate of charge, and although within well-defined limits, lower and higher rates are permissible, these may only be used to some degree at the expense of economy in charging and the possible future life of the plates, dependent on the extent of the usual variations from the normal rate. When charged at the normal rate, a battery should be regarded as fully charged when the plates are equally active in gassing, and the cells have "boiled" freely for from 15 to 30 minutes, the former period being about the correct extent of free gassing when charging is required daily, and the latter when charging is necessary only once or twice weekly or at longer intervals. It is important that as far as practicable charging should be carried out in one run, as it is false economy to utilise at various times or during light-load periods any surplus power which may be available on the busbars, by charging in instalments on two or more occasions. This arises from the fact that the effects of local action are much more pronounced when the cells are only partly charged and left in this condition for any appreciable time, while apart from this, any savings effected by utilising surplus power in this way are usually more than cancelled by the depreciation caused by the unsuitable charging rates which naturally follow on this practice.

In the case of a central station with battery arranged as described, the neutral wire is connected to the mid point of the battery, and if the balancer is able to deal with the total out of balance on the system it is advisable that this connection should not be maintained during discharge with a view to ensuring that the extent of discharge on each portion is similar. Where the balancer is not capable of coping with the total out-of-balance and the neutral connection to the battery is of necessity maintained, the battery will then share the out-of-balance with the balancer, with the result that one portion of the battery is discharged to a greater extent, thus rendering necessary variable amounts of charge. The battery when assisting the balancer in this way is more sensitive to sudden fluctuations, and although these are damped fairly quickly by the voltage drop, it is usually found that the out-of-balance discharge is considerably more than might be expected from observation of the indicating instruments, and that it increases with the extent and frequency of the fluctuations. In general, the conditions under which the balancer is not capable of dealing with the total out-of-balance preclude the possibility of charging each portion separately, or of continuing the charge on the more heavily discharged portion after the lighter discharged portion is charged, as this would further increase the out-of-balance on the system, and it therefore becomes necessary to make an adjustment in the respective rates of charge, with a view to the complete battery being brought to a fully charged condition in about the same time. To this end the differences between the outputs of each portion should be ascertained, and the rate of charge on each portion should be adjusted above and below the normal, aiming that the ampere-hours charged are approximately requisite, and when all cells have attained the stage of active gassing, the rates on both portions should be altered to the normal figure and charging completed at this rate to the gassing period mentioned, the duration of which depends on conditions of operation. It will be found that the portion which is charged at the lower rate will not be so efficient, and that the ampere-hours are not proportionate, and allowance will require to be made for this; it will also be necessary to take into consideration the rating of the booster which is charging at the high rate so that this is not loaded beyond the safe limit. The important point to be remembered in the foregoing is that the rates employed should vary as slightly above and below the normal as is consistent with arranging that both portions are charged fully over the same period. In this way, and with little extra trouble to the switchboard attendant, unduly high or low rate charging can be avoided, and more important still, overcharging of the lighter discharged portion is prevented. This method of dealing with variable discharges can be applied to a system where boosters are either of the charging type or hand reversible for discharge, and if regulating cells are included, these should be removed from circuit when fully charged in the usual way.

In some three-wire central stations the complete battery is charged by one booster, and in such cases it is highly advisable that the balancer be liberally rated and that the neutral connection to the battery, if such is included, should only be closed when the out-of-balance is negligible. The utilisation of the battery to assist the balancer or for balancing purposes alone would, in these circumstances, result in variable discharge, to compensate for which no differential treatment is possible on charge, and therefore either the lighter discharged portion is overcharged or the heavier discharged portion insufficiently charged, and as human nature is always prone to err to the greater extent, the former result is the most usual. A battery of this type should there-

fore be operated as nearly as possible under two-wire conditions.

In many older central stations the major number of the cells are charged from the line and through regulating switches to the neutral, and the remaining cells, including those used for regulating purposes, are charged by means of a motor-generator (usually referred to as a booster) connected through regulating switches to the neutral end of each portion of the battery, the circuit being continued through the cells on each side up to the contacts on which the line regulating switches are placed and completed through the neutral. This arrangement, which involves a rather expensive lay-out of copper rods, has distinct limitations for dealing with out-of-balance discharge, as although charging rates can be varied through the cells charged from the line, such is not possible in the two portions charged from the motor generator, and if these have been subjected to different discharges, it follows that irregular charging is an inevitable result. Furthermore, there are usually one or two cells between the neutral contacts to the cells charged from the line and the neutral contacts to the cells charged from the motor-generator, and these cells, which include all within the limits of travel of the line regulating switches, are also variably charged relatively to cells charged solely from the line and solely from the motor-generator. This in actuality means that the complete battery is divided into six portions for charging purposes, viz., positive and negative portions charged from the line and from the motor-generator, and the intervening cells which are charged in the first instance from the line and later by the motor-generator. In only two of these portions can the current be varied to compensate for different discharges, and if the battery has been subjected to an out-of-balance discharge, the most careful attention of the switchboard attendant will be necessary, as not only do the rates on portions charged from the line require to be varied to permit of charging over the same period, but it is also necessary to keep a careful watch on the cells charged from the motor-generator, and to operate the switches on the more lightly discharged side, as these cells come up to a fully charged condition in advance of the cells on the more heavily discharged side. The cells in which the charge current cannot be adjusted to satisfy conditions of differing discharges usually number about one-third of the entire battery, and it will therefore be readily seen that depreciation arising from out-of-balance conditions is an item of importance, and that these conditions should be avoided at all costs. The suggestion that charging on each portion should always be carried out at the normal rate during the gassing period is with a view to preventing overcharging of the portion charged at the lesser rate, as the gassing would not be so vigorous, and where the condition of the cells is judged by observation, as should always be the case, the attendant might be misled. The fully charged appearance of the cells, when charging is being carried out at the normal rate, should be familiar to the attendant, and every endeavour made that both portions are in an equable condition as regards state of charge, and thus overcharging during direct charging will be largely prevented.

Overcharging may, however, occur in a further way, and to a more serious extent, in the case of a central station where the battery "floats" on the line for buffer purposes during times of light load. Whether in a partly or fully charged condition, if the line voltage exceeds the battery voltage to any extent, the cells are subjected to a constant charge at very low rates, which has a very wearing effect on the positive plates, this being more pronounced when these are fully charged. Apart from this, it is a distinct waste of energy, as even when the battery is not fully charged the units charged in this way are not recoverable on discharge, and in fact the plates are simply corroded. The simple precaution of retaining sufficient cells between the outers, so that the battery pressure exceeds the line pressure and that cells are discharged slightly and not charged, would completely prevent any trouble from this cause. It should, however, be remembered that floating discharge, unlike low rate floating charge, is effective, and is an actual discharge, thereby reducing the available output. If an out-of-balance exists under these conditions, the more heavily loaded side will discharge to a greater extent, but such discharge should not be reduced by altering the number of cells on the lightly loaded side, and therefore between the outers, to the extent which would permit of floating charge as a result of the total battery pressure being less than line pressure. The voltage across the total number of cells in circuit should slightly exceed the line voltage under all conditions of floating, as the difference in discharge which may arise from out-of-balance is the lesser of two evils, and can in most cases be adjusted on a following charge.

When the number of cells does not permit of this precaution, the booster, if of the hand-reversible type and capable of fine voltage adjustment, should be operated, or alternatively more cells should be added; of which the latter proposal is preferable.

The instruments installed in the battery circuit should include, in addition to the usual indicating ammeters and voltmeters, a recording ammeter and voltmeter, and charge and discharge integrating meters preferably of the ampere-hour type, and all should by periodical checks be maintained in an accurate condition and used in conjunction with careful observation during the latter stages of charging. The ampere-hour efficiency of a healthy battery may be regarded as a constant, but the watt-hour efficiency is affected by so many factors that it can only be expressed under very different limitations, so that satisfactory control is practically impossible in this way. If suitable rates are employed for charging, and floating charging and overcharging is avoided, the ampere-hour efficiency should approximate between 88 per cent. and 90 per cent., according to the extent, frequency, and rates of discharge. A higher efficiency cannot be obtained, and a lower efficiency indicates overcharging, provided the instruments are accurate. Integrating meters of the ampere-hour type arranged to read in units should not be used.

The foregoing remarks may be summarised in general directions to the effect that the out-of-balance should be minimised as far as possible, that charging should be at about the normal rate having regard to different discharges from each portion, that extent of charging should be limited as mentioned, and that floating charge should be carefully avoided, while in addition observation of appearance of cells should play an important part during charging and observation of instruments at all other times, together with a careful regard to all points on the working instruction card.

The conditions under which a battery is operated in conjunction with an automatic reversible booster differ to a considerable extent from those applying to usual three-wire systems, and the correct procedure in such cases depends on the nature of the load and type of booster. It may, however, be said that where the booster is externally controlled, and the frequency and extent of the load fluctuations somewhat pronounced, it is advisable to aim at full equalisation, when no doubt the "dips" will permit of charging at proper rates. If, however, the peaks and dips are not very marked or are out of proportion during peak loads to the load curve during between-peak loads, it will be generally found advisable to set the average line current lower during peak discharges, and higher during between-peak loads, aiming at about 90 per cent. ampere-hour efficiency over each day's working, in which way undue low-rate charging and overcharging will be avoided. The battery under these conditions should never be overcharged by a prolonged net charge or overdischarged during a period of net discharge.

The assumption that the operation is at fault is in most cases found to be correct, where central-station batteries fail within a limited period; but if proper care and treatment is given on the lines suggested, and reliable judgment cultivated by careful attention, depreciation can to a considerable extent be avoided.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New "Tok" Switch.

A number of improvements have been incorporated in the design of the new switch, illustrated in fig. 1, which is made by Tok Switches, Ltd., Granville House, Arundel Street, W.C.2.

The cover is made of a black heat-resisting, non-hygroscopic, insulating material, which is highly polished. The indicator, showing the position of the switch, consists of a disk on which the markings are boldly embossed in white, on a bevelled edge, so that when the switch is mounted vertically on a cooker the

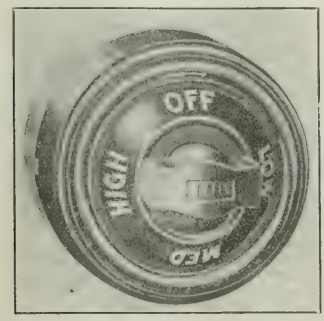


Fig. 1.—A New "Tok" Switch.

position of the switch can be easily seen. The underside of the indicator is fashioned in such a manner as to make it impossible to put the indicator on the wrong way in relation to the switch position. The key is provided with a locking device. This is a rack in the centre of the indicator, over which works a metal projection moulded into the inside end of the key. By this means the key is only allowed to be turned in a clockwise direction. To unscrew the key it has to be pulled forward clear of the rack. The key is made of material similar to that of the fireproof cover, and will not soften or turn on the spindle when subjected to high temperatures.

The switch is made with a variety of interior arrangements and for a wide range of currents.

The "Unit-Ad-Shade."

As briefly mentioned in our last issue, an ingenious advertising device, the invention of Mr. C. M. Bennett, has been developed by Messrs. Lamlok, Ltd., and is being put on the market by the Unit-Ad-Shade Co., of 133, High Holborn, London, W.1, which has been formed to handle the business commercially. As shown in the accompanying illustrations, it consists of a spun aluminium shade



Fig. 2.—The "Unit-Ad-Shade."

with a turned-up rim (fig. 2), on which are clipped a number of small brass frames. Into the frames (fig. 4) thin stencil letters can be slipped, together with glass plates of any desired colour, the latter being behind the stencils. Thus the letters are illuminated by the lamp without interfering with its normal functions. The letters are interchangeable, and the wording of the sign can be changed as often as desired, the operation taking only a few minutes at most. The aluminium shades are made in various patterns to suit usual requirements, and can have any desired finish; or the ordinary conical opal shade can be fitted with a narrow aluminium ring clipped on its rim (fig. 3). A special carrier is made for use with Holophane shades. In the case of pendants, the weight of the letters on one side is counterbalanced by a suitable weight clipped on the opposite side, unless

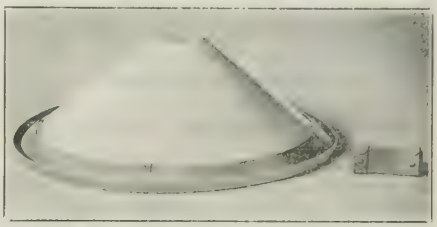


Fig. 3.—Opal Shade with Ring and Counterpoise.

the lettering is so arranged as to remain in balance without this aid. The frames are provided with wings which effectually prevent leakage of light between them, which would

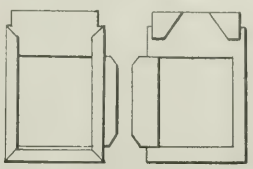


Fig. 4.—Frames to Carry Letters; Front and Back Views.

detract from the effect. The simplicity of the device and the ease with which its message can be varied should ensure its wide adoption in show-windows, shops, and innumerable other places where notices are exhibited.

The "Losles" Automatic Temperature Controller.

An improved form of the "Losles" automatic temperature control system, introduced by Mr. G. Wilkinson, of Harro-

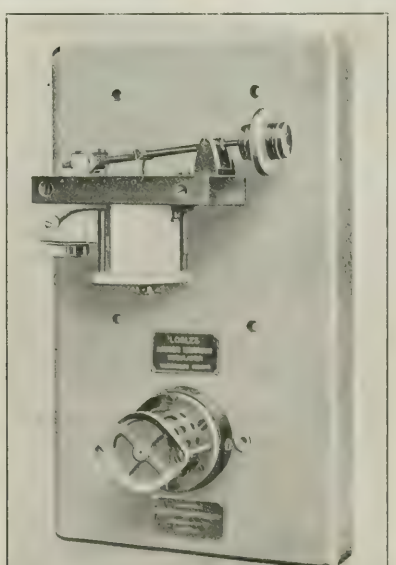


Fig. 5.—The "Losles" Temperature Controller.

gate, has been designed by the Leeds Electrical Construction Co., Ltd., Charmouth Street, Leeds. The system, as applied to the control of electric radiators, ovens, &c., consists

of a thermostat and a circuit breaker, with a shunt in which the thermostat is connected. The thermostat is fitted with an expanding diaphragm, and when the latter closes the thermostat contacts the shunt circuit is completed and the circuit breaker opened, cutting off the supply to the radiator or oven. The actual load handled by the thermostat does not exceed 12 W. The opening of the circuit breaker is made in two mercury cups. When the thermostat contacts open owing to reduced temperature the shunt circuit is broken and the circuit breaker closed. This action can be arranged to operate within 3 deg. F. (plus or minus) of any desired temperature. The device leads to a considerable saving of electricity, and at present the circuit breaker is designed for operation on a.c. or d.c. up to 100 A. at 600 V. The equipment is illustrated in fig. 5. The holes in the panel are for fixing a cover.

PARLIAMENTARY NOTES.

[By our Special Parliamentary Reporter.]

G.E.R. Electrification.—On December 12th, Lieut.-Col. Sir Raymond Greene asked the Parliamentary Secretary to the Minister of Transport, whether he was aware of the inadequate facilities for travelling from Hackney and Stoke Newington to other parts of London; whether any scheme had been put forward by the Great Eastern Railway Co. and the North London Railway Co. for the electrification of their lines; and, if not, whether he could urge upon those companies the need for some action to secure further facilities to the travelling public.

Col. Ashley replied that no specific schemes for the electrification of the line referred to had been put forward by either of the companies named. He had, however, communicated the question to both companies.

Stretford Light Railway.—On December 12th Mr. Lowth asked the Parliamentary Secretary to the Ministry of Transport, whether he was aware that although the Stretford Light Railways Order and the West Manchester Light Railways (New Lines, &c.) Order were made in 1906, no steps had yet been taken to put the work in hand; that the working population of Trafford Park having considerably increased the road and railway were more urgently needed than ever; and whether, in view of the fact that it was 16 years since the Orders were made, he would take whatever action was possible to get the schemes commenced, thus giving an opportunity of work to many unemployed men.

Col. Ashley said he was informed that the Stretford Urban District Council, which was empowered by these Orders to construct certain light railways and a road between Stretford and Trafford Park, was desirous of proceeding with the work, and was in negotiation with a view to the removal of certain difficulties which had arisen in connection with the crossing of the Bridgwater Canal. The Council stated that it had reason to hope that the work might be proceeded with at an early date.

G.N.R. Electrification.—On December 12th, Viscount Ednam asked the Parliamentary Secretary to the Ministry of Transport whether he would represent to the Great Northern Railway Co. that it was now time to put in hand a scheme for the electrification of its suburban lines.

Col. Ashley replied that no scheme regarding the electrification of the suburban lines of the Great Northern Railway was at present before him. The question of the preparation and introduction of such a scheme was one for the consideration of the railway company, and he had brought the suggestion to the company's notice.

Coal Prices.—On December 12th, Lieut.-Col. Lane Fox, Secretary for Mines, stated that the price of coal at the pit-head during the quarter ended September, 1922, averaged 18s. 2¾d. per ton. The corresponding figure for 1914 was between 10s. and 11s. In Northumberland the average selling price of coal at the pit during the quarter ended September, 1922, was about 18s. 11d. per ton, as compared with 10s. 5½d. per ton in the quarter ended June, 1914. The average declared value of coal exported at Tyne ports in October, 1922, was 29s. per ton, as compared with 11s. 10d. per ton in 1914.

Marconi Wireless Co.—On December 12th Mr. Middleton asked the Postmaster-General what licences were issued by his predecessor to the Marconi Co.; whether the text of such licences would be laid before the House; whether the State had any control over the operation of such licences; and whether the Marconi Co. had any power to send and receive wireless telegrams between Great Britain and other countries was exclusive.

Mr. Baldwin replied that no licences were issued by his predecessor to the Marconi Co., but provisional permission was given for the erection of a wireless station at Caister for the purpose of carrying on a wireless service with Switzerland, and also for the purpose of conducting wireless communication between Spain and France, which had previously been carried on by temporary permits. The question of the conditions under which permanent licences should be granted was the subject of negotiation. The terms of any agreement that might be arrived at on the subject would be laid before Parliament. Although the Marconi services had withdrawn a certain amount of traffic from the Government cables the effect on the revenue was not appreciable.

Wireless Apparatus.—On December 12th, Major McKenzie Wood asked the Postmaster-General what arrangements, if any, had been made with the Broadcasting Co. or the British Radio Apparatus Manufacturers' Association for notifying the electrical trades as to the admissibility of imported parts in wireless apparatus approved for Post Office licence; whether he was aware that leading British import houses who had hitherto sold parts to wireless manufacturers were finding the greatest difficulty in securing the information necessary to guide them in considering forward contracts; and whether he would consider the issue of a detailed statement on the subject.

Mr. N. Chamberlain said that the receiving apparatus which might be used under receiving licences would be limited to types submitted for the approval of the Post Office by members of the Broadcasting Co. and found to conform to certain technical standards. It would be a condition during a period of two years that such apparatus must be made in this country with the exception of certain parts which, for the present, were confined to batteries, accumulators, and outside aerial equipment. These conditions were announced by his predecessor, but he would endeavour to secure publicity for them in the technical Press.

The Marconi Claims.—On December 13th, Mr. Middleton asked the Chancellor of the Exchequer whether any claims by the Marconi Co. against the Government were outstanding; if so, the number and the respective amounts of such claims; why a settlement was delayed; and whether there was any prospect of an early settlement.

Mr. Baldwin replied that claims by the Marconi Co. against the Government were outstanding in respect of the use of the company's patents by the Admiralty, War Office, and Air Ministry, and in respect of the company's services to the Post Office during the war, and also in respect of the future payments, if any, to be made for the use of the company's patents by the Post Office in connection with the Imperial wireless chain. He did not think it advisable to refer to the amounts involved in the claims under discussion. In reply to the third part of the question, the late Government decided that there must be a comprehensive settlement of all these claims rather than individual settlements, and this had necessarily caused some delay. He could only say, in reply to the fourth part of the question, that negotiations were being pursued.

Tube Extension Contracts.—On December 14th, Captain Brass asked the Chancellor of the Exchequer whether he was aware that the Foundation Co., Ltd., to which a contract had been given for a portion of the Hampstead tube extension under the Trade Facilities Act, was an offshoot of the Foundation Co., of New York; whether the contract for this work was offered in open competition in this country; and, if not, whether a list of those invited to tender could be given.

Mr. Baldwin said that he understood that thirteen firms were asked to tender, and that the tender of the Foundation Co. was not only the lowest, but favourable as regarded dates of delivery. The company was a British firm, separate from the New York company, and undertook to fulfil all the usual stipulations with regard to the use of British materials.

Midland Railway Electrification.—On December 14th Captain Martin asked the Parliamentary Secretary to the Ministry of Transport whether he was aware that a clause was inserted in the Midland Railway (London, Tilbury, and Southend Railway Co. Purchase) Bill in July, 1912, to the effect that the company should forthwith prepare a scheme for working the traffic by electric power on the route between Fenchurch Street station and Southend-on-Sea; and what extension of time had been granted to this company to carry out the obligation imposed on it by Act of Parliament.

Col. Ashley replied that the Act provided that the Midland Railway Co. should apply to Parliament for any powers necessary to carry out an electrification scheme not later than the session of 1914, and the period so limited was extended to the session of 1916 and later to the session of 1917. There had been no further extensions.

Sale of Queensferry Factory.—On December 15th Sir Rowland Blades asked the Chancellor of the Exchequer whether he was aware that the War Office had arranged to dispose of the Queensferry electricity plant, building, and land to the City of Chester for £54,000, and that another offer had been made to purchase the factory, and that the present sale was being entered into without any opportunity being given to others to tender for the factory; and whether he was prepared to sanction the sale of Government property for about one-third of its value without giving other willing buyers the opportunity of making higher bids for the property.

Mr. Baldwin replied that for over a year the Queensferry factory had been advertised for sale in one lot, but no reasonable offer had been received, consequently the factory was being disposed of piecemeal to the best advantage; and the power-house, plant, and site had been sold by the Disposal Board to the Chester Corporation for £54,000, subject to the approval of the Electricity Commissioners. The price of £54,000 was the best obtainable. The Corporation was at

present obtaining electricity from this source under a three years' agreement, which had not yet expired. The Disposal Board was willing to consider any reasonable offer to purchase the remainder of the factory.

Royal Assent.—On December 15th the Royal Assent was given, by Commission, to the Trade Facilities and Loans Guarantee Act, 1922, and to the Glasgow (Tramways, &c.) Order of Confirmation Act, 1922.

Parliament rose on Friday, December 15th, until Tuesday, February 13th, 1923.

LEGAL.

Magnetos Alleged Not to Order.

In the Mayor's and City of London Court, on December 12th, before Mr. Registrar Dell, John Palmer, Jun., & Co., Dauntsey House, Frederick's Place, sued the County of London Engineering Works, Ltd., 27, Stockwell Road, for £65 12s. 10d., return of money paid, or, alternatively, damages for breach of contract. Mr. Matthews, in the employment of the plaintiffs, said his firm bought from the defendants magnetos represented to be in perfect order. They paid 50s. 6d. each. Eighteen magnetos were packed by the defendants and shipped to South Africa, where they had been rejected by their (plaintiffs') customer in South Africa as not being according to order. Notice had been given to the defendants that the magnetos had been returned, and that they were lying open to their inspection. Within the last three days an inspection had been made by the defendants, plaintiffs also being represented. The total amount due in respect of the shipping was £65 12s. 10d., representing £51 12s. the price of magnetos, the balance being in respect of freight and charges. Mr. Kirby, motor engineer, said that he had examined the magnetos in question and found they were second-hand machines. Old parts had been put together, and the re-assembling had been done badly. He would certainly reject such goods upon an order for new magnetos, in going order, surplus Government stock. He would say that the magnetos supplied were certainly not in compliance with such an order, and a customer would be entitled to reject. There was no appearance on behalf of the defendants, and judgment was given for the plaintiffs for the amount claimed. Later counsel and solicitor appeared in court to defend the case on behalf of the defendants, and an application made for the case to be re-heard. Eventually it was ascertained that the witnesses for the plaintiffs had been sent away, and the case could not be re-heard that day; it was therefore adjourned.

Ferguson *v.* Manham.

Judge Cluer gave his decision as to damages recoverable, owing to employés being thrown out of work through the faulty installation of a machine, in the Shoreditch County Court on December 12th. The plaintiffs were Messrs. C. J. Ferguson & Sons, of 54, Chiswell Street, E.C., electrical engineers, and they sued Messrs. Manham & Co., of 28, Sun Street, E.C., manufacturers, to recover £2 5s., being the fitter's time incurred in disconnecting a defective 3-h.p. motor and fixing in its place another 3-h.p. motor, connecting it, and leaving it running.

Mr. A. E. Robinson appeared for the plaintiffs.

It appeared that the plaintiffs were called in to see defendants' electric motor, and found the armature burned out, whereupon they advised defendants that it was useless, and they had better have a new one, to which they agreed. They were charged £28, and the plaintiffs had the old one as well.

The defendants said it only went for two hours, when it stopped, and the whole of their 15 hands were idle for four hours while the plaintiffs put it right. The plaintiffs' charge was for putting their own defective work right, it was declared, but plaintiffs' manager said it was for the time employed in fixing the motor. He did not consider plaintiffs liable for the stoppage of the works.

Judge Cluer: What he says is, that if he supplies you with an engine without a piston rod, he is not to pay you for the time wasted while you send for the piston rod.

The defendant was cross-examined, and agreed that the motor might have failed through want of lubrication, but that had to do with the fixer, and not with him.

Judge Cluer said the plaintiffs were clearly liable if the machine was fixed without any lubricant, but the girls' time for the loss of business was, he was afraid, too remote for damages. If work was run so close up, he did not think the fixer responsible. He gave judgment for the plaintiffs on the claim for 32s. 6d., and for the defendant on his counterclaim for 5s.

Workmen's Compensation Case.

A case under the Workmen's Compensation Act was heard in the Norwich County Court last week, when Horace J. D. Langham, apprentice fitter, of Norwich, claimed compensation for an accident against Messrs. Laurence, Scott, electrical engineers, of the Gothic Works, Norwich.

Counsel stated that on April 15th, last year, Langham was drilling holes in a steel casting, when the drill broke and part of it lodged itself in his right eye, which had to be removed. There was no dispute as to liability. There was no question of liability until after February 28th of this year, because the firm took the man back and treated him very generously, paying him full wages until the end of his apprenticeship on February 28th, when, as a rule in such cases, he finished his service, and had to find employment elsewhere to broaden his experience. From that date until June 19th, when he got a position as grocer's assistant at 25s. a week, the applicant was unemployed. The man was unable to find work. His wages before the accident were 35s. a week. He could, in the ordinary way, have been earning 45s. 6d. per week, and counsel ask for half the difference between 45s. 6d. and 25s., the wage he was now earning.

For the respondents, Mr. Edmund Reeve said that the rule of Messrs. Laurence, Scott, Ltd., with regard to apprentices, was that, for their own benefit, they should get experience in a wider field following the completion of their apprenticeship. Applicant was still eligible for some engineering work if he could get it. It might not be wise for him to do drilling work, but there was a great deal of other work that a one-eyed man might do.

Mr. James William Bransby, works manager to the respondent firm, said that the applicant was handicapped by having to wear glasses, but it was quite possible for a one-eyed man to do engineering work. As the applicant had stated, he had left the firm simply because of the rule that apprentices sought work elsewhere after completing their apprenticeship. In cross-examination, he said that applicant could not get work as a fitter to-day on account of the trade; there were thousands of men with full sight out of work. As improver, applicant would have been paid 43s. 6d. per week.

For the respondents, Mr. Reeve submitted that if the engineering market were normal, this man could do engineering work. He certainly ought to be about a 35s. a week man if the Trade Union would allow him to work—25s. was not the measure of the man's value. His Honour would be justified in taking something between 35s. and 43s. 6d. a week.

His Honour, in giving judgment, said it was not fair that the applicant's deterioration had gone down to 25s. a week; his earning, he thought, might be calculated to be reduced from 43s. 6d. to 30s. That meant a loss of 13s. 6d. a week. That amount would be allowed during the time applicant had been out of work, and afterwards it would be 10s. a week.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electrical Trading Relations.

With reference to the remarks in your issue of December 1st by Mr. Barfield, regarding the cost of electricity as compared with gas for engineering production, I should like to take this opportunity of endorsing what he says. As a matter of fact, he did not carry his point as far as he might have done, perhaps from modesty! Not only has the running cost been proved cheaper, but—what is of even more importance—the finished product is better. There is no scrap, and further, unskilled labour can obtain better results every time in the Wild-Barfield Furnace than highly-skilled men with gas muffles can ever obtain consistently.

At several engineering works where these furnaces are installed, I have been informed that even if the running costs were higher than those of gas, the furnaces would still be cheaper in view of the avoidance of scrap, due to certainty of results.

F. W. Skidmore.

Coventry, *December 5th*, 1922.

Technical Engineers.

I regret having to trespass on your valuable space, but feel that it is necessary in view of the letter appearing in your issue of December 1st, signed by "One of Them."

It is, of course, generally recognised that the S.T.E. does not cater, as a protective organisation, for the technical engineers, and, from its constitution, cannot do so. The only two organisations, so far as I am aware, which cater for the economic and educational needs of such supervisory workers in the electrical industry as managers, foremen, supervisors, technical representatives, &c., are the E.P.E.A. and the National Association of Supervising Electricians. It is understood that the E.P.E.A. deals mainly with the power-station people and the N.A.S.E. with the remainder.

Both organisations demand certain qualifications for admittance to membership, and as a member of the N.A.S.E., I know this organisation has done much for its members and has a national agreement with the Employers' Association covering its members in the contracting trade, and has under consideration the question of approaching the Engineering

[illegible] Federation on behalf of its members in the [illegible] industry.

[illegible] of the N.A.S.E., your [illegible] will have noted in the reports appearing in the Electrical Review from time to time, the excellent educational work which the Association is doing. In fact, I am informed, that is their principal object. In addition, there are [illegible] benefits.

As the N.A.S.E. caters for the technical staffs of electrical [illegible] it is the right place to join a live organisation, those concerned should apply to the general secretary, N.A.S.E., 82, Victoria Street, London, S.W.1, for particulars.

Organisation.

[illegible] 16th, 1922.

The Society of Technical Engineers.

[illegible] Mr. Norman Wyatt the pardonable [illegible] which he delivered his reply to your correspondent, one of them, who certainly timed his thrust at the S.T.E. rather unfortunately in one respect. All the same—unless it is attributable to coincidence—there is evidence that the point of the latter's rapier pricked some sensitive spot, to judge by the considerable emission of printer's ink which has followed. This sudden leap into the limelight is a distinctly new departure for the Society, which, ever since the flourish that accompanied the declaration of its somewhat anæmic "policy," has consistently shunned publicity.

It is scarcely possible from the information given in the Press to gauge the precise extent to which the S.T.E. has succeeded in organising the class of technical engineers for which it ostensibly caters. There is a good deal of talk about what should be done and what should be aimed at, but little indication of solid accomplishment. True, the establishment of an unemployment insurance scheme is trumpeted with considerable emphasis. Now, an efficient scheme of this sort is an excellent thing, without doubt, but in this case there is some foundation for the suspicion that the initiative lay with a section of the members themselves, and not with the Society, which only took the matter up after it had been proved a success.

There is a vague claim put forward that the S.T.E. has succeeded in securing for its members advantages with regard to their conditions and terms of employment, but the general impression I have gained is that of "much cry and little wool."

To my mind the real test of the Society's success is the percentage of potential members it has managed to attract to its standard. Rumour has it that roughly about 2,000 out of a possible 20,000 or so have been so impressed with the advantages offered as to become enrolled in the membership.

I am not a member of the Society; I have neither direct interest in nor animus against it; but I consider the numbers and importance of the technical engineers in manufacturing concerns to be so great that their efficient organisation is a matter of urgent moment to themselves, to the engineering profession, and to engineers of similar standing in other fields. If 2,000 out of a potential 20,000 is the criterion of the Society's success in organisation, then I consider it has lamentably failed.

It would be interesting to learn the reasons for this failure to attract members. Is it the policy of the Society which is at fault, or are its methods of propaganda inadequate? Are its declared objects of too restricted and conservative a character to serve as a means of creating enthusiasm for its cause, or is there a suspicion amongst technical men in engineering manufacturing works that the S.T.E., under its present auspices, has, owing to timidity or from preference, too much regard for the interests of employers for it to function advantageously for the benefit of those of an employed status?

I make these inquiries with the hope of eliciting some information, as I am convinced there is a great field for a live and go-ahead organisation of the technical staffs for which the S.T.E. claims to act.

One is led to question whether all is well with the S.T.E. when one considers the success of the E.P.E.A. The latter, with a much more restricted field and a much smaller potential membership, has succeeded, by dint of a well-considered policy and utilisation of the unbounded enthusiasm of its honorary officials, in securing substantial benefits and advantages for its members. In addition, it has gained recognition from all authorities connected with the electricity supply industry as the representative organisation for technical engineers engaged in that branch of engineering.

Those who control the activities of the S.T.E. would, in my opinion, do well to consider seriously the position of their Society, lest its apparent somnolence and comparative failure eventually lead to its membership falling away in disgust and disappointment, and turning towards a live organisation, which can at least [illegible] having proved its efficiency. Speaking personally, I venture to hazard the opinion that the E.P.E.A., while earnestly desirous of seeing the S.T.E. wake up and do something to attract the 18,000 engineers still outside its ranks, would be prepared, if called upon, to undertake the task itself.

[illegible] in propaganda for the E.P.E.A., and of supposing that [illegible] the most expedient [illegible] a kindred association. As a matter of fact, I am quite indifferent as to which particular organisation does the work. The main point is that one or other should take the [illegible] in hand.

There may be several difficulties in the path of the S.T.E. of which I have no knowledge. Difficulties, however, should act as incentives to increased efforts to overcome them. Is the S.T.E. going "all out" to tackle these difficulties, and are its members satisfied of this? It would be interesting to know.

Salvo jure.

December 17th, 1922.

The Improvement of Power Factor.

When recently I made a few remarks at the I.E.E. I fully hoped and expected some instructive criticism, as I felt certain that my good friend Mr. E. W. Dorey must be in the room. However, my disappointment and misgivings at the time now appear to have been without foundation.

The amount of energy stored in a condenser in watt-seconds is, I believe, dependent upon the capacity and the square of the voltage applied, and may be expressed by the equation $W = \frac{1}{2} C V^2$. Obviously, therefore, the higher the voltage the smaller the capacity C required for any specified kVA correction or £ s. d. equivalent.

A year or two ago Mr. Dorey quoted and published the fact that the capacity required to produce a certain leading current could be expressed as C in microfarads = leading load in kVA $\times 10^6 / 2\pi n V^2$, n being the frequency and V the voltage across the condenser. Now, however, our datum lines or standpoints should be specified. Mr. Dorey is avowedly a salesman of static condensers and wishes to grind his axe accordingly. Both your correspondents appear to think that I wished to depreciate static condensers.

For years I have been convinced that sooner or later supply authorities would seriously have to tackle their own power factor afflictions.

Being personally connected with the supply industry, your correspondents should, I think, rather regard me as a possible small influence in the direction of a buyer of condensers. Knowing me personally, Mr. Dorey is aware that I am not in a position to take up his challenge. As we are both desirous of working in the same direction, but from absolutely different platforms, I contend that, with a few exceptions, supply authorities' personnel are not aware what poor power factor is costing them. All who are really interested in cheap electricity must get down to "bed rock."

In conclusion I would ask all correspondents and contributors to your columns to satisfy themselves as to what I actually did say, and to take no notice of what I am reported as having said I am out for information, and not for destructive criticism.

W. E. Rogers, A.M.I.E.E.

London, *December 17th*, 1922.

REVIEWS.

The Practical Applications of X-rays. By G. W. C. Kaye, O.B.E., M.A., D.Sc., A.R.C.Sc., F.Inst.P. Pp. viii+135 figs. 96. London: Chapman & Hall, Ltd. Price 10s. 6d net.

Besides dealing with the actual applications of X-rays, this book contains a readable account of the physics of X-rays, and can be recommended, both to the general reader who wishes to keep in contact with X-ray progress and to many actual radiographers whose knowledge of the physics of the phenomena they utilise is often slight.

The chapter on the X-ray bulb is illustrated by the usual types of tubes commonly used. Of more interest, since the weak link of X-ray installations is doubtless the tube itself, are the illustrations of the metallic Shearer tube, and as a minor criticism it is regretted the author has not given a reference to the original source. The Coolidge tube is dealt with at some length, but the German Lilienfeld tube, which is becoming an increasing favourite abroad, is rather scantily dealt with.

The high-potential generator is dealt with on the usual lines, and is well illustrated.

In the chapter on measurement of X-rays the essentials of the Seemann spectrometer are illustrated, and to the electrical engineer the alternative use of this instrument as an accurate high-pressure voltmeter is becoming of importance. It is to be regretted that the author has not pointed out the desirability of more accurate physical measurements in place of the empirical barium-plantino-cyanide pastille which, whilst extensively used in England, is practically useless with the methods of deep therapy used abroad, for which the Furstenau Intensimeter is largely employed, and which is very scantily dealt with by the author.

The chapter on medical applications is very brief and open to comment. It is doubtful whether, as stated on page 76, that we are yet able to say deep-seated organs are "successfully" treated by X-rays, even with the German technique the author [illegible]. The author omits to point out that the

results depend both upon the histological type of growth and its situation. In commenting upon the difficulties of measuring the deep dosage of X-rays (for which the pastille method is useless) the author could very well have introduced a method using scales which are superimposed on each other in accordance with the different ports of entry. This method, first shown to the reviewer by Prof. Holthusen, of Hamburg, early this year, has since been described in the English medical papers. It is to physicists of the eminence of Dr. Kaye that the purely medical radiologists must look for an evolution of more accurate physical methods of measurement.

In the industrial applications of X-rays the author is on more familiar ground. It is of interest to note the spectrometer used at the N.P.L. is actually a modification of the Bragg instrument. The applications of such a spectroscope to analyse mixtures of salts which present difficulties to ordinary chemical methods, and the author's statement that such a method is more simple and certain than the optical spectroscope indicates a very important future use of X-rays, and one likely to be of much more importance than its temporary use to examine shell fuses, hand grenades, revolvers, &c., which the author extensively illustrates. Perhaps the greatest use of X-rays in industry will be to examine aeroplane castings and parts for flaws and bad workmanship, which the author deals with at length, but it would have been well if the author had laid stress on the dangers of industrial X-ray work to the operatives, and it is doubtful whether the advantages offered by X-rays to examine the cores of golf balls, as the author illustrates, is not overbalanced to the great risk to the operatives owing to their own possible ignorance and carelessness, or where an employer, on grounds of economy, neglects proper safeguards. Should, however, this type of application become more general, doubtless stringent Home Office legislation will be introduced.

A very interesting portion of this book is the section describing the use of X-rays to detect spurious old masters, which is very well illustrated. As, however, the method largely depends on the use of inorganic paints by the old masters and the use of the copyists of organic paints, which give no shadow with X-rays, it would seem the method is likely to be useless if the copyists retaliate by using old canvases and inorganic paints.

The final section on the future development of X-rays is very suggestive, and the author points out that progress depends on the more intimate relations between radiologists and electrical engineers, and one could go farther and say that the future of medical X-rays depends on the medical radiologist being a trained physicist and engineer as well as a medical man.

Whilst the book has been somewhat severely criticised in minor points, which doubtless a physicist of Dr. Kaye's standing would prefer to a merely laudatory review, the whole book can be warmly recommended to everybody interested in X-ray work. The method of production and the many excellent half-tone plates leave little to be desired.—B.J.L.

The Lead Storage Battery. By H. G. Brown, A.M.I.E.E. Pp. 162; figs. 60. London: The Locomotive Publishing Co. Price 5s. net.

This volume is by no means the first attempt to provide the station engineer and the user of the lead storage battery with the essentials of this subject, which depends so largely for its successful application on a fairly complete understanding of its underlying principles, and on a common sense knowledge of its practical operation.

The author has approached his subject with a mind singularly free from prejudice, and has credited his readers with some knowledge and reason.

The book has ten chapters, only one of which is devoted to theory. The generally accepted theory of the chemical changes in an accumulator is the only one dealt with, and in making this limitation the author shows wisdom, as it is possible to explain by means of this theory alone most of the results obtained in practice. A part of the appendix dealing with the ionic theory might have been omitted without detracting from the value of the work.

The second chapter is concerned with the electrical characteristics of the lead battery, and the graphs are of much practical utility. The graph showing the relationship of "capacity" to "duration of discharge" is closely in accord with that which is recognised by the industry as approximately applicable to all types of lead accumulator, and this, together with the corresponding graph of "rate of discharge" against "duration of discharge," should prove extremely useful.

Further chapters deal with the construction of cells, erection of stationary batteries, boosters and switches used in battery installations, battery testing, and battery economics. This last section is very clearly explained, and to the reader who has not devoted much thought to the subject may come somewhat as a revelation.

A series of useful diagrams on pp. 74-80 gives details of the connections in use for country-house lighting plants and central stations. Train lighting batteries, vehicle batteries and car starting batteries are discussed in a separate chapter, which also furnishes some information regarding the very large cells used for the underwater propulsion of submarines.

In the appendix suggestions are made for the testing of the water and acid used in connection with lead batteries. The standards for the calorimetric estimation of iron and ammonia shown on page 154 are a striking and bold innovation. Disks printed in colour on this page indicate depths of colour for passing and for rejecting specimens of acid proposed for use in batteries. The colour relating to the permissible proportion of iron appears to allow for a degree of impurity needlessly high. It is possible to obtain very easily accumulator acid which is almost entirely free from iron. As a colour standard for rejection, it would have been advisable, we believe, to employ one shade of colour as a passing standard and to stipulate that if a sample of the acid diluted by, say, twice its volume of distilled water, gave a colour deeper in tint than that used as a standard for passing, then the acid would be unsuitable for use.

From the colour printing standpoint the opinion of the accumulator chemist will undoubtedly be that the ammonia tests are well illustrated, while there is some doubt about the iron test colours.

As a whole the book is excellent of its kind and complete within the limits of its size. It could confidently be placed in the hands of any user of batteries who desires to give them the attention they really require. There will, however, be some hesitation on the part of a great many battery makers in recommending the book, for the reason that the name of one of the best-known accumulator manufacturing companies is prominently identified with the illustrations.

The Wireless Telephone: What it is, and how it works. By Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E. Pp. 112; figs 49. London: The Wireless Press, Ltd. Price 2s. 6d. net.

The author describes simply the essential principles of wireless telephony, and explains how the apparatus required is built up. The book is profusely illustrated with photographs and sketches showing how the apparatus may be connected up. These sketches are a distinctive feature of the book, as they are generally employed in place of the usual circuit diagrams. As "lay out" sketches they are excellent, but the inclusion of more circuit diagrams would be helpful to the beginner, for whom the book is primarily intended, as it is not always easy to follow the circuits in the sketches. In the last chapter is outlined clearly a method of building up a simple receiver for broadcast messages.

The book should be very useful to all those who are now becoming interested in the working of wireless telephony.

The Mechanical Handling and Storing of Material. By G. F. Zimmer, A.M.Inst.C.E. Pp. xx+804; illustrated. London: Crosby, Lockwood & Son. Price £3 3s. net.

First published in 1905, the present volume is the third edition of this extremely interesting and popular work, dealing with "labour-aiding appliances and time-saving appliances," as the author terms them, on the suggestion of Sir John Purser Griffith, past president of the Institution of Civil Engineers, who has written a "Foreword" for the present edition. As the title indicates, the book consists of descriptions, illustrated with photographs and drawings, of almost every conceivable sort of apparatus for handling material, and is divided into seven main sections. These are: (1) The Continuous Handling of Material by Means of Mechanical Conveyors; (2) The Continuous Handling of Material by Means of Pneumatic and Hydraulic Means; (3) The Intermittent Handling of Material; (4) Unloading and Loading Appliances; (5) Unloading of Railway Wagons; (6) Miscellaneous Installations; and (7) The Automatic Weighing of Material. It is a strongly-bound volume of some 800 pages, divided into 44 chapters and a very complete index. It is a book which should be on the shelves of every works manager and engineer.

The Electrical Handling of Materials. By H. H. Broughton, M.I.Mech.E., M.I.E.E. Pp. xvi+336; figs. 299. London: Benn Brothers, Ltd. Price 50s. net.

This book is Vol. 3 of a set of books dealing with the electrical handling of materials, and deals with "Electric cranes." Vol. 1 deals with electrical equipment, and Vol. 2 deals with structural steelwork and mechanical equipment. The present work consists of a well-bound volume of 336 pages divided into 15 chapters, dealing with the arrangement and construction of every type of crane, from the small "runaway" to the giant hammer cranes handling weights up to 250 tons, and in Chapter VIII. a full description of the two 250 ton floating cranes for the Panama Canal are given. These were built by a German firm at about half the price required by the American and British firms who tendered for the work, which failed on the test load being applied. The descriptive matter is accompanied with numerous tables and data and some hundreds of illustrations, very many of which are folding plates. We heartily congratulate the author on what we can only describe as a wonderful production, entailing, as it must have done, an enormous amount of labour and care in the selection and compilation of matter, and we certainly recommend it to anyone interested in this subject.

BUSINESS NOTES.

Bankruptcy Proceedings.—William Ford, Swan Street, Alvechurch, trading as Redditch Electrical Accessories Co., Central Chambers, Unicorn Hill, Redditch, electrician.—The public examination of this debtor was held on December 11th at the Court House, Corporation Street, Birmingham. The statement of affairs showed a deficiency of £180. Debtor attributed his failure to bad trade caused by the general depression. It appeared that he commenced business in January, 1917, at his present address in partnership with another. On the death of his partner, he paid £7 to the widow in settlement of her husband's share. Another partner subsequently came into the business, which was removed to Redditch, but no capital was introduced by this gentleman. In January, 1920, the partnership was dissolved, debtor retaining the assets and liabilities. Another partner came into the concern, but owing to slackness of trade he obtained a situation in January, 1921. The case was adjourned to be closed.

F. Wilde (Liverpool Engineering Co.), electrical engineers, 18 and 20, Vauxhall Road, Liverpool.—Receiving order made December 12th on creditor's petition.

D. H. Griffin (Midland Electric Co.), electrical engineer, 5, The Mart, St. David's Road South, St. Annes-on-the-Sea. First meeting, December 22nd, at the Official Receiver's offices, Preston. Public examination, January 12th, at the Court House, Blackpool.

J. J. Smith (J. Smith & Son), electrical engineer, 1, Central Street, E.C.—Trustee, Mr. W. Boyle, Official Receiver, Carey Street, W.C., released December 6th.

S. Holmes (Holmes & Co.), electrical contractor, Palatine Chambers, Halifax.—Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford, released December 7th.

Harold Busfield and John James Whittaker, trading as Busfield & Co., Welfield Street, and carrying on business at 215, Padiham Road, as electrical engineers.—This examination took place at Burnley Bankruptcy Court on December 13th. Bad trade and want of capital was the alleged cause of failure. The deficiency totalled £222. Debtors entered into partnership in April this year. Neither had capital, but Busfield had £50 in stock and Whittaker £45 worth. They borrowed £100 from a friend. That amount was still owing. Busfield said the business had never shown any profit. Examination adjourned.

Company Liquidation.—Abbott, Anderson & Abbott, Ltd.—Winding up voluntarily. Joint liquidators, Mr. E. C. Moore, Thames House, Queen Street Place, E.C., and Mr. H. Sharp, 16, King Street, E.C. Meeting of creditors, December 28th, at Thames House, Queen Street Place.

Dissolution of Partnership.—Clarkson, Hood & Co., manufacturers' sales engineers, 45, Hope Street, Glasgow.—Mr. P. Clarkson and Mr. J. A. Hood have dissolved partnership. Mr. Hood will attend to debts and continue the business under the same style.

Receiver Appointed.—R. W. Robins & Co., Ltd., importers and exporters of everything electrical, London, Cardiff, and Cologne.—Mr. W. Gordon Waterman, 85, Queen Street, Cardiff, was appointed receiver for the debenture holder in this case on November 8th.

Catalogues and Lists.—Messrs. L. Andrew & Co., 2, Whitworth Street West, Deansgate, Manchester.—A priced catalogue of insulating materials for electrical purposes, including ebonite, asbestos, mica, presspahn, varnishes, tapes, &c.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—List O.S., a well-illustrated brochure describing oil switchgear for panel mounting, for pressures up to 11,000 V and currents to 2,500 A.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—List A.24, giving illustrations, prices, and particulars of a wide variety of small electrical appliances and accessories, including wireless apparatus. Also an illustrated pamphlet dealing with sets and loud speakers for "broadcasting" reception.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—A priced and illustrated pamphlet advertising four types of "Magnet" electric cookers and cast-iron kitchen utensils.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Pamphlet No. [illegible] dealing with the construction, &c., of [illegible] and dynamos. Dimensions are given in both British and metric units.

[illegible] Electricity in Chartbook, 56, Victoria Street, S.W.—Monthly list (December) of motors and dynamos in stock.

The Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester.—An illustrated leaflet advertising "Lancashire" and "Crypto" [illegible].

[illegible] Victoria Works, Chapel Street, Salford. [illegible] electrical materials and [illegible], including fittings, conduits, fuseboards, &c.

The Parsons Motor Co., Ltd., Lower Gower Works, Southampton.—Publication No. [illegible] containing drawings and performances of engines for petrol tractors or wheeled steel of from 14 to 42 h.p. Price [illegible].

Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street, S.W.1.—An illustrated brochure entitled "Diamonds and Dust," dealing with the utilisation of waste fuels in colliery boiler houses.

Messrs. Gyer, Hill & Gyer, 661-3, Harrow Road, Willesden, N.W.10.—A catalogue of surplus Government stores, including tools, accumulators, telephone equipment, &c.

Trade Announcements.—Councillor J. Walsh, electrical contractor, is opening new premises in King Street, Blackburn.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., announce that increased business in the Bristol area has necessitated their taking larger premises at 11, Nelson Street, Bristol, and henceforth all communications should be addressed there, where larger stocks of wires and cables, &c., will be carried.

Mr. J. C. White is removing to 49, Bridge Street, Manchester, where, in premises which have been specially designed, he will have offices, stores, workshop, and showrooms.

Messrs. S. G. Leach & Co., Ltd., write stating that Mr. R. F. Sunderland, of Milburn House, Newcastle-on-Tyne, ceased to represent them on November 30th, and all communications should at present be addressed to the head office, 28-30, Artillery Lane, London, E.C.

Calendars.—From Messrs. Mawdsleys, Ltd., of Zone Works, Dursley, Glos., we have received an extremely pleasing wall calendar for 1923. A maiden fair is wistfully "looking forward."

A wall calendar, useful and practical, with monthly date slips and the patent contrivance which fixes the date for you, has come to hand from Messrs. Mather Bros., of 36, Farringdon Street, London, E.C.4.

Messrs. Parsons Bros., of 49, Westgate Street, Gloucester, have issued a wall calendar, with monthly sheets, for 1923.

A pocket diary in case, with season ticket receptacle and insurance coupon, has been received from Mr. C. Selz, of 83, George Street, Portman Square, London, W.1.

A small "Mazda" lamp calendar of the popular order for 1923 has been issued by the B.T.H. Co.

Messrs. Bruce Peebles & Co., Ltd., have sent us one of their "Up-to-Date" desk calendars for the coming year. It is constructed of art metal and possesses a special mechanical arrangement for progressively cancelling the dates.

Book Notices.—"Molybdenum Ores," by R. H. Rastall. Pp. ix+86. London: J. Murray. 5s. net.

"Science Abstracts A. & B." Vol. XXV. Part 11. No. 299. November 30th, 1922. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each net.

"Who's Who in Engineering" for 1923. London: The Compendium Publishing Co. Price 28s., plus postage in United Kingdom 1s. 3d.

The "Annales des Postes, Télégraphes et Téléphones," published by the French Government every two months, will be issued monthly from January next, without change in the price (27 fr. per annum abroad). The publishing office is La Librairie de l'Enseignement Technique, 3, Rue Thénard, Paris.

We have received from the Board of Education copies of the "Arrangements and Conditions for the Award of the National Certificates and Diplomas of the Institution of Electrical Engineers in Conjunction with the Board of Education." Copies can be obtained from H.M. Stationery Office, price 1d. net.

"M. & C. Machine Mining," December. Glasgow: Messrs. Mavor & Coulson, Ltd.—This issue contains a number of interesting articles upon coal-winning by mechanical means, including a description of the "M. & C." chain coal-cutter, and an account of the undercutting of four acres of coal in six months.

"The *Bulletin* of the Hydro-Electric Power Commission of Ontario," October, 1922. In this issue a history of the development and work of the Commission is commenced; the first instalment presents the case for public ownership of undertakings of national necessity. Another article pays attention to complaints which are put forward in ignorance of facts by consumers, showing the necessity of educating the public electrically. An interesting article comparing domestic heating by means of coal fires and electricity appears. Inserted in this issue is the first copy of "The Hydro Lamp," a publication which is to be produced monthly for public distribution.

Christmas Messages.—During the Christmas period Marconi's Wireless Telegraph Co., Ltd., is delivering its radio messages in a specially designed envelope. The word "Marconigram" appears diagonally in decorative characters, and the phrase "Season's greetings" is placed above and below it.

Phosphor Bronze.—Messrs. Charles Clifford & Son, Ltd., of Lancaster Street Mills, Birmingham, who are specialising in the manufacture of phosphor bronze sheets, rods, tubes, and wire, report increasing demands therefor from the makers of broadcasting and wireless sets.

A Birmingham Exhibition.—The International Foundry Trades Exhibition will be held in Birmingham in the early summer of 1924. The arrangements will again be in the hands of the Birmingham Chamber of Commerce and the British Cast Iron Association. The next exhibition, it is expected, will be more international in its character than was the exhibition held this year, which was the first of the kind to be held in this country.

Works Closed for the Holidays.—The works of the London Electric Firm at Croydon will be closed from to-night, Friday, until Thursday morning, December 28th.

The works of the Electric Heating Co., George Street, Croydon, will be closed on December 22nd, and will be reopened on Tuesday, January 2nd.

Inquiries Regarding Canadian Trade.—Mr. G. T. Milne, O.B.E., H.M. Senior Trade Commissioner in Canada, who is shortly retiring from the Trade Commissioner Service, is at present in this country and, until the end of the year, can be interviewed by appointment at the Department of Overseas Trade by manufacturers and merchants who are interested in trade with Canada. Communications should be addressed to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Annual Dinner.—The staff and employés of the Southport Corporation Electricity Department held their annual dinner on December 12th, the chairman (Mr. Councillor Little), and vice-chairman (Mr. Councillor Owen) of the Electricity Committee, being present. The Chief Engineer (Mr. E. Moxon) thanked his staff for their loyal and energetic co-operation during the past twelve months, and expressed his conviction that with a continuance of this spirit the department would very soon be in a position second to none of the undertakings of a similar size and character.

Socials.—The Newcastle Branch of the General Electric Co., Ltd., held its first dance of the season on December 1st, when 140 of the staff and their friends spent a most enjoyable evening. Artistic decorations in the ballroom were carried out by the Illuminating Engineering Department, and music was rendered by Mr. H. Tuff's orchestra, which was ably assisted by Mr. C. N. Baston, Newcastle staff.

The second annual dinner of the staff of the Leatherhead and District Electricity Co., Ltd., was held on Friday, 15th instant, at the "Running Horse," Leatherhead, at 7.30 p.m. The dinner was followed by vocal and instrumental music, given by members of the staff. Mr. Griffiths, musical director at the Royal School for the Blind, acted as accompanist, and contributed several items to the programme. On the following Monday, Mr. Norman Land, Bookham, was presented with a silver cigarette case on the occasion of his leaving the works to go to Australia. The presentation was made by the manager, Mr. Horner.

Electric Lamp Production in Russia.—The Chief Concession Authority is negotiating with the international concern Osram-Phillips-General Electric Co., of New York, for the organisation of electric lamp production in Russia.

Trade Union Consolidation.—Thirty-five unions in the metal trades have been invited to send delegates to a conference to discuss the possibilities of amalgamation. The conference, which has been called by the general council of the Trade Union Congress, will be held in Manchester in the first week of February. The unions invited include the Amalgamated Engineering Union, and the total membership represented will be over 700,000. Fifteen of the textile unions, apart from cotton operatives, have also been invited to a conference at Bradford early in February, to discuss amalgamation. The aggregate membership represented at that conference will be nearly 160,000.—*The Times.*

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Individuals or firms desiring to enter an objection to any of the applications have one month in which to do so from the dates given below :—

P. G. (lettering and design). No. 429,687. Class 5.—Copper wire. No. 429,688. Class 8.—Electric cables. Pirelli-General Cable Works, Ltd., 144, Queen Victoria Street, London, E.C. December 13th, 1922.

Penguin. No. 428,011. Class 6.—Electrically-driven air-circulating fans. Percy Smith Brook, "Elsinore," 15, Curzon Park, Chester. December 13th, 1922.

Ionophone. No. 426,643. Class 8.—Wireless telephony receiving apparatus. John Henderson, "Kinnoull," Gregorys Road, Beaconsfield, Bucks. December 13th, 1922.

Eureka. No. 429,557. Class 8.—Instruments and apparatus for use in wireless telegraphy and telephony. The Electric Appliances Co., Ltd., Fisher Street, Holborn, London, W.C. December 13th, 1922.

Gecohma. No. 430,279. Class 8.—Electrical measuring instruments. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. December 13th, 1922.

Ohmerette. No. 430,500.—All goods in class 8. Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, London, E.8. December 13th, 1922.

Milan Hotel Equipment Exhibition.—The Department of Overseas Trade is informed by H.M. Consul-General at Milan that the Touring Club Italiano of Milan intends to hold a special exhibition of articles of hotel equipment in conjunction with the annual International Samples Fair at Milan, to be held from April 12th to 27th next year.

Iron and Steel Trade in 1922.—In the course of their annual report, Messrs. Bolling & Lowe, Ltd., say that the iron and steel trade appears at least to be very gradually recovering from the unparalleled depression of approximately the last two years, but when one takes into account the present maximum production, compared with 1914, brought about by extensions and improvements in old works and the erection of new works, it is impossible to forecast when the industry as a whole will be fully and profitably employed. The improvements in trade which were constantly predicted by some financiers and experts during the first six months of the year did not materialise, and the few spurts noticeable from time to time died away to be followed by further depression. "Today we are in a position to recognise that work will be forthcoming in the near future, if only by Government guarantees to give employment to some of the vast army of willing and anxious workers, who through no fault of their own or of their employers have been reduced in many instances to poverty and distress. For some time past many employers have accepted contracts without profit, and in several cases at a loss to keep their workers together, but this state of affairs cannot continue indefinitely."

After briefly reviewing the course of trade and the prospects in most parts of the world, Messrs. Bolling & Lowe conclude their report as follows:—"The year 1922 will stand out as a period of difficult trading, heavy losses, and erratic exchanges, but we look forward with a certain amount of optimism to the New Year, and feel sure that if the Government practise the promised economies, further reduce taxation, and allow the free development of international trade, our next annual review will be of a more encouraging nature than we have been able to write in 1921 and 1922. The stabilising of the exchanges in Europe, admittedly a most difficult problem, would go a long way to the restoration of more normal conditions."

New Belgian Companies.—There has been formed at Schaerbeek (107, Rue Joseph Coosemans) a company styled Electro-Matériel Roba et De Cock, with the object of the import, export, and sale of electrical material of all kinds.

With a capital of 50,000 fr. has been established at Charleroi the Electricité et Industrie, a company for the manufacture and installation of electrical material generally.

A Large Canadian Transformer Order.—The Ferranti Meter and Manufacturing Co., Toronto, has just closed what is said to be the largest order for transformers ever placed in Canada for export. The Southland Power Board of Invercargill, New Zealand, has placed an order with this Canadian company for 200 distribution-type transformers, three-phase, 11,000 V, in five, ten, fifteen, twenty, and thirty-kVA sizes. The transformers will be designed for 50-cycle circuits, and will be delta connected on the high-pressure side and star connected on the low-pressure side. This order was obtained in competition with German, Swedish, English, and United States firms; the order was placed on a quality, and not a price basis, the competing tenders being lower than the Canadian firm's figures. The Ferranti Co. submitted with its tender a sample transformer built to the New Zealand specifications, and the award was largely influenced by the details of transformer construction, coil impregnation, and the welded steel tanks.—*Electrical News.*

Window-dressing Prizes.—At a shopping week window-dressing competition held at Southend-on-Sea, prizes were offered for the best electrical window display. The first award went to Mr. H. J. Bell, Hamlet Court Road, and the second to the Westcliff Electrical Co., West Road.

French Capital in the Saar.—French interests and Saar banking firms have formed the Ateliers d'Appareillages Electriques, S.A., at Fraulautern, Saar, for the production and sale of electrical equipment and machinery, the share capital of 30,000,000 marks having been taken up by the promoters.

Lead.—In their last report (December 16th) Messrs. James Forster & Co. state:—"The increase in imports this year, as compared to last, which amounts to no less than 44,717 tons, or about 4,000 tons a month, is sufficient evidence that consumption is well on the up grade, and there is every indication of this being maintained and increased in the New Year. The price of lead is high, and should materially increase production, but of this there is little evidence. The Board of Trade returns for November show:—Imports, 10,429 tons; exports, 4,052 tons, leaving for home consumption 6,377 tons, and leaving for home consumption for 11 months, January-November, 131,473 tons."

Copper and Lead Prices.—Messrs. F. Smith & Co. report December 19th: Copper (electrolytic) bars, 99*l* 15*s*, no increase. Ditto ditto sheets, no change. Ditto ditto wire rods, 479 *l*. 5*s*. increase. Ditto ditto best wire, no change.

Messrs. James & Shakespeare report December 19th: Copper bars (best selected), sheet and rod, and English pig lead, no change in last week's prices.

Industrial League Lectures.—The January arrangements for the Thursday evening meetings of the Industrial League and Council are as follows:—

[illegible] "Piece-work or Day Wages: Capital"
[illegible] "The Basis of Wages"
[illegible] "Book Debts, and How to Talk About Them"
[illegible] "Education as a Function of Management"
[illegible] Hopkinson, K.B.E., M.P., on "Industrial Unrest."

Electricians' Wages.—A meeting was held last week in Glasgow between representatives of the Electrical Contractors' Association and the Electrical Trades Union to consider wages. The employers made a final offer of a reduction of 2½ per hour, from 1s. 7½d. to 1s. 5d., together with a reduction in outworking allowances from 3s. to 2s. 6d. per night; the new rate to commence on January 1st and to be stabilised until May 1st; further revision to take place during April. This offer is being submitted to the members of the Union for consideration.

A Permanent Exhibition at Prague.—The journal *International Commerce* has sent us a publication in four languages announcing its organisation of a permanent commercial exhibition at Prague. The display is to be housed in a building erected for the purpose, and it is proposed to divide it according to nationalities, showing both the products of foreign countries and Czecho-Slovakian goods suitable for export to those countries. The address of *International Commerce* is Prague-Smichov, Palackého trida, 38/1/9.

The Manchester Steam Users' Association.—The Memorandum by the chief engineer (Mr. C. E. Stromeyer) for the year 1921 has just been issued after some delay, first by boiler tests, which have had to be omitted, and then by a Home Office move with regard to the form of reporting on the inspection of factory boilers. A protest against the alterations has been entered, although the inspection service of the Association fully safeguards members. Mr. Stromeyer makes a number of suggestions with regard to economic boiler design, and concludes with an exhaustive analysis of experiments on the specific heat of steam.

Sequestration.—Martin & McGregor, electrical engineers, Coltness Road, Wishaw.—A meeting to elect the trustee and commissioners was called for December 19th at the County Buildings, Hamilton. Mr. F. J. Mackenzie, 55, West Regent Street, Glasgow, agent.

G.W.R. Pumping Plant Contract.—The Great Western Railway Co. has placed with the Pulsometer Engineering Co., Ltd., of Nine Elms Ironworks, Reading, a contract for the supply and erection of a hydraulic pumping installation consisting of four Pulsometer turbine centrifugal pumps designed for a working pressure of 800 lb. per sq. in. Each pump is to be direct coupled to an electric motor of 650 b.h.p. (a total of 2,600 b.h.p.), for a pressure of 6,000 volts. The pumps will each be capable of delivering 800 gallons of water per minute. Auxiliary low-pressure pumping machinery and switchgear for automatic operation are included in the contract, the latter embodying features which are of considerable electrical interest. The installation is intended for the dock service of the G.W.R. at Cardiff. We are informed that the order was secured in the face of strong British and foreign competition.

LIGHTING AND POWER NOTES.

Ashton.—Electricity Order.—The town clerk has suggested that the Limehurst Council should apply for an Order to supply electricity in bulk, and then assign the powers to Ashton.

Australia.—Victoria.—A loan Bill has been introduced in the Victoria Legislative Assembly providing for the raising of a sum of £1,500,000 for works in connection with the State electricity scheme.—*Reuter* (Melbourne).

Barnsley.—[illegible] The Town Council has applied to the L[illegible] for a loan of £10,500 to meet excess expenditure on previous loans, and for prospective work.

Blackburn.—Loan.—The Town Council has decided to borrow £60,000 for the laying of electricity mains, &c.

Bristol.—[illegible] The report for the year ended [illegible] shows that the revenue earned by the city electricity undertaking (engineer: Mr. H. Faraday Proctor) amounted to £345,139, as compared with £303,930 in the previous year. The working expenses remained at about the same level, £238,324 as against £236,166, leaving a gross profit of £106,815 (£67,521). The final result was a net profit of £51,525 over [illegible] 1920-21—£6,884. Of this [illegible] £30,507 was [illegible] to capital account, and £14,904 contributed to the general district rate. A total of £12,584 was spent in [illegible] during the year. The [illegible] high tension [illegible] and services. The sales of energy increased from [illegible] 417 kWh in 1920-21 to 37,079,702 kWh, and the maximum simultaneous load from 15,336 to 15,972 kW. The system now has a total cable mileage of 157.

Chippenham.—Electricity Scheme.—The Town Council has referred to a committee a communication from the Western Electric Distributing Corporation, proposing an electric lighting scheme for the town and district.

Clowne.—Electricity Supply.—The Parish Council has decided to approach the Stavely Coal and Iron Co., Ltd., with a view to obtaining a supply of electricity for the district from Barlborough Colliery. The company's electrical engineer has expressed willingness to comply with the request, and advises the formation of a subsidiary company to carry out the scheme.

Continental.—Moravia.—It is reported that four companies have been formed in Moravia for the purpose of the systematic electrification of the country. A special region has been allotted to each company. The programme of works includes the utilisation of the river Dyje between Freinstyn and Znojmo. In order to provide the funds necessary for the project the Moravian administration has decided to contract a 4½ per cent. loan in communal bonds of the Moravian Mortgage and Agrarian Bank for a total sum of 30,000,000 kronen. —*Reuter's Trade Service* (Prague).

Formby (Lancs.).—Special Order.—The Urban District Council has referred to a committee a communication from the Western Electric Distributing Corporation, proposing an electric lighting scheme for the town and district.

Heckmondwike.—Electricity in Bulk.—An agreement has been reached between the District Council and the Yorkshire Electric Power Co. for the supply of electricity in bulk by the company to the Council in place of the latter's maintenance of separate generating plant. In April last it was reported that the loss on the local electricity works was £2,950, and a further loss of £2,000 on the current year's working is anticipated. Since 1919 the aggregate loss on the undertaking has amounted to nearly £10,000.

Highbridge (Somerset).—Street Lighting.—The Urban Council has decided to approach Messrs. Kennedy & Co. with a view to lighting the streets by electricity.

Hitchin.—Inquiry.—A public inquiry was held by the Electricity Commissioners at the Town Hall on the 5th inst. into the question of electricity supply for the town. The Urban District Council is opposing the application of the Electric Supply Corporation, Ltd., for a Special Order authorising the company to supply electricity in the district. The Council is desirous of making its own arrangements for an electricity supply.

Holmfirth.—Electricity in Bulk.—At a meeting of the Urban District Council last week it was reported by the Electricity Committee that the electrical engineer had been authorised to dispose of the Bates & Scholes engine in the generating station as a preliminary to the change of system, under which electricity will be bought in bulk. The Electricity Commissioners have sanctioned the borrowing of £5,000 for the necessary work in connection with the change. A petition was received from ratepayers asking for the extension of electricity supply to Dunsley, Malkinhouse, and Ward Place, but the Council decided that the extensions could not be carried out at present. The proposals will be reconsidered at a later date.

Inverurie.—Scheme Abandoned.—The Town Council has abandoned the scheme for electric lighting of the burgh on account of the cost involved.

Irish Free State.—Dublin.—*New Plant.*—The Corporation has applied to the Free State Minister of Industry for an Order authorising the installation of the necessary plant for a supplementary supply of electricity to Rathmines and Pembroke. The Electricity Committee is installing two new Babcock boilers at the Pigeon House power station.

Leeds.—Loan.—The City Council is applying to the Electricity Commissioners for sanction to the borrowing of £80,000 for electricity purposes.

London.—Bermondsey.—The Borough Council is reducing the price of electricity by ½d. per kWh, the flat rate for lighting to be 7d., and for heating and cooking 2½d. per kWh, less 20 per cent.

St. Pancras.—*Loans.*—The Council has received the permission of the Electricity Commissioners to borrow the sum of £27,373 for electricity purposes; the amount of the application was £36,640. The disallowed amount includes an item for cables which should have been charged against a previous loan; provision for the conversion of a building into a sub-station is to be treated separately; and a contribution to the purchase of certain land is also disallowed. Application is being made for sanction to borrow a further sum of £17,382.

Converting Plant.—Although the contract with Messrs. Holtzer & Co. for a large annual supply has not been signed, the electrical engineer recommends that the installation of the two motor converters at Tavistock Place be proceeded with in view of the increasing demands in the area. A similar set is to be installed in the King's Road station, and both contracts have been awarded to Messrs. Bruce Peebles & Co., Ltd

Marlborough.—Electricity Supply.—The Town Council has decided to accept the offer of Marlborough College to join in an electricity scheme. Mr. H. Leaf, a former assistant master, has given £30,000 towards the cost of the scheme.

Menai Bridge.—Electricity in Bulk.—A scheme for a bulk supply of electricity from Bangor to the Menai Bridge Council is now complete. Originally it was proposed that the cable for the supply should be laid over the suspension bridge and continued to the sub-station proposed to be built on a site behind the Council's offices. Owing to certain difficulties which have arisen, it is now proposed to lay the feeder cable by a more direct route across the Straits. This will reduce the capital expenditure by at least £250. It is estimated that the scheme will cost £3,971.

New Zealand.—Wellington.—In connection with the proposal by the electricity supply authorities in Wallington to raise the voltage of the a.c. distributing system from 105 to 230 V as soon as the necessary electrical energy can be supplied from the new hydro-electric power station at Shag Point, Evans Bay, H.M. Trade Commissioner at Wellington reports that the proposed alterations have been definitely approved by the City Council, but no decision is expected to be arrived at for some six months as to whether tenders will be invited for the supply of the material required, or whether the work will be given out to local contractors. The scheme is expected to involve an outlay of from £50,000 to £100,000.

Nottingham.—New Generating Station.—Substantial progress is being made with the new generating station which is being built by the Corporation upon a site contiguous to the River Trent at Clifton, a suburb of Nottingham. Speaking at a recent assembly of the Nottingham and District Association of Building Trade Employers, Mr. W. J. Broad, the town clerk, said that the machinery at the station was now well in hand, and within the next two years it would be completed. In the Corporation Bill now before Parliament they were asking for powers to supply energy to districts outside the city. He did not know how these districts would receive the proposals, whether they would think that Nottingham had an ulterior motive, but he assured them that there was nothing of the kind in view.

Portsmouth.—Price Reductions.—The Town Council is reducing the charges for electricity from the end of the year as follows:—Lighting, first 5,000 kWh to 6½d. per kWh; 5,000 to 10,000, 5½d. per kWh; 10,000 to 20,000, 4¾d.; beyond, 4d.; power, by ½d. per kWh; street lighting, by 5s. per annum for small lamps, and by 20s. per annum for large lamps. The minimum annual charge for electricity supplied through one meter only will be reduced from 35s. to 32s. 6d.

Loans.—Application has been made to the Electricity Commissioners for sanction to the borrowing of £31,000 for additional plant and £40,000 for mains and services.

Reigate.—Price Reductions.—The Town Council is reducing the charges for electricity from the meter readings at the end of the year from 9d. to 8d. per kWh for lighting, from 6d. to 4d. per kWh for heating, and from 4d. to 3d. per kWh for power.

Romsey (Hants.).—Electricity Supply.—The Romsey Gas and Coke Co. has informed the Rural Council of its intention to apply to the Electricity Commissioners for powers to supply electricity in the borough and district. The Council has decided to offer no opposition.

Sheffield.—Loan.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £23,000 for electricity purposes.

Southend.—New Plant.—The Town Council has decided to purchase three marine-type Diesel engines, at a cost of £5,500 each, and application is to be made to the Electricity Commissioners for sanction to borrow the necessary amount to cover the purchase.

Southport.—New Plant.—Mr. E. Moxon, borough electrical engineer, has reported to the Council that the Brush Electrical Engineering Co., Ltd., has made good progress with the erection of the new 1,500-kW turbo-alternator, and that there is every likelihood of the set being available for commercial service early in the New Year.

Sunderland.—Loan.—The Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £6,000 for services.

Swinton and Pendlebury.—Electricity in Bulk.—The Urban Council has entered into an agreement with the Lancashire Electric Power Co. for a supply of electricity in bulk. The Council is to pay a charge of £4 10s. per kW per annum, plus 0.25d. per kWh, with coal at 20s. per ton, the coal variation to be .011d. per shilling. The agreement is for a period of 10 years.

Tilbury.—Electricity Supply.—The Urban Council has decided to take up the question of an electricity supply with the County of London Electric Supply Co. and the Electricity Commissioners with a view to an early supply being obtained, or the cancellation of the company's Romford Order, and authority being obtained for the Council to carry out a scheme.

Wantage.—Electricity Supply.—Sir Clarges Bright and Partners recently informed the Urban Council that the Western Electric Distributing Corporation had instructed them to apply for a Special Order authorising it to supply electricity to the town. They added that the finance was available for carrying out the work immediately an Order was granted. The Council expressed approval of the scheme.

TRAMWAY AND RAILWAY NOTES

Bradford.—Tramway Extensions.—The Corporation Tramways Committee has been reminded by the Bingley District Council that the extended period for completion of the tramways extension from the existing Crossflats terminus to the Bingley boundary along Keighley Road expires on February 7th, 1923. The Bingley Council is applying for a further year's extension, and urges the Corporation to consider the advisability of completing the work during that year. The Committee has decided to ask Keighley Corporation what prospect there is of its tramways being extended from Stockbridge to the Bingley boundary, with a view to linking up to the Bradford system when extended.

Track Renewals.—With regard to the Nab Wood section of the Corporation tramways within the area of the Shipley District Council, the Shipley Council suggested that in view of the need of renewal of the track the Corporation should at once commence reconstruction on behalf of the District Council, without waiting for formal execution of the agreement between the two authorities. The Committee agreed to act on the suggestion and tenders for the work have been obtained.

Continental.—Spain.—La Compañia del Tranvia Electrico de Aviles has recently secured a concession for the construction and working of an electric tramway between Piedras Blancas and Cardeco.

Germany.—It is stated that out of the total network of German railways, 272 miles is at present being operated by electricity and a further length of 505 miles is in course of electrification. The latter is centred in Munich, and the lines proceed towards the south and the south-west, so that eventually all the Bavarian South-Eastern system will be worked electrically.

Derby.—New Route.—The Town Council has decided to extend the tramways in Ormaston Road, at a cost of £21,800.

Leeds.—Loan.—The Corporation proposes to borrow £79,500 for repairing tramcars and making bodies for new cars.

London.—The City and South London and the London Electric Railway Companies propose to make improvements at the Elephant and Castle Station by installing escalators and providing improved booking facilities.—*The Times.*

L.C.C. Tramways.—*Track Renewals.*—Owing to the improved financial position, the Highways Committee of the L.C.C. reports that it will not be necessary in the 1922-23 period to charge half the cost of track renewals to capital account, as has been done, with Government consent, in the three previous years.

Agreements.—The Highways Committee recommends that agreements be entered into with the Metropolitan Electric Tramways, Ltd. (*a*) with regard to the Harrow Road tramway, and (*b*) to provide through services between Aldgate and Euston, Aldgate and Wood Green, and between such other points as may be agreed upon by the managers of the two undertakings.

Richmond Tube Scheme Postponed.—The proposed extension of the Central London Railway from Shepherds' Bush to Richmond has been postponed in view of the fact that the Piccadilly tube is to be extended to Turnham Green from Hammersmith, and will serve part of the same district. It is thought advisable to see what effect the Piccadilly line extension has upon the traffic before proceeding with the extension of the Central London Railway.

L. & N.W. Railway.—Electrification.—A conference of representatives of Oldham and Rochdale Town Councils and six urban district councils in the area was held at Oldham on December 11th, when a resolution was passed urging the L. & N.W. Railway Co. to press on with the electrification of the railway between Manchester, Oldham, and Rochdale. This, it was contended, would enable better services to be run, whilst the scheme would provide work for the unemployed.

Mexico.—Railway Electrification.—The directors of the Mexican Railway have decided to adopt electrical working on part of the main line. For the present the work will be confined to the mountain section, where the line rises over 1,000 ft. in a distance of some 20 miles. The total cost of the equipment and track work is estimated at about £500,000 and a contract has been entered into for a supply of electric locomotives under which the terms of payment are spread over a period.—*The Times.*

Preston.—Year's Working.—The report of the engineer and manager of the Corporation Tramway undertaking (Mr. J. F. Simpson) for the year ended March 31st last, records a total income of £90,318, comparing with £96,482 in 1920-21. Working expenditure amounted to £75,853, as against £85,458, leaving a gross balance of £14,465 (£11,024). Capital charges, &c., reduced this to £4,567, which compared favourably with a deficit of £6,898 in the previous year. The net profit was reduced by a loss of £57 on the motor omnibuses. Both car-mileage and the number of passengers carried were reduced, the former from 1,209,867 to 1,190,220, and the latter from 15,885,352 to 13,260,659. The capital expenditure during the year amounted to £5,963 for the tramways, and £4,849 for the motor omnibuses.

South Africa.—Railway Electrification.—It is anticipated that steps will be taken in the near future for the construction of an electric railway to run between Johannesburg and Pretoria.

Wakefield.—Inauguration of Omnibus Service.—The Yorkshire (West Riding) Electric Tramways Co., on December 12th, formally opened its latest public utility service, namely, a large fleet of motor omnibuses operating over a wide area. A well-equipped public shelter was opened in the afternoon in the centre of the city by the Mayor of Wakefield (Coun. H. H. Holdsworth). This shelter contains a parcels office, inquiry bureau, and a street telephone cabinet available for day and night service.

The tramway service was opened in August, 1904, and it links the city by a through service to Leeds, the metropolis of the West Riding of Yorkshire, and there are also routes extending into the country districts south and west of Wakefield, as well as a very popular route joining up to Ossett, and linking up Wakefield with the whole of the Heavy Woollen area. In all there are 40 miles of single track, including the lines at Normanton, Castleford, and Pontefract, which were laid some years after the Wakefield service was commenced. There are 75 cars in use on the tramway service, running 1,730,000 miles per annum and carrying 15,000,000 passengers. The company has power stations at Belle Isle (Wakefield) generating 4,000,000 kWh per year, and there are car depôts at Wakefield, Ossett, Rothwell, and Castleford.

A few months ago the company inaugurated a motor-'bus service, using 22 cars of the "Bristol" type, and operating over routes covering 116 miles. The complete tramcar and 'bus service is now running in areas controlled by 54 local authorities, the districts including Barnsley, Dewsbury, Shelley (near Huddersfield), Morley, Normanton, Pontefract, Castleford, Hemsworth, Knottingley and Ferrybridge. The population served by the tramways is 175,701, and it is estimated that that number has been more than doubled by the introduction of the latest service. It is estimated that 201,000,000 passengers have been carried since the tramway company's service was opened.

The introduction of the new 'bus service necessitated extensive alterations at the company's central depôt at Wakefield, and to accommodate the cars a huge steel frame garage has been erected, 200 ft. long and 80 ft. wide (in one span). This garage was formally opened by the Mayor of Wakefield following the ceremony at the public shelter in the city.

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—Automatic Telephones.—The first automatic telephone office in Belgium has just been opened at Uccle, Brussels.

Denmark.—Radio-Telephony.—Interest in radio-telegraphy and telephony in Denmark is enormous, and it may almost be said to be an epidemic. Wireless clubs have been formed all over the land. The law has, however, stepped in and placed a ban on the amateur telegraphist, and it has been made punishable to transmit signals. Those found guilty are punished by the confiscation of their apparatus and fines up to 400 kroner. The public opinion is, however, that the State has blundered, and, notwithstanding the law, many small stations are in operation surreptitiously all over the country.—*Electrician.*

France.—Telegraph Tolls.—The charges for telegrams to foreign countries, with the exception of French colonies and protectorates, have now been raised in accordance with the readjusted value of the gold franc. The rates for messages sent by wire and for those sent by wireless are identical.—*Reuter.*

Holland.—New Radio Station.—The Dutch Government is establishing a powerful radio station at Kootwyk, in the province of Gelderland, covering an area of 750 acres. Another station for receiving will be established 30 miles southward. Five masts, 500 ft. high, have been erected at Kootwyk, weighing 100 tons each. The work is being directed and the materials supplied by the German Telefunken Co. The station is expected to be ready for service at the end of the year, and will be equipped with a special duplex system to receive and transmit messages to and from [illegible] 7,500 miles distant.—*Electrical Review.*

Irish Free State.—Telegraphic Communication Interrupted.—It was stated at the Dublin Post Office on December 18th that all telegraphic communication between the Free State capital and the south of the island had been cut off.—*Daily Mail.*

The Telephone Service.—Foreign Tariffs.—In pursuance of the Telephone Regulations, 1922, the Postmaster-General gives notice that the charges for telephonic communication from January 1st, 1923, between Great Britain and Switzerland have been fixed as specified in the *London Gazette* of December 15th.

Installation Speed-up.—New telephone subscribers in the City are having their instruments installed with much less delay than there was a year ago. Mr. Neville Chamberlain, Postmaster-General, told the *Daily Express* that in 50 per cent. of cases service is now provided within a fortnight and in more than 75 per cent. of cases, within three weeks. The number of applications now outstanding does not exceed two or three dozen.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—January 24th. Tramways Board. 1,650 steel poles, either solid or in three sections.

March 7th. Electricity Commissioners. Ash and dust extraction plant. (December 15th.)

January 24th. Victorian Railway Department. Insulated copper wire.*

January 31st. Three-phase a.c. motors, starting apparatus, and accessories for the Newport workshops (17 enclosed squirrel-cage motor sets, 2 h.p. to 20 h.p., two enclosed slip-ring motor sets, 25 h.p. to 30 h.p.).*

January 31st. Impendance bonds for power signalling; 100 three-position line relays; accumulators and accessories.*

Postmaster-General's Department. January 8th. Operators' calling devices. January 11th. Switchboard cable. January 17th. Telephone and telegraph apparatus. January 24th. Testing and telegraph instruments. February 22nd. Switchboard parts. March 1st. Telephone and telegraph parts. (See this issue.)

Sydney.—January 31st. New South Wales Railways Department. Four 1,000-kW rotary converter sets.

January 29th. Municipal Council. Feeder protective apparatus for sub-stations.*

Newcastle (N.S.W.).—January 11th. Town Council. 750-kVA or, alternatively, one 1,000-kVA transformer voltage regulator.

Basford (Nottingham).—January 1st. Board of Guardians. Economiser. (December 15th.)

Birmingham.—January 27th. Salvage and Stables Committee. Plant for the refuse destructor and salvage works:—One 3-wire balancer set and switchgear for lighting purposes; two 110-kW steam-driven generator sets, with switchgear and condenser; one 5-wire balancer set, with switchgear and charging panels, for electric vehicle charging; paper press; scrap-iron press; hydraulic accumulator and pumps. (December 15th.)

Cheadle and Gatley.—January 1st. Urban District Council. Sub-station switchgear and static transformer. (December 15th.)

Chile.—January 13th. State Railways. Covered copper wire, g.i. wire, g.i. cable, porcelain insulators, insulator pins, telegraph cords, &c.*

Dundee.—Corporation. Electric lighting installation at the public market. Particulars from City Architect.

Egypt.—Alexandria.—January 17th. Ports and Lighthouses Administration. Stores, including electrical goods, for 12 months.*

France.—Calais.—Tenders will be invited shortly in connection with electric lighting and power installations at Calais. Particulars from the Mairie, Service des Travaux, Calais.—*Reuter's Trade Service* (Paris).

Hunslet.—December 30th. Board of Guardians. Electric wiring of houses at Halton, near Leeds. Mr. W. P. Pindar, clerk to the Guardians, Leek Street, Hunslet, Leeds.

Huntingdon.—January 3rd. Huntingdonshire County Council. New heavy-plate type battery, 400-420 amp. hours. (See this issue.)

India.—Madras.—January 18th. Corporation. Eight 30-kVA, 3-phase transformers; h.p. switchgear; 15,000-V testing set; 700 30-ft. steel tubular poles; 10 tons h.d. copper wire, [illegible] gauge; 6 tons g.i. wire, No. 8 gauge; switchboard instruments. Specifications, &c., Revenue Officer, Corporation of Madras. (Rs.1 per set.)

Manchester.—January 1st, 1923. Rivers Committee. Conversion of Davyhulme sewage works, Urmston, from steam to electric drive. Secretary, Rivers Department, Town Hall, Manchester.

South Africa.—Brandfort, O.F.S.—January 30th. Municipal Council. Water-tube steam boilers, steam engines and alternators, switchboard, boiler and engine-house auxiliaries, steel poles and overhead conductors (erected), transformers, house services and meters. Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.

Cape Town.—January 12th. City Council. 10,300 yd. h.p. and l.p. cable; three 150-kVA single-phase transformers; four 100-kVA ditto; three 40-kVA ditto.*

Stoke-on-Trent.—January 10th. Electricity Department. Neutral earthing resistance. Twelve months' supply of static transformers, sub-station switchgear. (See this issue.)

Uruguay.—Montevideo.—January 16th. State Electricity Works. 45,000 metres v.i.r. cable.*
December 29th. L.p. armoured cable, telephone cable and accessories.*

Wolverhampton.—January 17th. Electrical Engineer's Department. One 5,000-kW turbo-alternator, condenser and auxiliaries. (December 15th.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Barnes.—Urban District Council. Accepted:—
Turbo-alternator, condenser, and switchgear.—English Electric Co., Ltd.
Rotary converter.—Mather & Platt.

Dublin.—Streets Committee. Recommended:—
Two electrically-driven centrifugal pumps.—J. Cochrane & Co.
Irish Builder and Engineer.

East Grinstead.—Urban Council. Accepted:—
Overhead crane (£115).—Holt & Willetts.
Main switchboard (£762).—Park Royal Engineering Co.
Mains (£3,451).—G. E. Taylor & Co.
Storage batteries (£1,789).—Crompton & Co.
Engines and dynamos (£4,196).—Vickers, Petters, Ltd.

Falkirk.
Electrical work for the extensions at the works of F. Johnston & Co., *Herald* office.—T. Laurie & Co.

Glasgow.—Tramways Committee. Recommended:—
Two rotaries and switchgear for Bearsden sub-station.—Metropolitan-Vickers Electrical Co., Ltd.
Rubber and asbestos goods.—N.B. Rubber Co., Ltd., and Rubber Co. of Scotland, Ltd.

Corporation. Committee on Libraries. Recommended:—
Portable electric vacuum cleaning machine (£90).—Frame & Barr.

India.—Calcutta.—Corporation. Pumping installations at the Pulta and Tallah pumping stations. Three steam-driven pumping engines, boilers, stokers, coal-handling plant, and electrically-driven auxiliaries. According to the *Times Trade Supplement*, tenders were received from Fraser & Chalmers (£142,376) and C. A. Parsons & Co. (£156,978). The engineer in-charge of the waterworks, Mr. Coats, recommended the acceptance of Messrs. Fraser & Chalmers' tender solely on the ground of its being substantially cheaper. On the other hand, Messrs. Moore & Bateman, consulting engineers to the Corporation, advised the acceptance of Messrs. C. A. Parsons and Co.'s tender. The difference between the two estimates was about Rs.2 lakhs. It was decided that a further reference should be made by cable to Messrs. Moore & Bateman for their opinion.

London.—St. Pancras.—Electricity and Public Lighting Committee. The Committee recommends that the contract with Bruce Peebles & Co., Ltd., for the supply of two motor converters for the Tavistock Street sub-station be entered into forthwith at the revised price of £5,100 per set; and that sanction be given to the purchase of an additional motor converter set from Messrs. Bruce Peebles & Co., Ltd., at £5,100.

L.C.C. Highways Committee. Reinforced concrete to cover the inner surface of coal bunkers at Greenwich power station:—

D. G. Somerville & Co., Ltd. (accepted)	**£1,893**
L. H. & R. Roberts	1,980
P. Lind & Co.	2,320

Portsmouth.—Town Council. Accepted:—
Boiler and bunker (£8,245).—Babcock & Wilcox, Ltd.
Turbine, alternator, and condensing plant (£14,933).—Fraser and Chalmers, Ltd.

Sunderland.—Town Council. Accepted:—
Cable.—British Insulated & Helsby Cables, Ltd.
Arc meters.—Metropolitan-Vickers Electrical Co., Ltd.

Torquay.—Town Council. Accepted:—
Switchgear for Newton Abbot power station and main sub-station at Torquay (£6,420), special system of feeder protection (£435); neutral earthing gear and resistance for main power station (£232).—British Thomson-Houston Co., Ltd.
Turbine rotary pump (£405, and extras (£72).—J. & G. Weir, Ltd.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association. Tuesday, December 26th. At the Royal Technical College, 6.15 p.m. to 11 p.m. Annual Social.

Royal Institution of Great Britain. Juvenile Christmas Lecture (No. 3). Stepping the Ladder to the Stars. by Prof. H. H. Turner, D.Sc., M.A., F.R.S. At 3 p.m. Thursday, December 28th. Time Determination and the Stars. By Professor H. H. Turner, D.Sc., M.A., F.R.S. Friday, December 29th. The Discovery of the Planet Neptune. By J. G. F. Monckton.

Junior Institution of Engineers.—Friday, December 29th. At 39, Victoria Street, S.W. At 7.30 p.m. Presidential Address, "Literature, Engineering and Mr. C. F. Morgan."

NOTES.

Diesel Engine Pyrometers.—In the course of a paper on the running conditions and operating symptoms of marine Diesel engines, which Mr. A. J. Brown read before members of the Institute of Marine Engineers (Inc.) on December 5th, it was pointed out that pyrometers are invaluable for denoting the condition of the exhaust valves, if used in conjunction with indicator cards, while the balance of the engine can be approximated also by their use, provided the condition of the valves is known. They consist of thermo-couples placed as close as possible to the exhaust valves in each cylinder, while the wires are led into a switch and the readings are taken from a common dial. If the exhaust temperature of any one cylinder was observed to be lower than normal, it would probably be found that the cylinder was low in output due to fuel admission, or loss of compression due to piston rings, or sources other than the exhaust valve. If the temperature were above normal, then the cylinder would be overloaded, or fuel injection be late, or else the exhaust valve would be leaking. With a leaking exhaust valve a higher pyrometer temperature would be recorded, even though the fuel distribution to that cylinder was less than its neighbours, due to the escape of gases right through the firing stroke. Therefore, if all valves, piston rings, and cylinder joints were known to be tight, uneven pyrometer readings would draw attention to fuel injection and load balancing conditions.

Welfare Work at Ferranti's.—Messrs. Ferranti, Ltd., Hollinwood, have just completed a recent improvement in their Women's Dining Room, where a new maple floor has been laid. This now makes it possible to utilise the room for social functions. The first such event took place on Tuesday evening last week, when a successful dance was held for employés and their friends. A representative gathering from all departments attended. The room was artistically decorated by Mr. H. Sampson and his staff of the building department, and the lighting effects were arranged by Mr. E. Morris of the plant department. This work was almost entirely carried out by voluntary effort. Mr. H. Sampson and Mr. Hilton Taylor proved themselves efficient M.C.'s, and the Lisle Jazz Band rendered lively and inspiring music. The following evening an exhibition of handicraft was held in the same room, when work of all descriptions done by the employés was exhibited. Prizes were awarded for the best work done in each grade. Other attractions included a Japanese tea garden, and various amusing competitions. In this same room a stage has been fitted up out of the proceeds of dinner-time concerts, and operatic and dramatic events have already taken place. On January 19th, 20th, 22nd, and 23rd, the Ferranti Operatic Society is giving performances of the "Pirates of Penzance," when successful evenings are anticipated.

X-Ray Martyrs.—The Carnegie Foundation has presented gold medals to M. Bergonie, of Bordeaux, and Dr. Vaillant, research workers, for their devotion to their labours. M. Vaillant has been given a further grant of 50,000 francs. Dr. Vaillant, of the Lariboisière-Hospital, Paris, is one of the best-known of French radiologists. Owing to the harmful effects of X-rays, he had to have his left arm amputated in September, 1917, and since then he has undergone no fewer than 12 operations, the last early this month, when his right hand was amputated.—*Daily News.*

A movement is on foot to bestow a pension on Dr. Vaillant by the Municipal Council that will enable him to spend the rest of his days at least in freedom from material want. Dr. Vaillant is shortly to receive a gold medal from the French Poor Law Department.—*Morning Post.*

Relief of Russian Engineers.—We have received a copy of an appeal which is being circulated by the Engineers' Section Sub-Committee of the Committee for the Relief of Russian Intellectuals, of which section Sir Robert Hadfield, Bart., is hon. president. The appeal reveals the reduced state to which Russian engineers have been brought by the famine and stagnation of industry. Donations should be made payable and sent direct to the hon. treasurer, Mr. R. C. Griffith, 8, Victoria Avenue, Bishopsgate, E.C.2.

Ontario Peat Deposits.—The Ontario and Dominion Governments' Committee of Experts, reporting after an investigation lasting seven years, that Ontario peat can be manufactured in commercial quantities in connection with anthracite, recommends the Governments to undertake the construction and operation of a peat-producing plant near Alfred, Ontario. A good market has already developed for the product, which the Committee thinks should retail large quantities at $10 (£2) a ton.—*The Times.*

The Electric Vehicle Committee.—The Electric Vehicle Committee of Great Britain held a meeting at the Institution of Electrical Engineers on December 14th. Mr. J. A. Priestley (Cleansing Superintendent to the Sheffield Corporation) presided, and a discussion took place on the position of the electrically-propelled vehicle in relation to the proposed changes in motor taxation. A sub-committee of the Electric Vehicle Committee was appointed to deal with this important matter, in close association with the Electric Vehicle Section of the Society of Motor Manufacturers and Traders, and will consider both the interpretation of the present Act and the future policy which should be adopted.

The hon. secretary reported that a satisfactory response had been received to the advertisements announcing a poster competition in connection with electric vehicles. The Incorporated Municipal Electrical Association is to be asked to publish, through its medium of communication with members, an appeal to all municipal electrical engineers and members of electricity committees to assist the propaganda work of the Electric Vehicle Committee and to take steps to secure all the benefits of the electric vehicle load.—*Electric Vehicle.*

London Transport Organisation.—Sir Henry Maybury, Director-General of Roads, Ministry of Transport, giving evidence recently before the Royal Commission on London Government, said that during the last two years the traffic situation of London had very much improved. More omnibuses, additional trains and tramcars had greatly relieved the congestion existing just after the Armistice. The improvement had caused him to modify his view of the recommendations of the Kennedy Jones Advisory Committee on London Traffic, whose report he had signed. He saw difficulty in financing such a Board as was contemplated by that Committee. He recommended the appointment of a London Traffic Committee of not more than fifteen members, to advise and assist the Ministry of Transport or any Department which took over its duties. The traffic area dealt with should be that within a radius of twenty-five miles from Charing Cross. He recognised that if some comprehensive authority were in future set up for Greater London the powers of the suggested Committee might have to be merged in the general powers of the greater authority.—*The Times.*

Longer Tube Trains.—Seven-car trains are now running on the Central London Railway between Ealing Broadway and Liverpool Street during the rush hours. The record number on the tubes has been six-car trains hitherto, apart from the District Railway. Each car seats 48 passengers, and there is, therefore, total seating accommodation for 336 passengers in the new trains. Since the Central London Railway extension between Wood Lane and Ealing Broadway was opened in August, 1920, the traffic from West London to the City has increased from month to month; the big London shopping centres also being linked up with West London, a daily shopping traffic has developed, and thus increased accommodation has had to be provided. More six-car trains of the latest type were placed in service on the Piccadilly line towards the end of November. The principal feature of the new cars is an improved arrangement of doors. The old type Piccadilly car had but two doorways, one at each end. These end doorways are retained in the new cars, but there is also a 5 ft. 6 in. door in the centre, which overcomes one great difficulty, for whereas passengers were formerly reluctant to pass down the car if they were only travelling a short distance, they do not mind doing so in the new cars, as there is a "way out" in the centre. The centre doors are operated pneumatically, and not until the last door is closed does the motorman receive the signal to start the train. The signal is given automatically by an indicator electrically connected throughout the whole of the doors on each side of the train. The circuit of this indicator is broken unless every door is closed. Tests have been taken of the time of arrival and departure of these new trains at busy stations, and it is found that the "stops" have been reduced from 35 to 25 seconds. Congestion on both trains and platforms is thereby considerably reduced. The new Underground rolling stock now being constructed will be provided with the same system of doorways as that described above, and further improvements in connection with the seating, lighting, and decoration of the cars will also be incorporated with a view to making them as bright and comfortable as possible.

The Electrical Engineer and the Metallurgist.—At the annual dinner of the Birmingham Metallurgical Society on December 9th, Mr. F. C. A. H. Lantsberry, replying to the toast of "The Metallurgical Industry," said that those who practised in the metallurgical industry followed at one and the same time [illegible] industry must have to recognise that the technical man must take a more active part in the control of industry.

Prof. W. Cramp, chairman South Midland Centre, Institution of Electrical Engineers, urged the desirability of metallurgists getting into closer touch with similar technical [illegible] metallurgists and electrical engineers, as, for instance, in electric furnaces for iron and steel and the non-ferrous metals, [illegible] steels. Neither the electrical engineer nor the metallurgist could develop the art to its fullest extent; it must be worked [illegible] of the two.

Lectures.—On December 7th, Capt. P. P. Eckersley gave a lecture to the Chelmsford Engineering Society on "Wireless and Aircraft." The President, Capt. H. Riall Sankey, C.B., occupied the chair.

The lecturer started by emphasising the importance of communication between aircraft and the ground and also between different machines. Many collisions in the air might have been avoided if pilots had been able to communicate with each other and fix their courses accordingly. The pilot of a machine lost in a fog can find out his position by wireless. It has been necessary to design a special microphone which is only actuated by a strong impulse. The noise of the machine does not affect it, but when placed close to the mouth it works successfully. A great difficulty previously met with has now been overcome by screening the magneto and sparking plugs. Capt. Eckersley explained clearly the working of the thermionic valve and other parts of the wireless sets used in aircraft.

Energy.—Old Lady (who has been watching with growing interest the gesticulations of two Fascisti conversing unrestrainedly at Victoria Station): "I've often wondered what this conversation of energy was that they talk such a lot about, but it's really quite simple, after all!"—*Morning Post.*

Electrical Power Engineers' Association.—On January 5th Mr. J. H. Pane, B.Sc., will deliver a lecture before the Association (at the Institution of Electrical Engineers) on "Water and its Action on Steam Boilers." Mr. W. J. Oswald, A.M.I.E.E., will take the chair at 7 p.m.

The International Conference on High-Pressure Transmission.—The report of the proceedings at the Conference which was held at Paris in November last year—a volume of 1,200 pages, with 350 illustrations—is now ready, and is being issued to subscribers by the Union des Syndicats de l'Electricité, 25, Boulevard Malesherbes, Paris (price 100 fr.). Only 150 copies will be available after the subscribers have been supplied, and the work will not be reprinted; those who wish to have copies should therefore lose no time in sending their orders to the Union.

The work includes a statement of the object of the Conference, a general report by M. Boucherot, the full text of the 68 reports that were submitted, and a verbatim report of the discussions (revised by the speakers—this is the cause of the delay in publication). The Report thus contains not only practical information regarding all that has been done throughout the world in connection with electric transmission at very high pressures, but also the personal views of the most competent engineers on the systems dealt with, and should prove invaluable to those engaged in similar work.

Radio Acoustics.—The acoustic properties of radio transmitting rooms have been the subject of investigation at the Birmingham station of the British Broadcasting Co. It has been found essential to arrange the room so that all the usual echo effects shall be eliminated, for these are incorporated and often magnified in the transmission of music. The desired conditions have been achieved by hanging the walls with heavy drapery, which has little or no reflective effect upon sound waves. The exact amount of draping used had to be determined by experiment, for it became apparent that if too much were provided the clarity of some kinds of music was damped to quite an appreciable extent—which was, of course, noticeable at the receiving end. The floor also it was found best to cover with thick carpets. The room itself is situated in the quietest part of the building, well away from the transmitting plant, so that parasitic noises are not introduced. Only the actual rendering of the programme is done in this room, and a separate lounge is provided for the artistes who, for the time being, are not engaged. The operator finds it a necessary preliminary generally to instruct the artiste on the correct use of the microphone. Some artistes naturally feel a strangeness when singing or speaking into it, and their proximity and the direction in which the voice is thrown enter largely into the success of the transmission. If the singer is too near, breathing between the pauses is plainly audible to listeners in. Usually a distance of between two and three feet from the microphone gives best results where vocal items are concerned, but in instrumental and orchestral selections the right proximity is a much more complicated question, and can only be determined by experiment.

Electricity in Steelworks.—Mr. C. T. S. Arnett read a paper at the annual meeting of the Middlesbrough and District Association of Foremen, Engineers, and Chief Draughtsmen on December 9th on "Electricity as applied to steelworks." He dealt with turbo-generators and boilers, switchgears, starters, and regulators, and made some interesting observations on crane electrical equipment and underground cables. He emphasised the need for electrical equipment of the very best quality and workmanship, since any defect, however, small, soon developed into a serious breakdown. He urged manufacturers and engineers in charge to pay more attention to details, and gave an instance in which a few shillings expended by the makers would have saved hundreds of pounds. Manufacturers must study and send their designers to study the local conditions and steelworks, and then they would get better electrical gear and stop spending money on extravagantly-designed motors.

The Radio Arc v. Valve.—Under the auspices of the South African Institute of Electrical Engineers, Mr. C. F. Elwell (managing director of the Messrs. C. F. Elwell, Ltd.) delivered an instructive lecture on "The Poulsen Arc System, as Applied to Long-distance Communication," at Johannesburg in July last, in the course of which the *Transactions* of the Institute report him as having said, *inter alia*. It has been calculated that over 20,000 kW of arc transmitters are in use to-day, and although many, with something else to sell, predict the death knell of the arc, it is very probable that it will be many years before the last arc generator will have been definitely scrapped in favour of another cheaper and less costly to maintain. It is the one good system which is not covered by a mass of patents which are employed, as a rule, to dictate the terms and conditions under which it may be used. Practically all other radio systems capable of being employed in high power stations are in the hands of the wireless combination of English-American-French and German companies. Such being the case, even though something quite superior should be developed, and experience has shown how long it can take for these developments to take place, it is quite likely that the arc generator, which can accomplish very useful results, and be obtained for a reasonable price, will still hold a large part of the field.

In reply to various questions put to him the lecturer said: I would not think of making arcs of much less than 5 kW. Up to 10 or 20 kilowatts the valve is a beautiful instrument. The tendency seems to be to think that because it is so supreme in the lower end of the field it will be also supreme at the other end.

The question of economics is simply this: With the arc you have to pay for the power, and renewing the copper tips and carbons is a very small matter. For even a large station like that at Rome the consumption of electrodes would be easily covered by about £100 per year. For generating the same amount of power in the aerial with large silica valves, supposing we want to put 100 kilowatts in the aerial, we will take 20 costing £60 apiece. Though we can take valves back, put in a new filament and clean them, it still costs in the neighbourhood of £30 apiece. One of these lasts, if one likes to be an optimist, somewhere round about a thousand hours. If a station were to run 4,000 hours per annum, you would have to have at least four renewals and, as I spoke of 20 valves, that would be 80 renewals at £30 apiece. So there is considerable money involved in renewals. Another point is that if an arc system exists and is working, a valve set though possibly cheaper, has still got to prove that it will save money. If it costs more to operate, you will refuse to have it.

As a manufacturer of valves, I cannot see a tremendous reduction in the price of valves coming just yet.

The reason why the Imperial Government adopted arc stations in out-of-the-way places like Nairobi, Singapore, and Hong-Kong was on account of the shipment of valves; they are very fragile; you have to have a large stock of them. A valve is easy to control; but there is no difficulty in getting an arc to work up to speeds of from 75 to 100 words a minute. The larger it is, of course, the slower it is to key. A key was tested at 133 words a minute, and it has been used at 60 or 70 words a minute at Leafield. There is not yet traffic enough to warrant the use of that high speed.

With valves which last 5,000 hours I am quite familiar for reception work, and it is quite possible that valves with a 5,000-hour life will come along soon for transmission. The efficiency of the arc is about 50 per cent. One type of valve has an efficiency of 66 per cent.; another 80 per cent. The question is: shall we get such efficiencies when we link up large numbers of valves as it is proposed to do?

The most valuable thing in connection with the Alexanderson system is not the alternator, but the Alexanderson multiple aerial. The day will come when the last word will be a rotary machine in a power house. I have seen recently, alternators of quite modern frequency, not "doublers or triplers," but multipliers of 13, 15 and 17. This system is thought a lot of by its originators. They have already built a 500-kilowatt machine and it stands a better chance than the arc or the valve, if it can be built cheaply enough; the Alexanderson alternator is expensive and not as simple as it looks.

Exide Battery Service.—We understand that a Buick motor-car is being used for a honeymoon tour round the world by Mr. and Mrs. R. J. Jefferies. The tour commenced June 10th last and travelling from Ohio to New York, the couple sailed for London; crossing to the Continent, they motored through Belgium, Germany, Austria, Bavaria, Switzerland, and France, returning from there to London. They have since carried out a circular tour of Great Britain, travelling by the East Coast to John o' Groats and down the West Coast to Land's End. They have now returned to London, having so far been in nine countries and covered over 11,000 miles.

Leaving London early in the New Year, they will travel through France, Italy, and Northern Africa to Palestine, thence proceeding to the Far East and *via* Australia back to the States.

The particular interest of this tour lies in the fact that such an undertaking demonstrates the thorough reliability of the modern car for such strenuous service and that an Exide battery is carried on the car for starting, lighting, and ignition, and whatever country the car can penetrate, there is an Exide battery service depôt to look after the battery.

Fans in Winter.—A correspondent of the *Electrical News* (London) points out that the use of electric fans need not be confined to hot weather. The temperature of an artificially heated room varies considerably at different levels, ranging under ordinary conditions from 58 deg. F. at floor level to 80 deg. at the ceiling. Actual trials made by the writer have shown that a 9-in electric fan, pointed at an angle towards the ceiling, so that no draught will be felt) will so circulate the air that the temperature of all parts of the room will be more or less equalised, giving a much more comfortable atmosphere. It is considered that a saving might be effected in the heating arrangements, which would compensate for the cost of the fan.

The Sperry Gyro Compass.—A paper on this subject was read by Mr. H. M'Comb before the Greenock Association of Electrical Engineers on November 29th. The lecturer clearly expounded the theory, and described the components of this type of compass. Precessional effects were demonstrated by spinning tops and gyroscopes.

The Electrical Trades Benevolent Institution.—N.E. Coast Section.—On Friday last a ball, organised by the Newcastle and District Advisory Committee of the E.T.B.I., was held at the Heaton Assembly Rooms, Newcastle-on-Tyne. The guests were received by Mr. H. W. Clothier, chairman, and Mrs. Clothier, and numbered 250. The committee in charge of the arrangements comprised, in addition to Mr. Clothier, Messrs. J. Gledson (treasurer), Anns, Wardroper, Spence, Robson, and Fletcher.

As in previous years, special attention was paid to the producing of remarkable lighting effects. On this occasion the decorations were exceedingly good, having been carried out by Mr. W. Fletcher, of Messrs. Fletcher Bros., and Mr. A. S. Lowrey, of Messrs. Robson and Coleman. Various firms lent the necessary lamps, &c. A Christmas tree, brilliantly lighted, was presented by Mr. Beck, of the British Thomson-Houston Co., and the presents on the tree, which were given by lady supporters of the Institution, were sold by auction in the course of the evening. The proceeds of the sale amounted to about £40.

It is anticipated that the Institution will benefit very materially, as the result of efforts of the energetic committee; Mr. Fletcher acted as dance secretary, and was untiring in his efforts to ensure the success of the ball, the fourth which has been held.

The General Electric Co., Ltd., and the British Thomson-Houston Co., Ltd., lent a large number of shades, lamps and projectors; and Messrs. Fletcher Bros., Robson & Coleman. Falconar Cross & Co., R. W. Cairns, and T. G. Usher & Co. gave the services of their workmen to carry out the work. Mr. W. Anns presented an electric kettle and a quantity of golf balls.

It is obvious that similar functions could be organised elsewhere, and we hope that the excellent example given by Newcastle (and Cardiff and Manchester, which are also active supporters of benevolence) will be followed in many other industrial centres.

Appointment Vacant.—Engineer (design) (£300+) for the Admiralty Mining Department, Portsmouth. (See "Official Notices" to-day.)

INSTITUTION NOTES.

Institution of Electrical Engineers. — Liverpool Sub-Centre.—Mr. W. A. Gillott read his paper on "Domestic Load Building" before the Sub-Centre on December 11th. The discussion which followed was interesting and lengthy, the following taking part:—Messrs. Dickinson, Nelson, Britton, Waygood, Moxon, Wilson, Watson, Tavernor, and Lang. Before the reading of the paper, the president, Mr. F. Gill, addressed the meeting on Institution matters. Mr. Welbourn reminded the meeting that it was not generally known that Mr. Gill's colleague, Dr. Jewett, was the president for this year of the American Institution, which Mr. Welbourn thought was a rather remarkable coincidence.

North-Eastern Territorial Centre.—*Students' Section*.—At a meeting of the Section, held on December 15th, Mr. J. Piquet (student) read a paper on "Automatic Control Equipment used in D.C. Traction." Mr. W. N. Kilner was in the chair, and six members took part in the discussion which followed. The next meeting will be held on January 12th, when Mr. J. Bell (student) will give his paper on "The Effect of Reactance on the Design and Performance of Electrical Machines."

Junior Institution of Engineers.—In his presidential address, on December 12th, Capt. H. Riall Sankey spoke upon the utility of theory to the practical man, illustrating his statements with concrete examples of the application of formulæ and first principles to engineering undertakings of many kinds. When theory and practice did not agree it was only because either sound theory was misapplied, or the theory was insufficient or visionary.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr F. T. Homan, A.M.I.E.E., chief assistant at the Northampton Electric Light and Power Co., Ltd., has received several handsome presents upon his leaving the company after 17 years' service to take up an appointment in Canada. The presents included a clock and a cheque from the directors, a silver entrée dish from the general manager (Mr. G. H. Jackson), and a fitted dressing case, together with a gold wristlet watch for Mrs. Homan, from the staff and employees.

Mr. Alderman H. Brown, vice-chairman of the Leeds Tramways Committee, has been appointed chairman of the National Joint Industrial Council for the Tramway Industry for the ensuing year.

Owing to his Parliamentary duties, Coun. R. J. Wilson, the new Labour M.P. for Jarrow, has resigned his position as chairman of Sunderland Corporation Electricity Committee. The vice-chairman, Coun. T. Speeding, has been elected chairman, and Ald. T. Harrison vice-chairman.

The Nobel Prizes were handed to some of the winners by the King of Sweden at Stockholm on December 10th. Prof. Bohr, of Copenhagen, was the winner of the prize for physics (1922); Prof. Frederick Soddy, of Oxford, the winner of the chemistry prize (1921); and Prof. Francis Aston, of Cambridge, the winner of the prize for chemistry (1922). Prof. Einstein (physics, 1921) was not present, but was represented by the German Minister.

Obituary.—Mr. A. R. McCallum.—In our last issue we were only able to report briefly the death of Mr. Alexander Rodger McCallum, B.Sc., A.C.G.I., as the full particulars were not in our possession at the time of going to press. Mr. McCallum was alive and well on Monday morning, December 11th, and he proceeded from his residence at Ealing to visit several towns in the provinces in connection with work upon which his firm, Messrs. C. P. Sandberg, consulting and inspecting engineers, of Westminster, were engaged. In the afternoon of that day he was at Leeds in touch with the London Office by telephone and was in conference with his firm's representatives in Leeds, and all was then well. He subsequently proceeded by express train intending to make Sheffield his destination for the night in readiness for the work of the morrow. According to the evidence produced at the inquest, which was held on the following Wednesday in Chesterfield, his ticket had been given up at Cudworth, some 30 minutes from Sheffield, and apparently he had then fallen asleep. Always a heavy sleeper he passed, the only occupant of the compartment, beyond his destination, since he was seen by the guard of the train asleep at Dore and Totley station, and when the train reached Chesterfield, the compartment door was found open and the carriage empty. A search party found his body on the line a short distance away. As far as can be known, he had, in a state of semi-consciousness, opened the wrong door in haste to ascertain his whereabouts, and instead of stepping into the corridor, as intended, had fallen on to the line. The jury at the inquest brought in a verdict of "Accidental death."

It may be remembered by some of our readers that Mr. McCallum (who was 56 years of age), was for many years in the service of the London Electric Railway Company. In 1921, he left that company to take up an appointment on the staff of Messrs. C. P. Sandberg. He had had a wide experience in connection with electric traction. Serving a pupilage at Messrs. Dick, Kerr & Co.'s Preston Works, he joined the London United Tramways in 1908, and later took a post on the staff of the London Underground Group, becoming, in March, 1915, chief assistant to the mechanical engineer. In this capacity he had charge of all rolling stock, workshops, and running repairs to trains, gaining unique experience in these matters. In the autumn of 1919, in company with three other officials, he visited the United States to make a study of electric traction conditions in that country.

In the year-and-a-half that Mr. McCallum had been on Messrs. Sandberg's staff, his work has been most successful and his services had proved invaluable. His duties generally consisted in dealing with the mechanical side of the various problems arising in connection with the firm's general business, and in addition to co-operating with the design and erection of plants for the treatment of iron by the Sandberg Sorbitic Process at various works throughout the country.

The death of Mr. McCallum came to his relatives, also to numerous and his many commercial and professional engineering friends, as a terrible shock; he was a man of lovable disposition, and highly esteemed by all who knew him. We believe we shall be expressing the sentiments of quite a large number of our readers when we extend to Mrs. McCallum, who is the elder daughter of the late Mr. T. F. Cotchester, and is left with two young children, and to his father (a well known contemporary in London and Scottish journalism), our most sincere sympathy in their bereavement.

A memorial service was held at Christ Church, Ealing, on Monday last, and the burial took place at Brookwood Cemetery. Among the floral tributes, which were very numerous, was a lorry load of affectionate tokens of remembrance from the staff and employés of the London Underground Railways, with whom, as mentioned, he had been in close association for so many years.

Herr P. Berthold.—The death is announced from Berlin, at the age of 57 years, of Herr P. Berthold, a director of the Bergmann Electricitatswerke Gesellschaft, of Berlin. He had been associated with the concern since 1899.

NEW COMPANIES REGISTERED.

Radio Recorders, Ltd. (186,375).—Private company. Registered December 14th. Capital, £6,000 in £1 shares. To adopt an agreement with F. Clutsham to develop the business of sound recording referred to therein, and to carry on the business of gramophone and phonograph manufacturers, manufacturers of discs, records, accessories, and fittings, importers and exporters of all kinds of gramophone and phonograph instruments and accessories, &c. The permanent directors are:—F. Clutsam, Ruskin Manor, Denmark Hill, S.E.; P. T. Perrins, 37, Leinster Gardens, W. Qualification, £25. Remuneration as fixed by the company. Registered office, 66, Victoria Street, S.W.

Ferryside Electric Supply Co., Ltd. (186,406).—Private company. Registered December 14th. Capital, £1,200 in £1 shares. To carry on the business indicated by the title. The permanent directors are: A. H. Stoodley, 5, Priory Street, Carmarthen; S. W. Thomas, Gelphi, South Parade, Tenby. Qualification, £50. Manager: A. H. Stoodley. Registered office: 5, Priory Street, Carmarthen.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Snowdon Mountain Tramroad and Hotels Co., Ltd.—Satisfaction in full on November 14th, 1922, of debenture dated July 10th, 1895, securing £100.

T. F. Collier & Co., Ltd. — Particulars filed of £1,000 debentures, authorised November 22nd, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; the amount of the present issue being £700.

Jones & Pordes, Ltd.—F. T. Shearcroft, of 22, Newgate Street, E.C., was appointed receiver and manager by Order of Court dated December 2nd, 1922.

H. Stanley Prince, Ltd.—Particulars filed of £500 debentures authorised December 7th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £250.

Yorkshire and District Electric Lamp Repairing Co., Ltd.—Two debentures dated November 29th and 30th, 1922, to secure (1) £600, and (2) all moneys not exceeding £2,000 which the mortgagees may pay under their guarantee to the company's bankers, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: H. J. M. Cockayne, Sheffield, and others.

East Anglian Electricity, Ltd.—Mortgage dated November 30th, 1922, to secure £3,000. Charged on the company's undertaking and property, present and future. Holders: L. H. Vulliamy and G. B. Steward, 17, Arcade Street, Ipswich.

Holmes and James, Ltd.—Particulars filed of £4,000 debentures authorised November 29th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

Walker, Macewen & Co., Ltd.—Particulars filed of £950 debentures authorised November 24th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Newcastle and District Electric Lighting Co., Ltd.—Particulars filed of £100,000, third mortgage debentures authorised November 15th and covered by trust deed dated December 6th, 1922, charged on the company's general assets, subject to prior deeds and debentures, the whole amount being now issued. Trustees: V. Thompson and W. Reay-Smith.

Omega Lampworks, Ltd.—Particulars filed of £2,000 debentures authorised November 25th, 1922, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,500.

CITY NOTES.

Ferranti, Ltd. Mr. A. W. Tait, C.B.E., presided on December 11th at the annual general meeting. In moving the adoption of the report, he said that the net profit for the year amounted to £24,371, as against £36,268 in the previous 12 months. The falling off in profit was accounted for by the acute depression in trading which had existed during the period covered by the accounts, and in their last report the board had informed the shareholders that there had been a serious diminution of orders from the beginning of 1921, which would materially affect the results of the next financial year. That in itself would be sufficient to account for the lower net profit, but the position was also aggravated by the dispute in the engineering trade in the spring of this year, which seriously curtailed output, particularly in the meter department. In consequence of the depression and the curtailment of output, the output of the year under review was only 60 per cent. of that of the previous year, which was the highest output ever attained by the company in the matter of its normal products, apart from the production of war material, which was, of course, entirely abnormal. In con-

sequence of the drop in output, the trading profit fell from £141,175 to £90,313, but against that they had been able to make certain reductions in general establishment charges, and there was a reduction in the amount required to be set aside for taxation, so that this item which amounted to £81,382 in 1921 had fallen to £46,945. Repairs and renewals amounted to £3,794, as against £5,271 in the previous year. During the war period the works were considerably enlarged and extended, and following that period they were reorganised in order to provide facilities for dealing with the large output in the three departments upon which the energies of the company were now concentrated. With regard to meters, which was the largest department of the company's business, they were now organised to deal with a very substantial output. The manufactures of the company were finding general acceptance both at home and abroad, and the new a.c. meter which was produced for the export trade had now a ready and substantial sale. They were at present at work upon a new type of d.c. meter, which they hoped to place on the market at an early date. With regard to transformers, they had been busily engaged in standardising types in order to extend the business in a satisfactory manner. They had also entered the extra-high-pressure field, having recently shipped certain transformers to New Zealand for raising a pressure of 10,000 V to 110,000 V. They believed there was considerable scope for this department not only in the general development of electricity both at home and abroad, but particularly in connection with the numerous railway electrification schemes which were under consideration, some of which must be proceeded with in the very near future. The results of the instrument department for the year were disappointing, but steps had been taken to overhaul the organisation; this, it was hoped, would lead to better results. The financial position of the company had materially improved in the year. With regard to the assets, leasehold land and buildings at £85,108 were at the same figure as in the previous year. Plant, machinery and tools stood at £166,974, or an increase of £4 851, as compared with the previous year. Goodwill and patent rights at £1, and investments at £18,937, were the same as in the previous year. Stocks and stores, and expenditure on work in progress, at £156,527, represented a decrease of £50.881. This decrease was accounted for not only by an actual reduction in quantity but also by a considerable reduction in values due to the fall in prices. Cash at bank and in hand at £41,646, represented an increase of £25,492 on the previous year. On the liabilities side of the account, the share capital remained the same. First mortgage debenture stock showed a reduction of £4,000, and the five-year notes which, at June 30th, 1921, stood at £32,200, had been paid off to the extent of £27,700, and the outstanding balance would be repaid at the end of this month. The loan from bankers against security, which amounted to £2,716, had also been paid off in the year, and the security which represented £30 000 second debentures of the company, had been handed back and cancelled. Trade creditors at £106,088, represented a reduction of approximately £96,000 on the previous year, which was very satisfactory. With regard to the depreciation reserve account, the sum of £50,000 had been transferred from that account to the general reserve account, leaving a balance of £56.912. The general reserve account, after making that transfer, stood at £152,630. The reduction which had been made in the secured and unsecured liabilities had been very substantial, and the company was now in an excellent position and credit. He did not propose to make any forecast with regard to the current financial year. He would say, however, that the orders which had been received during the last six months were encouraging, and, as there seemed to be indications of a slow but gradual improvement in trade, there was every reason to believe that they would get their fair share. In consequence, they were hopeful of being able to submit a satisfactory account of their operations for the year to June 30th, 1923, unless something unforeseen occurred.—Dr. S. Z. Ferranti seconded the motion, which was carried unanimously.—Subsequently an extraordinary general meeting was held when resolutions were agreed to sanctioning a scheme for the rearrangement of the company's capital, which had been framed in order to deal with the arrears of dividend on the 6 per cent. cumulative preference shares, to provide a share bonus to the ordinary shareholders to compensate, in some measure, for the absence of dividends and to increase the deferred shares to an amount more commensurate with the value of their interest in the company.

The chairman explained the scheme, which was set forth fully in our "City Notes" last week, and the proposed arrangements were approved subject to the sanction of the Court.

Fuller's United Electric Works, Ltd.

The directors state that the accounts for the year ended March 31st, 1922, cannot at present be presented, in view of the scheme of reconstruction, which has already been approved by all classes concerned, and which is now awaiting the formal approval of the High Court. As soon as possible accounts, showing the position after reorganisation is completed, will be submitted. Meanwhile the company's business shows steady improvement, and with the support of shareholders and noteholders, as provided under the scheme, it is considered that the future prosperity of the company is assured.—*Financial Times.*

Barbados Electric Supply Corporation, Ltd.

The trading profit for the year ended June, 1922, amounted to £5,665, as compared with £5,272 and £4,015 for the two previous years. After charging general expenditure in London, debenture and loan interest and a reserve for taxation, the amount remaining (including £1,084 brought forward) is £4,895; £2,000 of this has been transferred to depreciation reserve account, and £1,784 had been written off in respect of discount and expenses of issue of 6 per cent. debentures, leaving £1,022. £2,549 has been charged against trading for repairs and renewals, as compared with £1,481 in the previous year. The number of consumers increased during the year from 2,087 to 2,395, and the lamps connected from 25,796 to 29,524.

The capital expenditure during the year was £2,722, consisting of additions to plant and to house connections and mains. The issue of 5½ per cent. debentures matured on June 30th, 1922, and arrangements were completed for an issue of £25,000 6 per cent. debentures, of which £18,000 were taken up and £4,000 have been lodged as collateral security.

German Companies.

The directors of the *Insulated Wire Works Co.* (*Vogel*), of Berlin, recommend an increase in the rate of dividend from 35 per cent. in 1920-21 to 50 per cent. last year. It is proposed to increase the share capital from 104 to 208 millions of marks.

The *United Electro Works Co.*, of Saarbrucken, reports net profits of 1,541,000 marks in 1921-22, the first year of its activity. During the later months of the year the directors state that the company's manufactures experienced satisfactory sales, and success had attended the efforts to open up new markets, particularly abroad. A dividend at the rate of 20 per cent. has been declared on the ordinary shares and the future prospects are said to be favourable.

The report of the *Telephone Works Co.*, (late *Berliner*), of Hanover, states that supplies of raw materials were more easily obtainable in 1921-22, and the works were adequately occupied. After having made provision for depreciation, the accounts show net profits of 16,192,000 marks, as contrasted with 4,331,000 marks in 1920-21, and the dividend rises from 20 per cent. in the latter year to 35 per cent. for 1921-22. At the recent meeting it was decided to increase the share capital by 80 millions to 120,000,000 of marks.

The accounts of *Max Schorch & Co.*, of Rheydt, show net profits and balance forward amounting to 5,099,000 marks in 1921-22, as compared with 1,596,000 marks in the previous year. The rate of dividend, as stated in a former issue, is increased from 10 per cent. in 1920-21 to 25 per cent. last year. It was decided at the recent meeting to raise the share capital from 19½ millions of marks to 50 millions, and it was mentioned that considerable orders had been received through the company's connections with three industrial groups.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Auckland City Tramway Loan.—£127,200 5½ per cent. debentures of £100 each, Nos. 1,073 to 2,334 (with coupon due January 1st, 1923).

Ever Ready Co. (Great Britain).—7,000 ordinary shares of £1 each, fully paid, Nos. 442,001 to 449,000, and 1,000 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 133,644 to 134,643.

Applications have been made to the Committee to allow the following to be officially quoted in the list:—

Llanelly and District Electric Lighting and Traction Co.—135,000 ordinary shares of £1 each, fully paid, Nos. 1 to 60,000, 135,001 to 150,000, and 225,001 to 285,000; and £125,000 7½ per cent. debenture stock. (Special application.)

Venezuela Telephone and Electrical Appliances Co., Ltd.—Profit for the year ended June, 1922, £24,365. Dividend 8 per cent. on the cum. preference shares. Capital expenditure during the year was £19.958, and this expenditure makes it impossible for the directors to recommend a dividend on the ordinary shares. The increased telephone rates took effect from October 1st, 1920.

British Vacuum Cleaner and Engineering Co., Ltd.—Industrial depression and trading conditions during the past year are reflected in the adverse result reported by the directors. In view of the loss sustained they have transferred to profit and loss account £3,250 from reserve. The accounts show a loss of £7,196.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income tax, on the preference stock for the quarter ending December 31st, 1922, and the third quarterly interim dividend of 2½ per cent. on the ordinary stock, free of income tax.

Victoria Falls and Transvaal Power Co.—Six months' dividend at the rate of 6 per cent. per annum, less tax, on the preference shares.

Automatic Telephone Manufacturing Co., Ltd.—Dividend on the 6 per cent. preference shares for the half year ending December 31st.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Interim dividend for the three months ended September, 1922, of 5s. per share, payable free of income tax.

STOCKS AND SHARES.

MONDAY EVENING.

[illegible] and the week after, are invariably [illegible] business is concerned in the Stock [illegible] [illegible] that was said at the Devan trial, a [illegible] selling goes on in various directions, window-dressing that does not necessarily mean selling stock in order to [illegible] bank balances, but which sometimes takes the form of buying with a view to increasing the amount of [illegible] a company that makes up its balance sheet to the end of the year. The various political developments abroad are regarded as being more favourable than they were at the beginning of the month, and the less truculent attitude adopted by Turkey has enabled gilt-edged stocks to present a firm front.

The boom is winding up favourably in most of the markets connected with electricity issues. Although the railway stocks are not quite at the top prices which they reached a week or two ago, there is noticeable strength in Metropolitans at a trifle under 60 and in Districts at 45½. The Underground Electric Railways shares lean to the dull side, those of the £10 denomination going back to 22¾. For some reason or other, these are neglected at present, and there seem to be a fair number of shares on offer to meet the moderate amount of demand now current. Foreign tramway issues are good, with Mexico Tramway bonds in demand. As an interesting sidelight on the Mexican situation, it may be mentioned that the Mexican Railway Company issued its report the other day, showing that steady progress is being made on the line, and suggesting that conditions are becoming more settled in Mexico. Hope still pins its faith to the expectation of an agreement being reached between the United States and the Mexican Governments, whereby the objections to a loan from America to Mexico would be removed, and, in consequence, the flow of capital into the latter country encouraged. Were means found whereby fresh money could be provided for Mexican utility companies, it is likely that the immediate effect would be a general rise in the securities, though the Americans would doubtless impose onerous terms as a condition of subscribing to new bond issues.

Home electricity shares keep strong, with Westminsters better than they appear at 8 rather buyers. County of London ordinary has moved up to 30s. 6d. bid, and the new ordinaries spurted to 5s. 10½d. premium. This represents a handsome profit to the subscribers who took up the shares when they were issued last May at 22s. 6d., but the strength of the buying movement is so considerable as to cause shareholders to look for a better profit in the near future. The important announcement made by the Electricity Commissioners, as to an agreement between the various London companies and some of the principal provincial undertakings, confirms the faith felt in the industry by those who have been supporting it, not only lately, but during the thin times through which it passed during the war.

There are not many electricity supply shares on offer; Charing Cross ordinary at 8, City Lights at 44s. 6d., County ordinary at 31s., Westminsters at 8½, and London Electrics at 3 are all that appear in the list of one of the well-known firms of Stock Exchange jobbers, as available in this department. A greater variety can be obtained in the preference list, and it may be of service to set out in detail what can be obtained, adding a few tramway and other investments, for purposes of comparison.

Preference share.	Div.	Price.	Yield	Div. usually paid.
Anglo-Arg. Tram. 1st £5	5½	3 15 10	6 19 0	J. & J.
Calcutta Tramways £5	5	3¾	6 13 6	J. & J.
Charing Cross City £5	4½	4¼	5 9 0	J. & D.
City of Lon. Elec. 2nd £1	5	28/-	5 11 6	M. & S.
County of Lon. Elec. £1	6	23/6	5 2 0	M. & S.
English Electric £1	6	18/6	6 9 6	A. & O.
General Electric "A" £1	6½	21/9	5 19 0	J. & D.
Do. "B" £1	7½	21/9	6 18 0	J. & D.
Lancashire Elec. £1	7	24/6	5 14 0	J. & O.
Lon. Elec. Sup. Corp. £5	6	5¼	5 14 6	M. & S.
Newcastle-on-Ty. Elec. £1	7	22 6	6 4 6	M. & S.
North Met. Elec. £1	6	21/6	5 11 6	A. & O.
Scottish Power £1	8	23/9	6 14 6	F. & A.
Westminster Elec. £5	4	4 7/16	5 1 0	J. & J.
Yorkshire Elec. Power £1	6	21/6	5 11 6	F. & A.

Of the debenture stocks, £2,000 Anglo-Argentine 4½ per cent. debenture is offered at 80, paying £5 13s. 6d., and £5,000 of the [illegible] per cent second debenture stock at 82 ex dividend, yielding £6 2s. per cent. Whitehall Electric 6 per cent. debenture at 88 pays 7 per cent. on the money taking redemption into account. South Wales Electric 5 per cent. debenture stock (irredeemable) at £71 gives £7 1s. Newcastle-on-Tyne 5 per cent. first debenture at 91 returns £5 6s. 6d. per cent., and Electric Supply Corporation 5 per cent. debenture stock at 91 affords 5½ per cent. outright, or £6 13s. per cent. allowing for redemption at 100 in 1929. There are others of similar character, but this gives a fair idea of the varying degrees of security and yield which can be obtained at the moment.

In the market for cable stocks and shares, Anglo-Americans continue to advance, a feature being the strength of the deferred stock, which has risen to 5¾, in consequence of the near approach of the full year's dividend payment in February. The Eastern Telegraph and Eastern Extension have declared their usual 2½ per cent. free-of-tax dividends, and the group shows no particular change. Marconis are better, the parent shares hardening to 2 3/16, while the debentures, now that the call is out of the way, have recovered to 3 premium.

British Columbia Electric deferred and 4½ per cent. debenture stocks have gone back a little. Mexicans are a trifle irregular; Mexico Tramways 6 per cent. bonds improved to 56½. Mexican Light Common shares fell back to 21½. Anglo-Argentine Tramways are unaffected by consideration of the scheme for dealing with arrears of dividend on the second preference. Part of the information was published well in advance of the official announcement. The seconds keep good at 4⅜.

In the manufacturing group, the feature is the strength of Electric Supply Corporation ordinary shares, to which attention was drawn here last week, when it was noted that the price of the shares had come up from 14s. to 16s., and might quite possibly move up to the neighbourhood of a pound. The present price is 18s. Babcock & Wilcox have touched 72s., a price which induced a little selling, and the shares reverted to 70s. Metropolitan-Vickers remain good, in consequence of the expectation that the company will receive substantial orders out of the forthcoming activity in railway extensions. The rubber market presents a firm front, with rather more business doing in spite of the close advent of the Christmas holidays. Armstrongs and Vickers have joined in the rise which iron and steel shares have enjoyed by reason of the brightening trade prospects, prospects which were emphasised by the speech of Mr. Bonar Law, at the end of last week, when he spoke hopefully of the general outlook for trade.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Dec. 18. 1922.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	12	10½	—	£5 17 1
Charing Cross Ordinary	8	9	7¾		5 16 2
do. do. do. 4½ Pref.	4½	4½	4⅜	+ ⅛	5 7 5
Chelsea	6	6	6¾		4 9 0
City of London	14	14	2⅛	+ ⅛	6 7 10
do. do. 6 per cent. Pref.	6	6	23/-		5 4 4
County of London	8	8	30/9	+ 9d.	5 4 1
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7⅛		6 7 0
London Electric	2½	4	2⅞	—	4 4 3
do. do. 6 per cent. Pref.	6	6	5⅛	—	5 17 1
Metropolitan	7	7	6½	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4⅛		5 9 1
St. James' and Pall Mall	12	12	9⅞		6 6 4
South London	7	7	4¾		5 18 0
South Metropolitan Pref.	7	7	1⅝		5 18 0
Westminster Ordinary	10	10	7¾	—	6 7 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	102½	+ ½	5 17 1
do. Def.	4½	31/6	23⅛	+ ⅛	6 5 0
Chile Telephone	6	6	6¼	—	4 16 0
Cuba Sub. Ord.	7	7	8	—	8 15 0
Eastern Extension	10	10	19⅛	—	5 4 0
Eastern Tel. Ord.	10	10	190½	—	5 5 0
Globe Tel. and T. Ord.	10	10	19¼	—	5 4 0
do. do. Pref.	6	6	11⅛	—	5 7 10
Great Northern Tel.	24	22	28⅝	—	7 12 0
Indo-European	10	10	35⅛	—	7 1 0
Marconi	25	15	2⅜	+ 1/16	6 17 0
Oriental Telephone Ord.	12	12	2⅞	—	*5 4 0
United R. Plate Tel.	8	8	7⅛		*5 6 8
West India and Panama	Nil	Nil	10/-	—	Nil
Western Telegraph	10	10	19xd	⅛	*5 5 3

HOME RAILS.

Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	59⅛	—	8 15 8
do. District	Nil	1	45⅛	—	2 4 0
Underground Electric Ordinary	Nil	Nil	2⅞	— ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5

FOREIGN TRAMS, &c.

Anglo-Arg. Trams. First Pref.	5½	12½	83		7 2 0
do. do. 2nd Pref.	Nil	5½	48		5 19 0
do. do. 5 per cent. Deb.	5	5	80½	1	6 2 8
Brazil Tractions	Nil	Nil	48	—	8 6 8
British Columbia Elec. Rly. Pce.	5	5	78½	—	6 7 5
do. do. Preferred	5	93/-	76¼	—	*6 3 6
do. do. Deferred	3	124/-	97⅝	−1	*7 0 6
do. do. Deb.	4½	4½	78⅞	½	5 8 3
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½	—	6 2 8
do. 6 per cent. Bonds	Nil	Nil	56½	+1	Nil
Mexican Light Common	Nil	Nil	21½	−1	Nil
do. Pref.	Nil	Nil	51¼		Nil
do. 1st Bonds.	Nil	5	67		7 8 2

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	16	3⅛		4 11 5
British Aluminium Ord.	10	5	16/3	—	6 3 1
British Insulated Ord.	15	15	2½		6 13 4
Callenders	15	15	2⅜	—	6 17 0
do. 6% Pref.	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison Swan	10	Nil	2/6	-	Nil.
do. do. 5 per cent Deb.	5	5	64		7 16 4
Electric Construction	10	10	14		7 5 6
English Electric	8	5	15/9		6 7 3
do. do. Pref.	6	6	18/3		6 10 6
Gen. Elec. Pref.	6½	6½	21/9		5 19 6
do. Ord.	10	5	17/0		5 17 8
Henley	15	15	2⅝	—	6 11 3
do. 4½ Pref.	4½	4½	4⅜	-	5 2 10
India-Rubber	10	—	11/8	-	—
Met.-Vickers Pref.	8	8	2⅞		6 11 2
Siemens Ord.	10	10	1⅛		—
Telegraph Con.	20	20	25¾	—	*4 11 6

* Dividends paid free of Income Tax.

THE LUBRICATION OF VERTICAL GAS ENGINES.

By M. S. MASON.

Gas engines of the vertical type can be classified under two headings:—

1. Tandem engines.
2. Ordinary multi-cylinder engines.

As this article is written from a central-station point of view, and not personally recommending engines of the tandem type (for reasons which I will not state here), for this purpose, I will confine myself to the lubrication of the ordinary multi-cylinder engine.

The proper lubrication of these engines plays a very important part in their success. Insufficient attention is usually shown in the choice of oils. A good many engineers seem to think that as long as oil of some kind is present, everything should be all right.

In the ordinary steam engine, bad oils only show themselves in wear and tear, and one or two other points which do not materially affect the running from day to day.

In the case of gas engines, the reverse is found. Engineers get constant troubles of one kind or another, but seldom look for the cause of them in the oil they are using. Price too often arises before other considerations. One of two systems is usually adopted in the lubrication of these engines:—

(a) *Forced lubrication of crank case and special lubrication for cylinders.*

(b) *Forced lubrication of crank case and splash lubrication of cylinders.*

Referring to (a), a gas engine crank case oil is used for the crank case, and pumps working on the same system as the ordinary steam engine supply oil to the bearings, &c. This oil is in most cases not of the highest grade in lubricating oils, in fact many engineers use too low a grade, much to the engine's detriment. One engineer who was always anxious to get something cheap bought a "very good oil for gas engine crank case use," with the result that a violent explosion shook the station and nearly wrecked the engine, the vapours from the "very good oil" having caused the explosion.

Still, in all cases the grade of this oil is not fit for cylinder lubrication. To prevent it reaching the cylinders, splash plates are fitted. This is one of the disadvantages of this system. The splash plates do not keep back all the splash, with the result that this "unsuitable" oil is worked up to the top of the cylinders, causing an accumulation of carbon and often pre-ignition through the flash and fire temperature being incorrect.

As regards the special lubricator, this is usually of the "plunger sight feed type." Of course, a gas engine cylinder oil is used in this, but I have found that by experimenting with oils above the average grade used, surprisingly better results can be obtained. I have seen cases where troubles like seizing, pre-ignition, and engines refusing to carry their rated loads have totally disappeared the class of oil was changed, using one that has been properly blended for the purpose. This lubricator is usually the cause of a lot of worry to the engineer-in-charge. Be as careful as he may, bits of foreign matter seem to get into the oil in one stage or another of its use, and these accumulate in the small ball valves in connection with the pump, the result being (if he cannot shut the engine down) he has to try to clean it while still full of oil so as to keep the other cylinders lubricated. From the lubricator the oil passes through piping to the cylinders.

The connection on the outside of the water jacket is usually made with a small non-return valve. Here again is a seat of trouble. Owing to the heat, the oil carbonises, with the result that the outlet to the cylinder or the valve itself gets choked up. The connection has to pass through the water jacket. This is a very serious disadvantage. Cases have been known where the connection has corroded away and water has entered the cylinder. The disastrous consequences can be imagined. I know that makers have given special attention to the composition of this connection in recent years, but the danger is always there, and apart from the material itself, there is always the joint on the cylinder wall to consider. Engineers who condemn gas engines for hard reliable use do so because, they state, there are too many small things that go wrong. In the preceding system of lubrication, as will be seen, are a mass of endless troubles with dire consequences in certain cases.

Some makers took this line of thought, and instead of trying to eliminate this, decided that the easiest and best way was to take the oil companies into their counsel and find an oil that would be suitable, not only for crank case use, but for cylinder use as well. This was done and, consequently the (b) system of lubrication was adopted. Apart from the ordinary pumps as in (a), the splash from the cranks lubricates the cylinder. Scraper rings are fitted to the bottom of the pistons to prevent over-oiling. The only disadvantage I have found with this system has been that the makers of gas engines have not rendered the help they might by giving the result of tests on oils, leaving one more or less to find out for oneself.

With this type of lubrication, I have found it very hard to hit on the right oil; all my previous experience of different grades proved of no avail. For the benefit of engineers who have not yet done so, or others again who may be considering the installation of this type of gas engine, I will give brief results of the oils that were tried before satisfaction was gained:—

Test 1.—Carbon was found in large quantities in cylinder. Oil changed colour very quickly. Oil company stated the oil was coming into contact with very hot surfaces.

Test 2.—Carbon not quite so bad, but oil changed colour and went very thick and sludgy, evidently through carbon in the oil; also gave off a lot of vapour.

Test 3.—No carbon to any extent was found in cylinders, but the vent-pipe from crank case was like a steam-engine exhaust with the fumes given off from the oil. Naturally it required a large amount of oil to make up losses.

Test 4.—This oil went well for a month or so, until a piston seized, the first that ever happened on this engine. Still, the oil was not condemned at once, and was allowed another life. A few days later another piston seized. The engine was then opened up and examined, and it was found that ridges had worn in the cylinder walls, which only a month or so previously had not shown any signs of wear.

Test 5 (practically eighteen months after first test).—No carbon in cylinder; very little fumes; oil did not change colour for some considerable time; no wear and tear apparent; good gas consumption; the oil lasting well in life and generally giving perfect satisfaction.

Without making this an advertisement, for the benefit of other engineers, the oil on which No. 5 test was conducted was "Vacuum Vectra extra heavy gas engine oil X."

An advantage with this system of lubrication which I have not yet touched is the saving in oil consumed. In system (a), apart from the amount of oil consumed in the crank case, there is an appreciable amount used for the cylinders. A test was recently taken on a Browett-Lindley gas engine, which is lubricated on the (b) system and using the Vacuum oil. The engine used 28 gallons in 1,000 hours, during which 94,755 units were generated. This works out at .028 gallon per hour, or .00029 gallon per unit generated. The test was conducted on a 100-kW set. I think on the larger sets by this maker an even better figure can be obtained, as the

crank case keeps much cooler, and the oil, in consequence, does not break down so quickly. The best way to prevent this breaking down is to draw a bucket or so off each day and filter it, replacing it with fresh oil.

A great deal of trouble is often experienced in filtering these heavy gas engine oils. A very suitable filter can be made by having a large settling tank (placed in a warm position), out of the middle of which a tap is fixed, from which settled oil is drawn. This is passed through a container, in which is white cotton waste, two 32-candle-power carbon lamps being kept burning over the top of the layer of oil on the waste. The oil drains from this and passes through three tubes of varying lengths, partially filled with water. One 750-watt electric heater is placed under these tubes, which keeps the water on the move, particularly in the case of the smallest tube. The oil, after it has passed through these, will be found quite suitable for use again.

THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

Meetings of the I.E.C. Advisory Committees on Rating, Graphical Symbols, Standard Pressures, and Regulations for Overhead Transmission, as well as Screw Lamp-caps and Holders, already briefly referred to, were held in Geneva, commencing Monday, November 20th, and continuing until November 28th, 1922.

Mr. E. Huber, President of the Swiss Committee, on behalf of his colleagues, welcomed the delegates from the various nations.

The question of the rating of electrical machinery occupied the major portion of the time, being the most important subject, and the principal reason for the convening of the meetings. Sixty delegates were present from 12 nations. Dr. Mailloux, the president, and Col. R. E. Crompton, the honorary secretary of the Commission, were also present.

At the opening session, Dr. Mailloux, on behalf of the I.E.C., thanked Mr. Huber and the Swiss Committee for the excellent arrangements made for the convenience and comfort of the delegates. The preparation for the present meetings, he said, had necessitated a great deal of consultation between the central office and the various national committees, and the general secretary, besides having gone to Berlin, had done everything he could in consultation with



The I.E.C. Advisory Committees at Geneva.

the Swiss Committee to attend at the latest hardship as regards [illegible] meeting the meetings.

The Swiss Committee, in offering the Commission its hospitality, had prepared the way for more complete international accord, and he hoped that the visit of Dr. Strecker, one of the earliest workers in the I.E.C., and his colleagues, as the guests of the Swiss Committee, would be the first step in renewed co-operation with the German electrical industry.

Mr. L. Hunt suggested to people over the technical sessions of the Rating Committee, and arrangements were made for meetings of the other Advisory Committees to be held during the week.

The main object of the meetings of the Advisory Committee on Rating, [illegible] at the request of the British National Committee, was to consider the difficulties which have arisen in the attempt to introduce into practice the method recommended by the I.E.C. of rating electrical machinery on the maximum continuous load.

The British Delegation [illegible] found possible to adopt the I.E.C. [illegible] overload for certain classes of machine, but for the ordinary type of industrial motor and generator [illegible] British practice had for many years [illegible] machines on a 40° temperature rise [illegible] hours. The British Committee [illegible] a definite position in its efforts to be [illegible] to the I.E.C. as well, and that was the [illegible] to the I.E.C. for assistance in finding a [illegible] for greater confidence in it. The British were most anxious that an overload rating of this nature should be recognised by the I.E.C., and were moreover desirous that temperature rise alone should be specified and that the rating be based on the temperature rise at full load and not on the overload. In Great Britain it should be noted that the cooling air temperature did not exceed 30° C., and indeed was more nearly 20° C., and this overload, therefore, did not produce maximum temperatures in excess of those laid down by the I.E.C.

The British also felt that whilst established British practice with regard to industrial motors gave a more substantial machine than the 50° rating of the I.E.C. without overload, unless the I.E.C. agreed to adopt an overload rating for this class of machine, the rating the British desired to standardise in their own country would not actually be in accordance with the I.E.C. rules, although it might be within them.

Some misunderstanding arose with regard to the question of the temperatures produced on the overload, as an overload rating, if adopted by the I.E.C., would have to be applicable to all countries where the ambient temperature did not exceed 40° C.

The British Delegation, whilst emphasising the fact that the ultimate temperature limits of the I.E.C. had been based on laboratory experience carried out many years ago, and experience with the use of modern materials and methods of measurement might justify a review of the I.E.C. maximum temperature limits, was most desirous of putting forward only such proposals as would be entirely within the I.E.C. limits.

Some discussion then took place as to the necessity of the I.E.C. introducing overloads, seeing that any National Committee was perfectly at liberty to specify overloads in its national rules so long as this did not involve temperatures beyond the I.E.C. figures. In view, however, of the commercial importance attached to this question by the British Committee, the other delegations, desiring to give satisfaction to the British, after further discussion agreed to consider the question of recommending the introduction within the I.E.C. limits of a nominal rating with an overload as an international standard.

In deference, therefore, to the British views, the Advisory Committee, with the help especially of M. Boucherot (France) and Signor Semenza (Italy), endeavoured to find a solution satisfactory to their British colleagues.

The American delegates, whilst they had not come with any preconceived ideas or definite proposals, were at the same time inclined to favour the British suggestion, although they pointed out that there was a tendency in the United States [illegible] to single rating without overload, which would imply a specially designed machine capable of carrying both the mechanical and electrical overloads that such machines

had to meet in ordinary service. They urged most strongly that one rating only should be adopted.

In an international meeting of such a nature, much time has of necessity to be taken up with explanations, for in the discussions terms not fully comprehended by everybody are often used and also translations into different languages, and much patience has to be exercised in dealing with the various points as they arise; in some instances time was allowed through adjournment of the official sittings for members of each delegation to discuss details amongst themselves. It was not until the Thursday that, with the help of M. Boucherot, a generally-acceptable proposal embodying the wishes of the British delegates was agreed to, for submission to the National Committees, to the effect that overhead ratings within the I.E.C. maximum continuous rating be recognised and that, for general industrial machines (the class to be defined later) where overloads have to be provided, a machine having a 40° C. temperature rise and capable of carrying 25 per cent. overload for two hours applied at the end of the full-load run be recommended, the overload only to be applied under such conditions of air temperature as will not cause the limits of maximum temperature laid down by the I.E.C. to be exceeded. It will be remembered that the main object of the international rating of electrical machinery is to establish an equitable basis of comparison of tenders, and much discussion took place as to the method of indicating the relation between the proposed British nominal rating and the I.E.C. single rating. To carry this into effect, Signor Semenza suggested, and it was ultimately agreed to recommend, that the rating plate of the machine indicate, in addition to the other information, the output under the ordinary I.E.C. continuous rating (50° C. rise).

With this decision the meetings of the Advisory Committee were adjourned, and the British delegates expressed their thanks and appreciation of the manner in which their proposals had been received. They had fulfilled their obligation to consult the Advisory Committee before introducing into their National Rules recommendations at variance with those of the I.E.C., and in view of the agreement now arrived at, they felt, and the members agreed, that they would be at liberty to proceed with the urgently-required revision of their National Rules, introducing into the new British Rules a lower temperature rise and an overload rating conforming as to ultimate temperatures with the I.E.C. limits, and indicating at the same time on the rating plate the relation between their 40° degree rating with overload and the I.E.C. 50° single rating.

The German representatives, at the close of the meeting, expressed their appreciation of the manner in which they had been received, and said their desire was to resuscitate the German National Committee and its work, and, so far as possible, to bring the German rules entirely into harmony with the rules of the I.E.C.

A meeting of the Advisory Committee on Graphical Symbols was held, with Dr. Wyssling (Switzerland) in the chair. The proposals put forward at Brussels in 1920 were carefully looked through, and additional symbols were added. In the discussion the delegates had before them the graphical symbols issued by the B.E.S.A. (B.S.S. No. 108) and those of the Italian and Swedish and Swiss Committees.

A meeting with regard to Standard Pressures and Regulations for Overhead Transmission was also held, and in this case Dr. Mailloux took the chair.

With regard to the standard pressures recommended to the National Committees by the Advisory Committee at Brussels, the various delegates gave their views. The recommendations made at Brussels, including the proposal to adopt 45,000 (declared pressure) as the intermediate pressure between 30,000 and 60,000 volts were confirmed.

The French suggestion that 120,000, 150,000, and 220,000 volts should be the next stages was briefly discussed, and referred to the National Committees, but without a specific recommendation.

A point was brought forward by Mr. Doane (U.S.A.) regarding the low pressures for electric lighting, stating that a pressure in the neighbourhood of 110 or 115 volts was becoming a necessity from experience in the economic production of light.

The detailed work in respect of overhead transmission was not sufficiently advanced for more than a general exchange of views, but it was agreed to ask the Belgian Committee, which had taken a most prominent part in the question of regulations for overhead transmission, to bring forward for consideration a skeleton set of rules which might be adopted as a guide for all countries.

A meeting of the Advisory Committee on Screw Lamps, Caps, and Holders was also held, and was presided over by Dr. Mailloux. This was the first occasion on which the manufacturers of lampholders in the different nations had come together under the same roof. The ground had been fully prepared by M. Zetter (Paris) and Mr. S. W. Attwell (Great Britain) and also by the Americans, and as a result of an exhaustive review of the situation, the proposal of Mr. Doane (United States) that the lampholder should first be standardised, rather than the lamp cap, was agreed to. Proposals in full detail are to be drawn up in consultation with the experts in the various works manufacturing the lampholders, and are to be put forward at an early date.

The difficulties in the way of accomplishing this much-desired object did not seem so insuperable as had previously appeared, and as the meeting included representatives from France, Holland, Germany, the United States, Sweden, and Great Britain, there is every reason to look forward to an early solution of this problem.

The delegates were entertained at a reception at the Opera House by the Town Council, and at a banquet given by the Swiss Committee. They visited the headquarters of the League of Nations, where they were received by Sir Eric Drummond, K.C.B., the Secretary-General, and where the aims and objects of the League were fully explained. A visit was also paid to the works of Messrs. Sécheron & Co., where large electric locomotives were in process of manufacture.

Special arrangements were made for the delegates, by electric tramcars and automobiles, to visit the water-power works erected on the Rhone at Chauzy-Pougny.

In addition to the honorary secretary (Col. R. E. Crompton, C.B.) and the general secretary (Mr. C. le Maistre, C.B.E.), the British delegation comprised:—Mr. Attwell, Mr. E. G. Batt, Mr. A. R. Everest, Sir Richard Glazebrook, K.C.B., Mr. P. Good (Secretary, British Committee), Major H. Gunton, Mr. P. V. Hunter, C.B.E., Mr. J. S. Peck, Mr. C. Rodgers, O.B.E., Mr. Roger Smith, and Mr. C. C. Wharton. India was represented by Mr. J. W. Meares.

SOME OTHER WIRELESS ASPECTS.

By W. A. C. PHILLPOT.

On searching the index of the papers read before the various institutes during the past year for a suitable title for a scientific treatise I find that some aspects appear to be compulsory. In mine, therefore, I have endeavoured to show a fitting respect for established precedent without slavishly adhering to the hide-bound traditions of a hoary antiquity.

Wireless has always appealed to me as being about the least interesting hobby in existence for the man without curiosity as to his neighbour's affairs, and, until lately, I fancied that this fact alone accounted for its tremendous popularity. Another manifestation of the parlourmaid instinct I thought it, without danger from draughts, and the fact that the further off the people whose domestic chat was overheard the better the listeners liked it I put down to common prudence. I admit that I have myself felt the hypnotic influence of the gentleman with the painfully well-off voice who discourses from the Strand, but to say that I ever said: "Please Sir! it wasn't me" in reply to his complaint about somebody's fit of reactance while I was listening-in with a sixpenny crystal set, is an absurd canard, and I take this opportunity of denying it.

Recently, however, I have discovered another explanation of the popularity of the sport, but till now have been unable to classify it as either a primary or secondary cause.

Briefly, I find that it enables large numbers of gentlemen, whose opportunities would otherwise be limited, to talk in scientific language—the radiatic dialect—and the remarkable skill shown by the experts in bringing unseemly words into ordinary speech has never been equalled since Harris's famous report of his journey up the Matterhorn to Mark Twain.

Holding these heterodox?—dyne?—which is it?—views on the subject it is but natural that the buffoon, Fate, should bring me in daily contact with such numbers of radiacs as would satisfy Marconachi (as I have heard an ex-service enthusiast call him) himself.

In certain emergencies—between twelve and one—it is my duty to endeavour to sell wireless oddments to persons with money enough to buy them, and Fate, of course, sends more customers to my crowded hour of glorious life than come to our own expert in a day. For my assistance the various articles we sell are put on labelled trays, so that when De Jones, Junior, requires a filament rheostat I do not send him away with the insulated pliers. This seems simple, and if De Jones came alone or silent I could bear up under the strain, but, unfortunately, he usually brings Montmorency with him, and they brag and lie about their toys and drag in long words, and try new ones on me and each other, till I find myself unable to speak or write a word without an "ic" in it.

For instance, De Jones came along a day or two ago on his motor cycle bringing Montmorency with him on the carrier. Just before he arrived it happened that the shop charwoman had swiped all my samples off the trays and reset the scene by the light of nature. Some instinct seemed to tell me that "50 ft. h.d. copper" could not be made of glass, so I refused to sell anything until the real wireless merchant came back, but this did not deter De Jones. He had come to show Montmorency how much he knew in the place where they were supposed to know it, and he did. He turned to a thing with a knob on it—nearly all our things have knobs on—and remarked that it looked a rotten sort of variometer. Montmorency, game as a pebble, countered with a duolateral, to which De Jones promptly responded with atmospherics. This appeared to be a tactical error, as Montmorency had heard it before, and he slipped in a couple of variable condensers and an amplifier with telling effect. De Jones, recognising that his opponent carried too many guns, retired with a side slap

at the non-combatant—me—a suggestion that they come back when somebody who *knew* something was there. The scientists returned to their motor-bike, but as some layman had taken the opportunity of pushing back the spark lever, when De Jones gave his starting kick the silencer barked once like a dog and was silent. From the shop door I suggested advancing the ignition and De Jones thereupon backed an inch off the magneto lead, in such a manner as to make perfectly plain the subtle mind process which told him the shorter the distance the spark had to go the quicker it would get there.

This is by way of an appetiser; the full meal—which feeds me right up—I get when compelled to listen to a discussion between two of the bigheads of the local "Wireless-er-Radio-Society." They begin civilly enough, as a rule. Bighead A. will offer Bighead B. a couple of wave-lengths, for an inter-valve transformer with cantilever springing. This will be taken up and a counter offer of some high resistance for a second-hand brass formula will be made and accepted. Then A. will gently extol the virtues of an air dielectric he has, to which B. will reply that his is better and has his name engraved round the edge. A. makes ground with a remark caught with the dry fly between an air-pilot in New Zealand and his passenger; and B., not to be outdone, produces a 7 lb. curse from Kamchatka that he picked up on the spokes of a bicycle wheel. At the point where they pass on to the remarkable performances of their respective friends' sets ("My big bruvver's bigger'n your big bruvver") I leave them.

I had occasion to-day to dispose of an elderly wireless clergyman; a few high-frequency oscillations with a blunt instrument and I had tuned him up. A curious document was found on the body, laid out in the long and shorts of the pious and immortal one. Translated into a language it ran roughly as follows: –

"To my wife, Ann, whose distaste for scientific pursuits I have deeply deplored, I leave my

Loud Speaker and second-best Receiving Set

in token of my forgiveness.

To my daughter, Etheria, I leave my crystal detector and

Honeycomb Coils

in grateful recognition of the sweetness of her disposition.

To my son Hertz, who has shown himself in many respects an undutiful child, and has spoken disrespectfully of a micro-farad, I leave my

Basket Inductance

with the string handle.

I leave my tuning inductance and super-regenerative circuit to the Asylum for the Deaf and Dumb, and to my cook, LNOR, I leave my pancake of seventy turns, as a slight acknowledgment of her capacity.

To my brother Thomas, should he survive me, who has always prided himself on his hard-headedness, I leave my

Block of Ebonite.

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

ANNUAL REPORT.

The fourteenth annual report of the Hydro-Electric Power Commission of Ontario, covering the year ended October 31st, 1921, is a volume of 530 pages, containing a vast amount of statistics, which clearly indicates the wide extent of the Commission's activities. The size of the report renders adequate treatment in our limited space out of the question, but in the following review the progress made is briefly recorded, with other facts of particular interest.

At the end of the year the Commission had a total length of 2,042 miles of transmission lines in service, nearly half of this being part of the Niagara System, which is the largest of the Commission's undertakings. This total did not include the 110,000-V steel-tower lines of the Niagara system or lines from the Queenston-Chippawa system was rendered available. The operation of the Niagara high-pressure station was practically continuous (99.987 per cent.), there being only one total interruption of supply due to the failure of station equipment. On 64 days of the year electrical storms were experienced, but the lightning arrester equipment proved reliable, and damage to the system was avoided. The increased demands necessitated the installation of additional transformers at a number of local stations. Condensers of 5,000-kVA and 10,000-kVA capacity were introduced during the year with beneficial results to the system, especially in improved voltage regulation. The principal feature of the year's constructional work on this system was, of course, the pro-

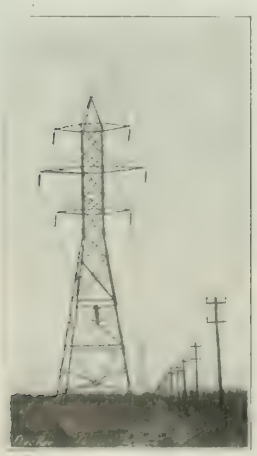


Fig. 1.—Standard Suspension Towers, 220 kV.

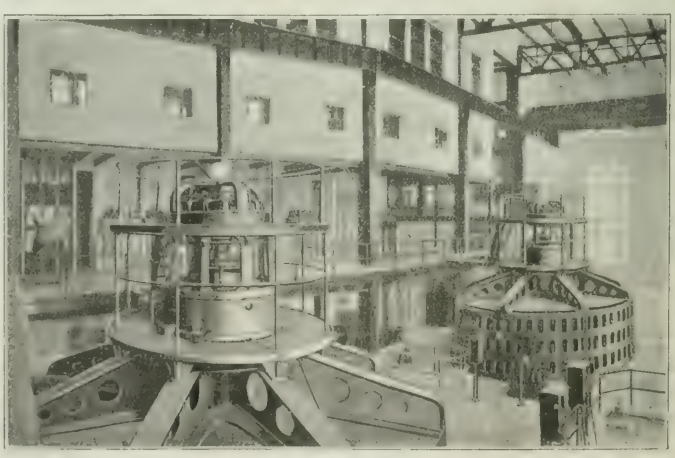


Fig. 2.—Interior of Nipigon Power House (Incomplete).

acquired by the [illegible], which represented a further 960 miles. During the year the addition made to transmission systems [illegible] the principal extensions being to the St [illegible] Bay systems. It is of interest to note that by far the greater part of these additions (149 miles) was of steel-reinforced aluminium. The 110,000-V steel-tower lines had a total length of 467 miles and a further 55 miles was being constructed. The latter includes a line from Queenston to Burc[illegible] of tower employed is shown in fig. 1.

In the report upon the [illegible] of the various systems it is satisfactory to note that the power demand increased to a considerable extent. In the Niagara system the call for power was so great that [illegible] had to be made to obtain 30,000 h.p. from power companies until the power

gress made with the first part of the Queenston-Chippawa system, but as this is now in operation the record is rather out of date. The development has been dealt with from time to time in our pages, and the first two 55,000 h.p. sets were placed in commission early this year. The third set was to have been started in August or September. In June, 1921, the constructional work was seriously retarded by the destruction of the Montrose distributing station by fire. The destroyed plant was temporarily replaced by borrowed equipment, and the service was restored within fifteen days.

The plant of the Ontario Power Co. suffered breakdowns on two occasions. One totally-enclosed generator and a semi-enclosed generator had their armature windings totally destroyed by burn-outs, the staff being unable to get at the fires to extinguish them. As a result of these mishaps it was

decided to employ only open-type end shields in future, and arrangements were made to have these fitted to the machines.

Throughout the Niagara system the principal transformer stations were improved and their capacity increased. Similar operations were carried out in the Severn, Eugenia, Wasdell's, and St. Lawrence systems. In the last the principal improvement was the substitution of four 5,000-kVA transformers for the same number of 1,250-kVA transformers. The Almonte municipal plant, in the Rideau system, was increased by the addition of a 200-kVA, three-phase generator.

Next to the Queenston-Chippawa development the most important work was the construction of the Nipigon generating station—part of the Thunder Bay system. To enable the city of Port Arthur to be supplied with power upon the termination of its contract with the Kaministiquia Power Co., it was decided to complete the erection of the first of the 10,600-kVA generators and to install temporarily two of the 8,000-kVA transformers. This preceded the completion of the building, and temporary wooden walls were erected to protect the plant. This first section was put into operation on December 20th, 1920; the second generator commenced work on March 14th, 1921. A view of the interior of the station is given (fig. 2). The power from these machines was dealt with by temporary switching equipment until August 7th, 1921, when the permanent high- and low-pressure switchgear was ready for service. The power was at first supplied to Port Arthur at 62,500 V, but the pressure was subsequently raised to 110,000 V.

In the Central Ontario system the equipment at several generating and transforming stations was improved and extended. The Ranney's Falls generating station, with two 5,000-h.p. sets, was proceeded with, and it was hoped that power would be available early in the present year. The capacity of the Nipissing generating station was increased by the installation of a new 1,400-kVA Canadian-Westinghouse generator and three 900-kVA transformers. The replaced plant was to be removed to other stations.

The total capacity of the transformers installed or ordered by the Commission at the end of the year covered by the report was 1,043,386 kVA, and a complete list of sub-stations is given in the report. The largest sub-station was that at Queenston, which had a capacity of 225,000 kVA; the Niagara sub-station followed closely with 202,000 kVA.

During the year surveys and storage studies were made on the St. Lawrence between Prescott and Cornwall and other sections, and also on the Trent, Crow, and Seguin Rivers.

A large number of municipalities received engineering assistance from the Commission, and great advances were made in the provision of power to rural districts. In the Niagara system over 3,000 applications were received, and reports from all over the province indicated increasing recognition of the benefits which the Commission has in its gift.

On the financial side the showing is most satisfactory. The annual surpluses, after providing all possible cost of operation, including an adequate depreciation charge, have increased, until, in 1921, the combined annual surpluses of the municipalities amounted to $619,726. The total plant value increased from $10,081,469 in 1913 to $31,656,855 in 1921; and the total assets from $11,907,827 to $40,111,979. The liabilities have not increased in the same proportion as the assets, rising from $10,468,352 to $25,434,258. The reason for this is that much of the cost of the increasing plant value has been financed out of surplus and reserve accounts without increasing the liabilities of the various systems. There has been a steady decline in the ratio of net debt to total assets. This was 88 per cent. in 1913 and 63.3 per cent. in 1921. Out of 205 municipalities only 32 failed to meet their actual cost of operation without regard to depreciation, and 11 of these had been in operation for less than a year. A total of 51, including the above, failed to provide full theoretical depreciation in addition to operation and maintenance expenses. These showed a deficit of $86,069, but the profits of $705,795 earned by the remainder gave the net profit for the whole indicated above.

Over 200 pages of the report are devoted to details of finance, consumption, rates, and other items of interest relating to the municipalities served by the Commission. A casual study of the tables is sufficient to give an idea of the rapid growth of the system—only in a very few cases is there any indication of retrogression, and in none of these is it serious.

Other tables form a record of the extent and cost of street lighting in "hydro" municipalities, and, so far as can be judged by mere figures, it would appear that Ontario townships are, generally, in advance of a great number of British towns of larger populations. It is seen that in the majority sums ranging from one to two dollars per head are spent on public lighting. Typical examples of the extent to which towns are electrically lighted may be given. Acton, with a population of 1,594, has no less than 165 100-W lamps in service—the cost per head being $1.15 per annum. Among the larger cities is Hamilton (population 114,766) which employs 7,600 100-W lamps and 1,200 ranging from 200 to 500 W. The cost per head per annum is $0.57. The rates charged to municipalities for bulk supplies of power are also given in tables. These are only estimated figures, the total charge being adjusted at the end of the accounting period, so that only the actual cost of supply is paid.

With regard to railways, it is stated that bonds to the extent of $900,000 were guaranteed by the Government for the improvement and extension of the Essex district system. The City of Guelph radial railway was taken over and bonds to the extent of $150,000 were issued, to enable improvements to be carried out.

A great deal of routine work was carried out in the Commission's laboratories. High-pressure testing assumed large proportions. The Commission has apparatus for obtaining single-phase voltages of 200,000 at 25 cycles, and 400,000 at 60 cycles. In the Photometric Section many new lighting devices were tested, and in the Structural Materials Laboratory a large amount of work was done for the benefit of the Commission's constructional department. The volume is illustrated with about 40 views and 16 diagrams, and a map of the system is provided.

The "Murray" Report on Electrical Undertakings.

Commissioners' Reply.

Messrs. Murray & Flood, a firm of United States consulting engineers, received a commission some time ago to prepare a report comparing electrical undertakings or "utilities" owned by the public and those in private hands. The result was a voluminous report in which government ownership was strongly condemned—the Hydro-Electric Power Commission of Ontario being the example of public ownership chosen. Mr. W. S. Murray signed the report and from this fact it was termed the "Murray Report." The Commission has now published what purports to be a complete refutation of the statements made in the report. Sir Adam Beck, the chairman, in a foreword says that the report is represented to be "based on an impartial and exhaustive study" of the materials freely supplied by the Commission. Eighty-five per cent. of the contents consists of information epitomised or otherwise arranged by the author from data supplied by the Commission, while in the remainder the privately-owned utilities in the United States are dealt with, but only in an incomplete manner, giving no adequate indication of the sources and limitations of the information. Sir Adam points out that the undertaking with which he is connected is not "government-owned," but is an example of co-operative municipal ownership working through the agency of independent commission control and administration, entirely free from any political interference. It is claimed that the Murray report is not "exhaustive" and "impartial" as stated, and, embodying, as it does, such fallacious methods, its conclusions also are necessarily unsound. Mr. Murray is said to have made many statements at absolute variance with well-known facts, but we have space for only a few of these.

In connection with the Queenston-Chippawa development, Mr. Murray stated that, in his opinion, such work should not have been carried out during the period of high costs of labour and material, and as a consequence the rates charged for energy for this source would constitute a serious burden to consumers. The Commission states that the development was absolutely necessary and that the power produced by the first projected development of 300,000 h.p. would have been insufficient to meet demands, and an increase to 450,000 h.p. was necessitated. It is shown that the power generated by the first two units was absorbed in a very short time without taking the load from other stations, and this in spite of the existence of trade depression. To arrive at the cost of power Mr. Murray is said to have deliberately inflated capital charges by assuming interest at the rate of 8.15 per cent. instead of the actual rate of 5.75 per cent., thus adding a false annual charge of $1,652,500. By this and other means the annual production cost is raised to $12,310,000—as against a corrected total, even under his own assumptions, of $7,200,000, or $25.60 per h.p.-year as against $14.00. Finally, it is made clear by the Commission that without the Queenston-Chippawa development, the municipalities would be experiencing a shortage of 125,000 h.p. which would be daily increasing. Mr. Murray averred that the Commission's methods of charging favoured municipalities near to the source of supply, tending to concentration of industries near the main transmission lines, and the retardation of the development of outlying districts. Apart from the fact that this is not the case, Mr. Murray naïvely admitted later in the report that "the transmission distances to reach their customers are generally greater than those of the private companies compared thereto."

The Nipigon development (Thunder Bay System) was also criticised as being unnecessary. Mr. Murray said that this with the power supplied by the Kaministiquia Power Co. would provide 3 h.p. per head of population, five times the *per capita* power available in the Niagara System. The two districts are not comparable: the Thunder Bay district has numerous pulp and paper mills, and grain elevators involving the employment of a small number of men, while the Niagara district is more thickly populated, being principally an agricultural district. Contrary to Mr. Murray's assertion, the Kaministiquia Co. was quite unable to meet all demands. The plant, although of a capacity of 35,000 h.p., can only generate 16,000 h.p. continuously, owing to the nature of the water supply. It is shown that the work was undertaken at the urgent request of the Provincial Government and the municipalities. The Murray report claimed that an alternative power

[illegible] have been generated by the Kaministiquia River and [illegible] but the Commissioners' [illegible] that [illegible] the Niagara development. Out of the Niagara power [illegible] is [illegible] and when the [illegible] at [illegible] the power estimated to be generated [illegible] 2,000 c.v. The power [illegible] estimated to be generated [illegible] 71,000 and Niagara [illegible] All other [illegible] from the Niagara stations. The Commissioners' reply asserts that "Mr. Murray's unprofessional [illegible] to the engineering data relating to [illegible] subject of [illegible] Power, is [illegible] sufficient to discredit the whole presentation."

Mr. Murray [illegible] out to compare California and Ontario. This was done by contrasting an undefined "section of California analysed" [illegible] "other than Niagara." [illegible] pointed out that six-sevenths of the Commission's power is derived from this source further comment is unnecessary. The ostensible reason for adopting this method was that the people of the Niagara district enjoyed special advantages in having Niagara [illegible] the source of power.

The cost of street lighting was found by Mr. Murray to be from 5d. to 6d. cents per [illegible] as against 67 cents in Toronto, but he omitted to point out that this represented the electrical half of the Buffalo lighting. The actual cost was $1.15 per head, owing to the use of gas and gasoline; Toronto is wholly electrically lighted.

The Commissioners admit that although the general [illegible] for lighting and municipal services is higher in Buffalo than in Toronto, power charges are lower on an average. This is said to be due to the [illegible] of power consumers as against domestic consumers by the supply companies. The overall average price is, however, shown to be much higher in Buffalo than in Toronto, an [illegible] with the exception of the [illegible] very large consumers is paying the average [illegible] people is much higher in Buffalo for every class of service. In support of its contention the Commission gives tables of *actual* charges, a method not adopted by Mr. Murray.

The Commissioners [illegible] inasmuch as the 'Murray Report' has been shown to be permeated by misrepresentations and unjust statements, it is, after all, seen to be but one more of those impotent attempts which, from time to time, have been made to discredit the outstanding achievements of the [illegible] in the province of Ontario.

EAST OF SCOTLAND ELECTRICITY DISTRICT.

Commissioners First Inquiry.

On December 12th the Electricity Commissioners opened a public inquiry in the City Chambers, Edinburgh, with regard to the reorganisation of the East of Scotland Electricity District. Sir John Snell presided, accompanied by Sir Harry Haward, Mr. H. Booth, and Mr. W. Lackie, with Mr. E. W. Hudson as solicitor and Mr. D. S. Cumberlege as clerk. Mr. H. P. Macmillan, K.C., Mr. W. S. Kennedy, and Mr. T. W. Cooper appeared for the Edinburgh Corporation; Mr. Morrice Mackay, K.C., for the Scottish Central Electric Power Co.; Mr. F. A. Gentles, K.C., for the County Councils of Midlothian and East Lothian and the burgh of South Queensferry; Mr. R. H. McConnochie for the Leith Dock Commission; Mr. J. R. Dickson for the North British and the Caledonian Railway Companies; Mr. Garrett for the National Electric Construction Co.; and Mr. Henderson for the West Lothian County Council.

Mr. Macmillan, K.C., said that surrounding the City of Edinburgh were country districts which had hitherto only been developed electrically to a very small extent, and he referred to the new Portobello power station which the Edinburgh Corporation was completing, and its capacity to supply all the electricity required. Distribution in the county area outside the City of Edinburgh would be undertaken by authorised distributors receiving their supplies in bulk on agreed terms from the Edinburgh Corporation. The name [illegible] County of Peebles objected to the inclusion of the parishes of [illegible] Edinburgh had no desire that these parishes should be unwillingly brought into the area. Objection was also taken to the inclusion of a portion of the County of Linlithgow. That [illegible]

Mr. Gentles, K.C., said that the burgh of South Queensferry [illegible] any other [illegible] the [illegible] power [illegible] Queensferry [illegible]

Mr. Morrice Mackay, K.C., said that the Scottish Central [illegible] Co. was prepared to [illegible] South Queensferry, and was in a very favourable position to supply that burgh. It had a very efficient power station at Bonnybridge.

The Commissioners agreed to the exclusion of the Peeblesshire [illegible] from the [illegible] area, and were of opinion that the five parishes in Linlithgow should also be excluded.

Mr. Ian C. Murray, secretary of the Scottish Central Power Co., gave evidence as to the ability of the company to supply South Queensferry.

The Commissioners stated that when South Queensferry obtained distribution powers, if the Scottish Central Power Co. could not supply it economically, it would obtain a supply from the Corporation of Edinburgh.

Mr. Macmillan, K.C., addressed the Commissioners on the main scheme as applied to Midlothian and East Lothian. He said that the Edinburgh electricity undertaking was efficient, economical, and profitable, in the sense of having a reasonable margin upon which to work. The Corporation had done all that, although in the last few years it had been seriously handicapped because the stations had been working with plant which was to a large extent obsolete. As to the future of the Edinburgh electricity undertaking, everything pointed in the direction of improvement in the public interest. Edin[illegible] [illegible] [illegible] important with regard to future expansion. When the Portobello power station was working, the Corporation would be able to generate electricity far more economically than hitherto. The idea was that ultimately the undertaking should be capable of meeting all demands from the area of Edinburgh and the two surrounding counties. They had already got a responsible Corporation with an existing site, and with a capital station already constructed, capital liabilities all incurred, and expenditure already met. That simplified the position to a remarkable degree. The Corporation would maintain its two old stations as a stand-by, and Leith would be a substation.

Mr. Macmillan explained that the promoters were under no obligation to set up a joint electricity authority, and the Commissioners could only resort to that form of administration if they found it necessary to do so in the public interest. If they considered the peculiar position of Edinburgh, where the whole responsibility with regard to the generation of electricity for the district rested with the Corporation, and where the district was already satisfactorily provided for, there was, so far as the Corporation was concerned, no need for another administrative body. Edinburgh itself did not require any more powers; it generated electricity under its existing Orders, and it distributed within the whole of the county area. It could obtain from the Commissioners power to supply in bulk outside its own territory. There would be no opposition from local authorities, or companies, outside Edinburgh. They would much rather be permitted to have a scheme which would dispense with the joint electricity authority proposed, and, on the other hand, introduce an advisory committee or an advisory board.

Mr. R. W. Hogarth, M.Inst.C.E., of Messrs. Buchan and Partners, consulting engineers, Westminster and Edinburgh, in reply to queries by Mr. Cooper, for the Edinburgh Corporation, said that in the Counties of Midlothian and East Lothian there was a large industrial field to be tapped apart from the collieries, there being many paper mills and engineering works in the area. There were 890 farms and 218 country houses, all of which, taken collectively, would give a valuable market for the energy to be supplied, and there were townships which at present had no supply. The great bulk of the industrial field to be developed lay within a twenty-mile radius from Portobello power station, which was therefore admirably situated for the supply of the area and for the efficient and economical development of the scheme.

In reply to Mr. Gentles, K.C., Mr. Hogarth said the County Councils found it an impracticable thing to take upon themselves, in the meantime, the risk and expense of distribution of the supply in their respective areas. He thought their position in that respect was sound.

Mr. Robert Paton, Edinburgh City Chamberlain, in reply to Mr. Macmillan, said that on May 15th last the total amount of loans sanctioned in connection with the Corporation's electricity undertaking was £3,044,514, and the amount actually borrowed was £2,395,126. There had been repaid by sinking fund 40 per cent. of the total amount borrowed. As to Portobello station, the position at May 15th last showed that a considerable part of the estimated cost had already been provided for. The estimated cost of the station was £1,124,000, and the actual expenditure to that date was £553,263; estimated cost of mains, £275,000, expenditure, £137,186; substations estimate, £207,000, expenditure £65,016; total actual expenditure at May 15th, £755,465, as against an estimate of £1,606,000. About half of the capital required had been found at the close of the financial year, and since then there had been a further large expenditure on the undertaking. "In the last six months a further sum of £400,000 had been spent on the station and mains.

Councillor W. Bruce Lindsay, Convener of the Corporation Electricity Committee, said that the rates for current compared very favourably with those in any other large town. In the event of a joint authority being set up he thought Edin[illegible] [illegible] representation, but he considered that it would be [illegible] to set up another body. The Corporation sold electricity at as nearly cost price

as possible. The County Councils shared the view that a Joint Authority was unnecessary. Any matter in which the National Electric Construction Co. was interested could be settled at a conference for the purpose.

Mr. W. B. Cownie, managing director of the National Electric Construction Co., said he had no difficulty in arriving at the conclusion that, provided they could get a bulk supply of electricity from Edinburgh on satisfactory terms, the scheme was one which he could recommend, but he was not prepared to say that the bulk supply price was as good as it might be. He did not think there was any necessity in this case for a Joint Authority in view of the fact that all the finance for the generating station was provided by Edinburgh. The Counties had no financial interest in the scheme.

Mr. George Cruickshank, County Clerk of East Lothian, said that his County Council felt that the Edinburgh Corporation should have such a majority on the governing authority as in effect would make it the Joint Authority.

Mr. A. T. Asher, County Clerk of Midlothian, said his County Council was very much opposed to the suggestion that there should be a Joint Authority: Edinburgh Corporation would naturally have a preponderating voice, and the setting up such an Authority might or might not involve considerable expense.

At the close of the evidence,

Mr. MacMillan, K.C., in addressing the Commissioners on behalf of Edinburgh Corporation, said the three topics with which they were concerned at this stage were—area, supply, and administration. Area was agreed to by all parties. All were also agreed that the capital station at Portobello was the proper and suitable source of supply. The method of distribution in the County Districts was a problem of no little difficulty, but it had been solved. The County Councils, not desirous of incurring expense at this time in the matter of distribution, wisely preferred to get into touch with a company, which would be disposed to undertake the risk and find the necessary capital. They had been fortunate in finding Mr. Cownie (National Electric Construction Co.) at hand, and in coming to an arrangement with him to put the resources of his company into operation. The Corporation had been no less fortunate in coming to an agreement with him to take from Portobello large supplies. From the point of view of the county areas, the whole mechanism of the scheme had been provided for, and it would necessarily proceed by degrees. He urged upon the Commissioners that this was a case in which it would be undesirable to inaugurate administration. The Corporation, however, would in no way resent, but would rather welcome in this scheme, in lieu of the Joint Electricity Authority, the insertion of certain clauses which would ensure that the Electricity Commissioners would have proper power of general direction and control over all parties in the area. The area being fixed, and supply and distribution well provided for, he submitted that administration would best be dealt with by leaving matters as they were.

This concluded the inquiry.

SALESMANSHIP:
INTERVIEWING THE PROSPECTIVE BUYER.

The last of the three lectures by Mr. Wallace Attwood, at the Salesmanship Conferences of the Electrical Development Association, was given on December 15th at Caxton Hall, Westminster. Mr. W. C. Lusk (managing director, British Thomson-Houston Co., Ltd.) presided.

Mr. Attwood gave as the title of his third lecture "Managing the Interview," and outlined the course to be followed by a salesman from the preparation for an interview to the actual clinching of a sale. He did not think that salesmen prepared themselves sufficiently before actually going to see a prospective customer, or "prospect," as he consistently called him. A salesman must first fix his objective and determine the motives which would impel the customer to be more willing to buy the goods than to refuse. The motives that moved people were set out as natural instinct, emulation, pride of possession, weakness, and hope of gain. The lecturer said that when a prospect was informed that somebody wished to see him he was instinctively on his guard. Therefore, he must be made to *want* to see the caller. His curiosity must be aroused, and amusing instances were given of how this could be done. Sometimes there was an obstacle to be encountered, in the shape of a commissionaire or a clerk, in which case it was necessary to enlist the personal interest of that person. If a salesman could not interview a prospect alone in his office, but in a little inquiry office, where he could not demonstrate his goods effectively, then it was better that he should not do so at all, because the prospect would be irritable and uninterested, whilst the salesman was uncomfortable and could not do himself justice. He urged the salesman to fight against handing in his business card, because it was difficult to make a card speak on his behalf.

Having approached the prospect, the first thing to do was to make some remark which would interest him. There was not, he said, enough "ferociousness" in selling, and he was a little tired of salesmen being too pleasant to the prospect. The salesman, having prepared the interview, and chosen his time, was in a better position to manage the interview than the prospect, and he should see that he had the opportunity to put his case to the fullest extent. It was necessary to get the prospect into a receptive mood, and he should not be afraid of saying unpleasant things if they were necessary to put the prospect in the right mood. There were various methods of approach. The prospect might be approached as a friend, or as a stranger, but the salesman should always be prepared to say something that would interest the prospect. It was necessary to study the prospect's character, and to be prepared to meet any objection. The salesman must not be afraid of saying unpleasant things if they were necessary to put the prospect in the right mood. There were various methods of approach. The prospect might be approached as a friend, or as a stranger, but the salesman should always be prepared to say something that would interest the prospect. It was necessary to study the prospect's character, and to be prepared to meet any objection.

In conclusion, Mr. Attwood said that the lectures were intended to cover broadly the aspects of selling. He then dwelt on the importance of salesmanship from a national point of view in reducing unemployment. We in this country had not had many years in which to study selling; we were only on the fringe of it, and if salesmen could sell more of their products it would be among the country's best service.

Mr. E. Shaw asked how Mr. Attwood would deal with a case in which a salesman had to interview a woman who had no influence with the prospective buyer, and whose sole duty was to keep undesirable people away from the master. He also mentioned the case of a salesman who had to interview a purchasing agent, a man whose position it was to be approachable, but who could only tell a caller that his tender was receiving consideration and that he would be notified in due course.

Mr. Attwood, referring to the purchasing agent, said that if all callers were on the same footing, then the tender which was favourable on the face of it would be successful. Having ascertained from Mr. Sharp that the purchasing agent he had in mind did the actual purchasing, but did not let the salesman know the fact, Mr. Attwood pointed out that there was a lot of selling done on paper. Why not put salesmanship into a tender, and make it distinctive? The office boy should be impressed with the fact that his employer was missing something which he really wanted if he did not see the salesman, and Mr. Attwood urged the importance of always giving the boy a definite message to take to his employer. If it were necessary to use a business card, it was very helpful to write a short sentence on the back which would appeal to the prospect.

Mr. F. W. Levers asked for Mr. Attwood's opinion of the greater use of the telephone.

Mr. Attwood replied that there was a time to make snap decisions, such as when prices were fluctuating a good deal, it was all right to use the 'phone, but perhaps it was not well to use it when goods had to be considered carefully. But the salesman ran a risk of being turned down on the telephone, and he closed the door against himself. He (Mr. Attwood) preferred to call first, and if he could not get in to see the prospect, then he had a reason for 'phoning afterwards.

Mr. H. H. Curtis asked for help in trying to sell a motor. The buyer wanted a motor, but the salesman was in competition with others whose prices were much the same. Also, in cases where a salesman had to depend upon his tender, could Mr. Attwood outline a letter which would assist.

Mr. Attwood said there were very few people who knew how to write a sales letter. The first word of a sales letter, as far as possible, should be "You," instead of "I" or "We." He put it forward as a principle that a salesman should never run down a competitor's goods. He suggested that in such a case the salesman was trying to run down himself to a man familiar with the technicalities, and whenever the prospect put forward a counter-suggestion, the salesman should always be able to meet it with a "but." If prices were the same, the salesman could say he could give a little better service, and if there was no difference between the merits of the competitors then it was a question of personality.

Mr. R. A. Lower asked whether Mr. Attwood considered it policy to run down a competitor's goods.

Mr. Attwood said he must have given a wrong impression. He had said all along that the salesman must appeal to the reason of the prospect. He did not believe in a forced sale unless the salesman could prove that it was to the prospect's advantage that the purchase should be completed with his particular firm.

Mr. H. F. Yates mentioned a case of a salesman who was always sure to get an order from a customer who would not give an order from him. It was a difficult case, but the salesman had secured an order by placing a large amount of work with the retailer, who at once felt under an obligation to him to return the compliment.

SALESMANSHIP CONFERENCE AT NEWCASTLE.

A [illegible] conference on salesmanship in the electrical industry [illegible] North East Coast was held in Newcastle on December 7th. Mr. N. W. Prangnell, M.I.E.E., occupied the chair, and the speaker was Mr. W. E. Warrilow, A.M.I.E.E., who took for his subject "Advertising and Salesmanship."

Mr. Warrilow explained that he did not propose to touch upon the heavier side of the question of advertising in its relation to sales. He proposed to deal with the promotion of the sale of electricity consuming devices and the extension of electric service. Advertising had an immense influence on sales. He did not propose to deal with the advertising value of showrooms. He was mainly concerned with the influence of printed literature on sales. The electrical industry was comparatively new to "live" advertising, and they were fortunate in that respect because they could now take advantage of many improvements in printing art and engraving. The constant change of "copy" was something like the constant re-appearance of the traveller at the door of the buyer.

There had been no more advertised electrical product than the lamp, and the influence of advertising on sales had been undoubted. The same sort of advertising had also been of great value in other branches of the industry. The wiring firms were now taking an interest in it, and they were doing excellent poster work. It was an indirect kind of advertising which tended to create demand. There was an enormous amount of work still to be done in that field, and at present the manufacturer was bearing the chief portion of the cost. Neither the wholesaler nor the contractor contributed a great deal towards electrical advertising. It was, however, noteworthy that the manufacturer had seen the importance of it.

He then gave details of a scheme of advertising which in his opinion encouraged mass production. A manufacturer of a particular article started a campaign in which he bought the front page of the *Daily Mail*. The page was then divided into different designs showing the uses to which the article could be put. Below that was a list of names of wholesalers who, in response to the manufacturers, ordered, say, a couple of dozen. For the price of the two dozen the purchaser could secure an advertisement on the front page of the *Daily Mail*. That method had been tried by several firms with the very best results. The advertising helped to sell the article. The contractor and wholesaler had sufficient confidence in the proposition to give the manufacturer an order which would enable him to put in hand, say, 10,000. They ought to aim at the standardisation of the product, as the more that was done the greater influence would the advertisement have upon sales. On the supply side enormous difficulties existed owing to lack of uniformity in voltage. There again the advertising man felt that anything in the way of a universal campaign was difficult to organise because it was not possible to sell a sufficiently small average number of articles to make the appeal general throughout the country. Unification of voltages was an ideal towards which they were moving. The work of E.D.A., which was after all advertising work, was receiving greater support from all branches of the industry, and it presented a platform upon which the many and conflicting interests could meet. Manufacturers, wholesalers, and contractors could, through it, contribute to the common fund for increasing the demand for electrical service.

Advertising presented great opportunities to men who had experience and training in electrical work. Some people believed that an electrical salesman who had no knowledge of the industry could be trained. That was a fallacy.

The problem was now falling more or less into two groups: the sale, on the one side, of consuming devices, and on the other of electrical service. By means of a diagram he sought to explain what he thought was the position. On the one side was the apparatus manufacturer, who was advertising direct to the consumer through the medium of the daily Press. He was also advertising to the wholesaler through the trade Press. That included catalogues, &c., for the benefit of the retailer. The retailer also in a small way advertised to the consumer. The manufacturer sold to the wholesaler, the wholesaler to the retailer, and the retailer to the customer. The central stations also ran their own showrooms and sold to the consumer. On the service side was the E.D.A., consisting of the manufacturer, wholesaler, and retailer and, through the medium of posters, influencing the mind of the consumer: The central station did not do that kind of thing. The central station, through the medium of the Press and circulars and so on, did its best to influence the customer, and that was the position at the moment. It was an extremely inefficient arrangement, and resulted in an enormous amount of overlapping. The advertising could be economised if the manufacturer was left to do his advertising to the wholesaler and retailer through the trade Press. There was a national kind of campaign which could only be undertaken by the E.D.A. In connection with sales, they ought to have four big weeks during the year: [illegible] the four seasons. The central-station man after all was mainly concerned with service. The central-station man could make his appeal through the Press and in co-operation with the retailer, and in that way create a demand for [illegible]; in that way they were likely to move towards standardisation.

In the ensuing discussion, Mr. Albrecht said that propaganda work was not only necessary for the public, but for the doubters within the ranks. Many were prone to reduce the matter to fine points of efficiency and cost, which were certainly not the only factors to be considered. He thought no man should engage himself in the industry unless he had the courage to use electrical apparatus. Some were faced with insurmountable difficulties, but there were others who could, and should, lend their support.

As to advertising, his opinion was that a lot of the selling value of advertising was lost because it was misdirected. More attention should be given to educating the public.

Mr. Warrilow, in reply, said that he was glad to hear that Mr. Albrecht supported him in the suggestion that electrical men should use their apparatus, and he suggested an intensive campaign towards that throughout the country. He thought it was a wrong line to try and educate the public that there was nothing to be afraid of in using electricity, and he did not think there was very much in the point. He believed that once a man became an electricity user he remained so.

Mr. Stephen Holmes said that he thought it would be found that all the big advertisement schemes originated from the manufacturer and were paid for by him. The manufacturer wanted to sell his particular goods, and the wholesaler and retailer would sell what there was a demand for, irrespective of who manufactured it. All they wanted was their profit on the turnover, and they could help to a certain extent by creating a demand for any particular line. His experience was that the man who had not a sufficient technical knowledge was absolutely useless.

Mr. Pinkney said that electric cooking was now satisfactory, and they must realise that the biggest field for development was the domestic field, and by cultivating that field they would get a big load, and then everyone in the industry would benefit one through the other—wholesaler, retailer, manufacturer, and supply company. Mr. Warrilow had said that the manufacturer bore the chief burden of advertising, but it was chiefly for himself. A great deal of advertising was done by supply authorities and the E.D.A. In his opinion too much standardisation was a bar to progress.

On the question of the speaker's diagram on the board, he thought that the manufacturer should advertise to the consumer. He did not think, generally speaking, he should sell to the consumer; he thought the supply authority should certainly provide showrooms for the consumer, and where there were not sufficient retailers available, should sell to the consumer. What they wanted to get at was the ultimate buyer, and if they were organising for selling to the consumer, it did not matter who did it.

Mr. Warrilow said that experience was contrary to Mr. Pinkney's suggestion that standardisation was a bar to progress. In America they first agreed upon the design, then the mass producer was called in. The processes were fixed and the sizes of the plant agreed upon, the machine tools purchased, and the job put in the hands of the manufacturer for, say, 100,000 articles. By the time 50,000 were made the sales campaign had commenced. He agreed that it did not matter who sold the things so long as they got to the consumer.

Mr. Wilson thought that the progress of domestic electricity was in the control of the supply companies and the contractors. They were the only people who came into contact with the consumers of domestic electricity, and the manufacturer did a great deal of the advertising. If the supply companies and contractors did the pioneering work, then the wholesalers, retailers, and manufacturers would have plenty of work to do.

Mr. Carter said that a gas company would send round and tell one exactly what one of its fires would consume and what it would cost, and he found that it worked out pretty correctly. But he did not know, for instance, whether the electrical service into his house was sufficient for heating and cooking without increasing the mains. He did not know what it would cost to install plant or to run it. If as an "electric person" it was so important for him to have this apparatus, and it was going to cost him twice as much, why should not the supply company do it for him? It was advertising, and they were out to pay for advertising, and he would advertise it for them.

Mr. Robson, dealing with the question of retailers paying their share of advertising, said he thought the amount of money spent on advertising should be in proportion to their turnover, but he did not know in their trade what that should be. The retailers had their share of advertising, but not in the technical Press. He would like to hear what was a fair percentage of turnover that should be spent in advertising.

Mr. Warrilow said he was sorry he had no figures that he could give Mr. Robson, but if the figures would be of any assistance to retailers in the district he would try to get them.

Mr. Cross spoke of the advisability of sending non-technical advertising matter to the general public; the E.D.A. recently had sent out leaflets which he thought were on the right lines for educating the ordinary user of electricity. He agreed that the manufacturers were clearly bearing the cost of advertising, and with the exception of the multiple shops, if they looked at industry generally they would find that the bulk of the advertising was done by the manufacturers. He suggested that the wholesaler and retailer should spend a fair amount on advertising, say, by circulars, and the circulars sent to the consumer should be in less technical terms. It was a nuisance to look up a circular and find, for instance, that the charge for the apparatus was not mentioned.

Mr. Warrilow agreed that the fullest information should be given to the retailer and wholesaler, but he was not sure that it was right in issuing leaflets to the public to give figures. He thought the figures were best presented by the salesman in the showroom.

Mr. Ellis said that the E.D.A. was putting out a series of leaflets and booklets which were invaluable, and he thought they should be utilised by all; scarcely any letters left any of their several firms which could not carry with them with advantage some E.D.A. matter.

Mr. Albrecht proposed a resolution to the effect that the committee should find out how many men were employed in the electrical trades in the North-East Coast and to take steps to induce them to become electrical users. This was carried by a show of hands.

THE FEDERATION OF BRITISH INDUSTRIES.

Col. Armstrong's Review of the Situation.

At the annual meeting of the Federation of British Industries, held at the Hotel Cecil, London, on December 14th, the retiring president, Col. Armstrong, reviewed the past year's trade briefly, considered the outlook, referred to industry's need of all available capital, and other matters. Having stated the factors in the prevailing situation, he asked what remedies could be suggested. We quote the following extracts from the speech:—

"The external debt which we have incurred, which we have definitely undertaken to meet, is going to impose a very heavy burden on us; nevertheless, the question of our participating in foreign loans to assist other European countries in their difficulties is freely discussed, and no question seems to be raised in regard to where the money for this purpose is to come from. Though for the moment money seems to be fairly plentiful, it must, nevertheless, be borne in mind that large sums at present invested represent the working capital of many of our industries, which, owing to bad trade, has unfortunately become liquid, and has been invested in easily realisable securities. If and when trade revives there will be a heavy and continued realisation of these investments, and a still further demand for money to finance our trade. When these conditions supervene we shall probably find that, so far from money being plentiful, the reverse will be the case, since for some time to come we can hardly look for anything approximating the large pre-war annual balance of production over consumption. We shall, therefore, be in a position of requiring for our own purposes, at all events, for a considerable period, the full amount of money available to develop our trade and our industries, and, if balance there be, I hope, to assist in a similar development within the confines of the Empire. If ever we are to regain our pre-war state of National prosperity it is obviously impossible for us to rely on the extremely narrow margin which at present exists. There are only two sources to which we can look for substantial help. The first, which will give more immediate results, is a serious and material reduction of the heavy burden of our national expenditure. It seems obvious that this cannot continue at its present figure. It may even be necessary, to tide over the immediate crisis, that the evil of some slight inflation of our currency should be accepted.

"It is, I think, now generally agreed that the policy of deflation which the Government adopted in accordance with the recommendations of the Cunliffe Committee has proceeded too far and produced results which were not anticipated at the time it was instituted. You may remember that last year we urged the Government to appoint a committee to re-examine the whole question. The Government replied that they regarded the appointment of a new committee at that time as inexpedient. I feel that the Government might do well to reconsider this decision, as, even if the same conclusions were arrived at, the present conditions are so different from those existing at the time the policy recommended by Lord Cunliffe's Committee was laid down that these conclusions need re-justification.

"The second remedy is one which more nearly concerns us, namely, that we must make every possible effort to enlarge the scope of our trade, to secure a greater share of the markets in which we already hold a footing, and that we must combine to develop new markets wherever such a course may be possible.

"We cannot afford to neglect taking any steps which may lie within our power to secure the rehabilitation of the European countries, and it is incumbent on us to do our utmost to enable them to stabilise their currencies and balance their budgets, though I am afraid for the present that anything we may do in this direction should be more on political than on financial lines.

"In regard to new markets, it would seem to be indicated that a most strenuous attempt should be made to develop them within the limits of our own Empire, where, at all events, we are dealing with kith and kin, and where we need not fear that hostile tariff barriers, unfair restrictions against our trade, and other disabilities will be imposed upon us.

"I would urge that, in the coming year, a strong committee should be asked to assemble and consider whether any joint scheme, either by individual trades or by trades collectively, can be devised to stimulate our foreign trade. If necessary, we might even invoke some support by His Majesty's Government, since assistance in such cause would in measure be reproductive, and would serve to lighten the burden of unemployment.

"I have been given to understand that we may have to look for very strenuous competition from Germany, that of late they have been perfecting schemes for collective selling abroad, and for jointly undertaking complete contracts. I am told that they have brought such organisation to a high standard of perfection, and as soon as they can establish some stability in their finances, under conditions favourable to themselves, we shall find that they have organised to our detriment.

"There is one further point bearing on foreign trade which requires prompt and energetic action, namely, the restrictions that are being imposed on us almost everywhere by hostile tariffs. In part this is the outcome of a wave of nationalism which has followed on the war, and in many instances time may prove that the duties imposed are economically unsound. Nevertheless we shall find these tariff barriers a serious impediment to the re-establishment of our trade relations.

"Meanwhile there appears to be an inclination on the part of Germany, by way of foreign investment, to resume her pre-war policy of acquiring substantial interests in industrial concerns within the limits of these protected areas.

"Gentlemen, we are in for a fight to regain our own. There are many adverse factors with which we have to contend, but I have no doubt in my mind that if only we conserve our assets and work together the time is not far distant when we shall again find ourselves approximating to our pre-war volume of trade, and a national balance sheet showing a satisfactory surplus of production over consumption."

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR NOVEMBER, 1922.

The Board of Trade records of electrical export business for the month of November show a decrease in values of £64,207 on last month's totals, and £296,736 as compared with November last year. The figures for the month were £944,074; for October, £1,008,281; and for November, 1921, £1,240,810. The principal decreases occurred in the items for batteries, £36,000, and telegraph and telephone exports, £22,000; lower values were also recorded in the sections for electrical goods and apparatus, lamps, carbons, and electrical machinery, whilst slightly increased values are shown in the items for insulated wires and cables and meters. Electrical imports at £250,182 for the month under review show an increase of £30,000 on the total for October, 1922, and £70,000 as compared with November, 1921; an addition of £28,000 in the electrical machinery import section accounts for the enhanced values for the month. The electrical re-export figures for November were £12,355, an increase of £1,300 on October, but a decrease of £2,400 on November, 1921.

Values of Electrical Exports, Imports and Re-exports for November, 1922.

	Exports.	Imports.	Re-exports.
	£	£	£
Electrical goods and apparatus ...	123,273	52,794	2,612
Insulated wires and cables ...	179,447	17,182	
Glow lamps	28,235	28,690	416
Arc lamps and parts ...	1,930	1,255	—
Batteries and accumulators ...	32,950	17,799	3,070
Meters and instruments	32,937	6,337	107
Carbons	3,967	7,030	205
Electrical machinery.—			
Railway and tramway motors ...	14,593	—	—
Other motors and generators ...	144,232	—	—
Switchboards (not telegraph or telephone)	10,690	4	—
Electrical machinery, unenumerated	137,596	72,539	648
Telegraph and telephone cable and material.—			
Telegraph and telephone wires and cable (not submarine) ...	27,325	1,675	—
Submarine telegraph and telephone cable	51,355	—	—
Telegraph and telephone instruments and apparatus	157,254	41,879	702
Totals	£944,074	£250,182	£12,355

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SKERTON-JONES, O'DELL AND STIRRARD, Patent Agents, 366, High Holborn, London, W.C. 1.

32,729 "Condenser induction and reaction coil for the prion of wireless telephony." C. C. Powell. November 30th

32,750. "Various electric conductors, lamp [illegible], &c." W. A. Edwards. November 30th.

32,781 "Motor-car head lamps." H. Workman. November 30th

32,799 "Cooling electrical apparatus." Brush Electrical Engineering Co. Ltd., and C. C. Sutton. November 30th

32,764 "Drag magnets for electric meters, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). November 30th

32,782. "Miners' safety lamp." J. E. Wilkinson. December 1st

32,787. "Motor-car lamp." E. Hayes. December 1st

32,818. "Ignition plugs." H. W. Bullock. December 1st

32,819 "Electro-pneumatic locomotives, tramcars, &c." W. P. Durtnall. December 1st.

32,831. "Transformers for radio-telegraphy, &c." A. Salomon. December 1st

32,857 "Current interrupters for ignition devices of internal-combustion engines." C. S. Garrigan and C. A. Mortensen. December 1st.

32,858 "Automatic reverse current regulators." W. Langdon-Davies and A. Soames. December 1st

32,841. "Reactance coils." Electro-dynamic Construction Co., Ltd., and N. Pensabene. December 1st

32,845. "Transformers and circuits therefor." Western Electric Co., Ltd. December 1st. (United States, August 8th.)

32,850. "Taking Röntgen pictures for medical &c., purposes." J. I. Freund. December 1st.

32,863. "Terminals for electric conductors." N. R. Nichols. December 1st.

32,865. "Commutator bars for incandescent electric lamps." J. B. Poitou. December 1st.

32,876 "Measurement of electric currents or potentials." Siemens and Halske Akt. Ges. December 1st. (Germany, December 2nd, 1921.)

32,877. "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. December 1st.

32,878 "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. December 1st.

32,885. "Protection of electric machines, &c., against overloading." British Thomson-Houston Co., Ltd. (Compagnie Francaise Thomson-Houston). December 1st

32,893. "Electric power-transmission systems." A. M. Taylor. December 2nd.

32,895. "Arrangements of transformers and cables on electric transmission systems." A. M. Taylor. December 2nd.

32,894 "Electric transmission systems." A. M. Taylor. December 2nd

32,896. "Coils or inductances for wireless telegraphy, &c." J. D. L. Bradshaw and E. A. Reynolds. December 2nd.

32,910 "Mine signalling apparatus." G. Adam and J. Allen. December 2nd

32,919 "Electric heaters." C. H. [illegible]. December 2nd.

32,944. "Transmission systems." Western Electric Co., Ltd. (Western Electric, Incorp.) December 2nd.

32,960 "Microphones." P. W. Willans. December 2nd

32,967. "Electric control of distant objects." W. C. Jeapes. December 2nd.

32,984. "Commutator device for incandescent electric lamps." J. B. Poitou. December 2nd. (France, December 2nd, 1921.)

32,985. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd., and A. A. Pollock. December 2nd.

32,991. "Method of maintenance of constant potential difference or constant current in electric circuits." General Electric Co., Ltd., and J. W. Rede. December 2nd.

33,012. "Electric power-transmission systems." A. M. Taylor. December 4th.

33,025 "Selenium cells." W. Prior and C. E. Riley. December 4th.

33,035. "Switchgear for electric condensers, &c." A. F. Pfeiffer. December 4th

33,047 "Swivel headlight for automobiles." O. K. F. Hauch. December 4th

33,052. "Joints for electrical cables." Pirelli-General Cable Works, Ltd. (Italy). December 4th

33,056. "Electric light switches." J. Glendenning. December 4th

33,062 "Switching apparatus for telephone, &c., systems." Siemens and Halske Akt. Ges. December 4th. (Germany, December 3rd, 1921.)

33,064 "Isolator switches." Lahmeyer. December 4th.

33,067 "Treating incandescent electric lamps." W. J. Webb. December 4th.

33,068 "Incandescent electric lamps." A. T. Berry. December 4th

33,069. "Automatic telephone systems." T. Lanaghan. December 4th.

33,090. "Incandescent electric lamp holder." J. B. Poitou. December 4th. (France, December 15th, 1921.)

33,101. "Electric switches." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.) December 4th

33,102. "Systems of electric motor control." British Thomson-Houston Co., and K. D. Gives. December 4th

33,131. "Transport electric signal lights." G. H. Henshaw and F. Rushton. December 4th

33,134 "Push-button controllers." W. L. McLennan. December 5th

33,146 "Method of obtaining air-tight seals between molten glass and wires in electric glow lamps, &c." A. I. Hoge and A. M. Hoge. December 5th

33,168. "Attachment to clocks to automatically switch on and off electric [illegible] circuits." A. Chardley. December 5th

33,[illegible] "Indicating signs for tramcars." W. J. Reynolds. December 5th

33,210. "Plug switches." F. E. Colleson. December 5th.

33,[illegible] "[illegible] devices, &c." F. E. Collinson. December 5th

33,[illegible] "Lamp-holding washer sockets." J. B. Rudkin. December 5th

33,244 "Telegraphic synchronizing system." D. Murray. December 6th.

33,251 "Electric switches for motor cycles." S. Cooper. December 6th

33,310 "Microphone relay." C. F. Hilton. December 6th.

33,318 "Propeller blades for aeroplanes." A. P. Collier. December 6th

33,319 "Means for [illegible] electric motors." W. H. Scott. December 6th.

33,321 "Wireless aerials." T. H. G. [illegible]. December 6th

33,322 "Wireless receivers." E. H. S. H. Hamilton. December 6th.

33,327. "Telephone and wireless receivers." J. Kelly. December 6th.

33,332. "Locking device for electric switches, &c." Luma-Werk Akt. Ges. December 6th. (Germany, December 6th, 1921.)

33,342. "Electric current [illegible]." [illegible]. December 6th

33,345 "Incandescent [illegible] lamps." José Félix Izquierdo de Villamea[illegible] Ortiz Rosales. December 6th. (Hungary, December 15th, 1921.)

33,350 "Spark discharge [illegible]." C. Galetti. December 6th

33,364 "Electric current [illegible], &c." J. Anderson and G. Ellison. December 6th.

33,366. "High-tension transformers." E. Pfiffner. December 6th. (Germany, December 6th, 1921.)

33,370 "Earthing choking coils or [illegible] transformers." E. Pfiffner. December 6th. (Germany, December 6th, 1921.)

33,[illegible] "Atmospheric absorber for wireless telegraphy, &c." B. Quarrie. December 7th

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

12,464 "Thermo-electric generator of steam." G. Durando. February 27th, 1922 (Convention date not granted.) (162,628.)

14,372. "Controlling arrangement for electric current." H. Brownlow and C. A. Hadley. May 23rd, 1921. (189,156.)

15,105 "Signalling by means of invisible light rays." L. Bell and N. Murchison. May 31st, 1921. (189,161.)

17,332. "Self-induction coil." Felten & Guilleaume Carlswerk Akt. Ges. June 24th, 1920. (165,416.)

19,758. "Electro magnets." H. Lacy. July 22nd, 1921. (189,174.)

19,854. "Voltage coils for electric meters, measuring and like apparatus." E. C. R. Marks (New Antwerp Telephone and Electrical Works). July 23rd, 1921. (Convention date not granted.) (166,899.)

21,808. "Fire and burglar alarms." W. J. Luse. August 17th, 1921. (189,185.)

22,335. "Electric cord holder." W. C. Fairweather (Diehl Manufacturing Co.). August 23rd, 1921. (189,203.)

22,611. "Switches for charging batteries." A. B. Webber and Standard Time Co., Ltd. August 25th, 1921. (189,227.)

23,724. "Calling devices adapted to be operated by wireless signals." W. J. Davis. August 26th, 1921. (189,233.)

22,837. "Condensers and other electrical apparatus with electrodes immersed in a gas." American Radio and Research Corporation. August 30th, 1920. (168,882.)

23,040. "Circuit closers for electrically-operated alarm mechanisms of the thief or burglar type." G. W. Wacker. August 30th, 1921. (189,244.)

23,246. "Liquid rheostats." Metropolitan-Vickers Electrical Co., Ltd. October 18th, 1920. (170,559.)

23,469. "Combined collector and terminal block for electric ignition distributors." W. P. Thompson (Splitdorf Electrical Co.). September 3rd, 1921. (189,253.)

23,501. "Permanent magnets for magneto-electric machines." C. F. Dufaux. September 7th, 1920. (168,897.)

23,610. "Frictional driving gear for dynamo-electric machines installed on railway vehicles." Vickers, Ltd., E. C. Astington, and E. T. Flann. September 5th, 1921. (189,257.)

23,617. "Frictional driving gear for dynamo-electric machines installed on railway vehicles." Vickers, Ltd., F. C. Astington, and E. T. Flann. September 5th, 1921. (189,258.)

23,640. "Electric heating apparatus for waving or curling the hair." E. F. Suter. September 5th, 1921. (189,259.)

23,790 "Directional wireless systems and apparatus." G. P. Grenfell, J. Robinson, H. L. Crowther, T. H. Gill, and J. Erskine-Murray. September 7th, 1921. (189,266.)

23,880. "Apparatus for transmitting electric signals." G. Miniotti. September 7th, 1921. (189,267.)

24,045. "Electrically heating wires, such as the filaments of electric discharge devices." General Electric Co., Ltd., and A. C. Bartlett. September 9th, 1921. (189,270.)

26,073. "Electric switches." F. S. Riggs. September 21st, 1921. (189,279.)

25,411. "Electrical cut-out." W. H. Illingworth. September 26th, 1921. (189,284.)

25,569. "Flux-coated electrodes for electric arc welding." A. C. Hyde. September 27th, 1921. (189,285.)

27,538. "Protected electric switches." J. Hall and New Switchgear Construction Co., Ltd. October 17th, 1921. (189,307.)

28,456. "Electrical resistances." H. Lucas, H. W. F. Ireland, and W. C. Turner. October 26th, 1921 (189,330.)

29,164. "Electric spark indicators." I. Poulsen & Co. September 1st, 1921 (185,379.)

30,337. "Electric switches." A. H. Mackley. November 14th, 1921 (189,336.)

30,599. "Holders for thermionic valves." A. P. Welch. November 16th, 1921. (189,339.)

31,014. "Electrical telephone transmitters." B. A. Pilkington. November 21st, 1921. (189,344.)

31,096. "Apparatus for overcoming the effects produced upon telegraph and telephone lines by the vicinity of single-phase currents." F. Carles. March 4th, 1921. (176,317.)

32,066. "High-frequency transformers." W. Dornig. November 30th, 1921. (189,349.)

32,068. "Electric condensers." W. Dornig. November 30th, 1921. (189,350.)

32,321. "Electrical control systems and switch mechanism therefor." R. Amberton. December 2nd, 1921. (188,975.)

32,547. "Head lights of motor-road vehicles." J. F. Smith. December 5th, 1921. (188,977.)

33,663. "Electrical device for destroying rats." D. Marshall. December 14th, 1921. (189,361.)

32,726. "Supporting devices for electric transformers and other heavy apparatus. S. Z. de Ferranti and Ferranti, Ltd. December 6th, 1921. (188,979.)

33,060. "Electric fuse boards." Cable Accessories Co., Ltd., F. H. Reeves, and A. Crawford. December 9th, 1921. (188,985.)

34,222. "Telephone systems." Western Electric Co., Ltd. (Western Electric Inc.). December 20th, 1921. (188,996.)

34,223. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). December 20th, 1921. (189,365.)

34,330. "Electric switches." E. C. Strong. December 21st, 1921 (188,998.)

34,529 "Electric lamp bulb fitting." D. M. Oswald. December 28th, 1921 (189,004.)

1922.

1,336 "Insulating sheet materials." Metropolitan-Vickers Electrical Co., Ltd. January 26th, 1921. (174,593.)

1,862. "Telephone systems." Siemens & Halske Akt. Ges. January 21st, 1921. (174,305.)

5,409. "Indicator device illuminated by electricity." P. Jager. February 23rd, 1921. (175,993.)

5,896 "Regulation of polyphase commutating motors." Forges & Ateliers de Constructions Electriques De Jeumont. April 5th, 1921. (178,879.)

9,968. "Electric pocket and night lamp." P. Rombach. November 1st, 1921. (188,299.)

10,805 "Electrical pocket lamps." B. Rogge. April 18th, 1922 (189,053

12,070. "Electric lamp holders and switches." Wayne Engineering and Equipment Co., Ltd., and N. D. G. Robertson. April 29th, 1922. (189,060.)

14,527. "Insulator supports." L. Schmitt. May 23rd, 1922. (189,064.)

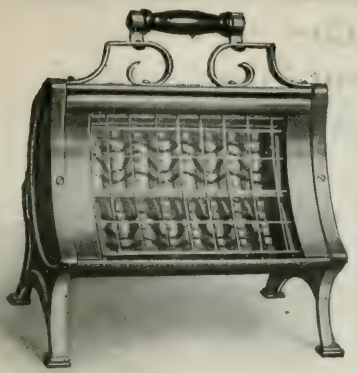
15,767. "Electric ignition devices for internal-combustion engines." Sky wing Aircraft Corporation. December 1st, 1920. (Divided application on 173,308.) (181,958.)

16,104. "Sparking plugs." R. Bosch Akt. Ges. June 13th, 1921. (181,379.)

20,818. "Treatment of magnetic materials." Western Electric Co., Ltd (Western Electric Co., Inc.). July 18th, 1921. (Divided application on 188,688.) (189,410.)

20,819. "Loaded electric conductors." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 17th, 1921. (Divided application on 188,688.) (189,075

21,708 "Electric switches." Aktiebolaget Birka Regulator. September 30th, 1920. (Divided application on 169,696.) (184,482.)



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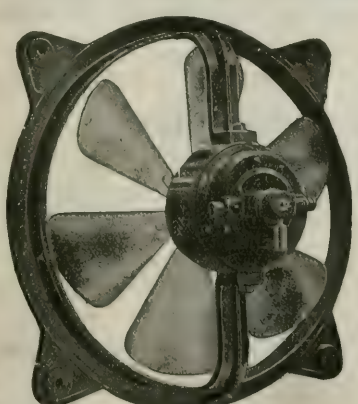


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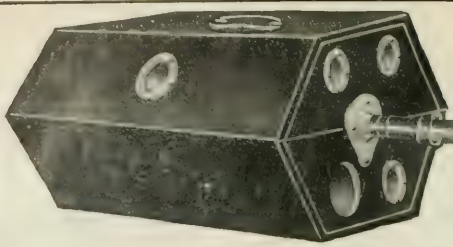
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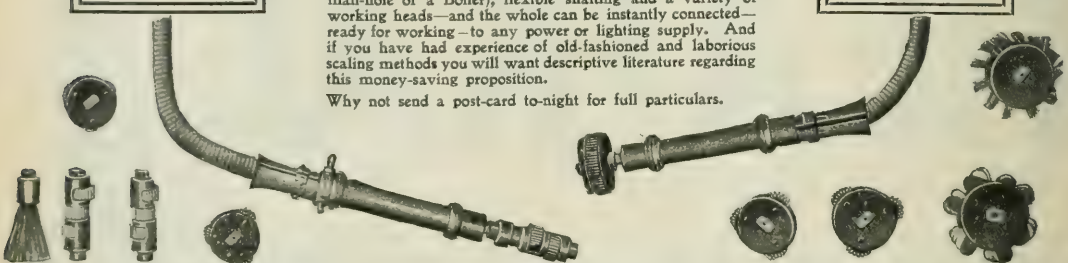
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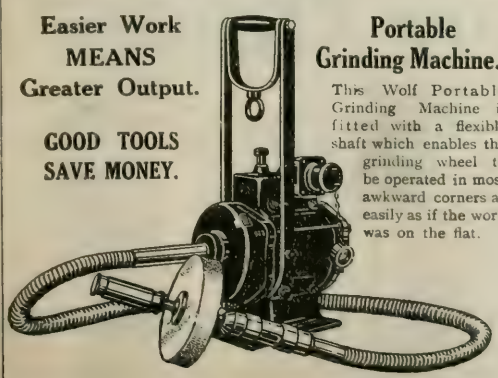
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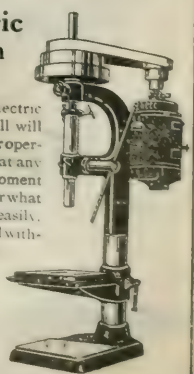
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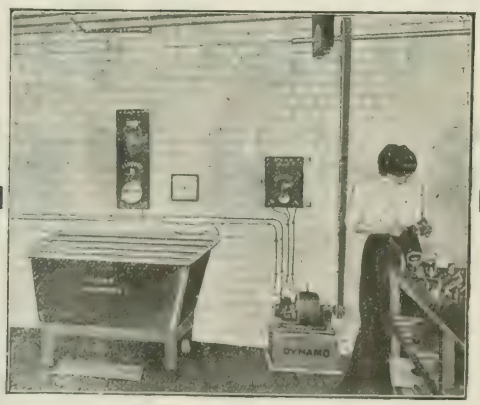
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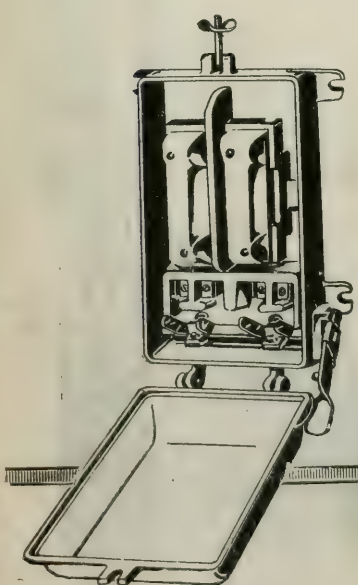
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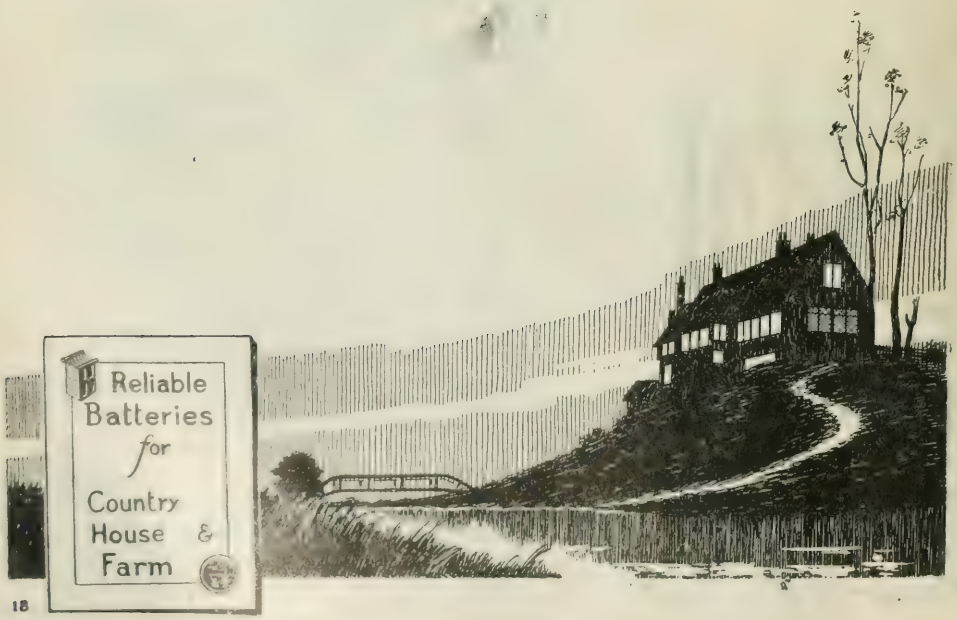
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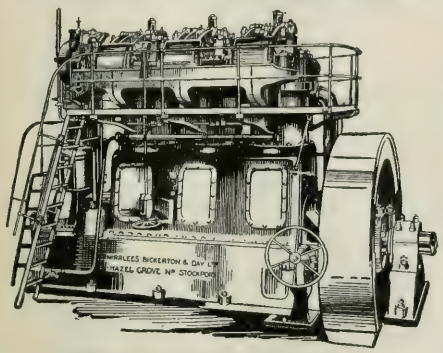
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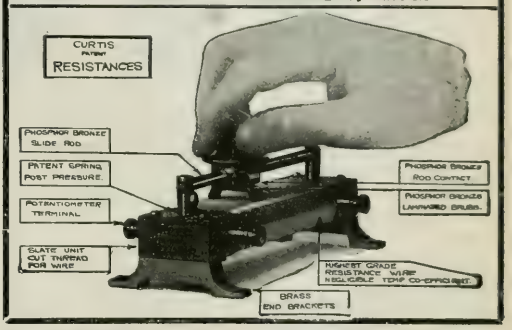
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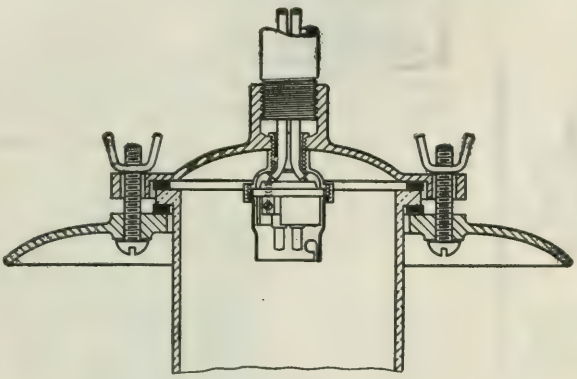
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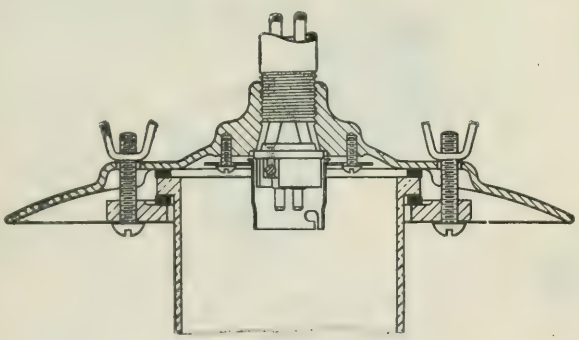
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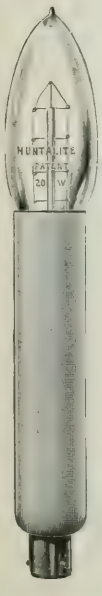
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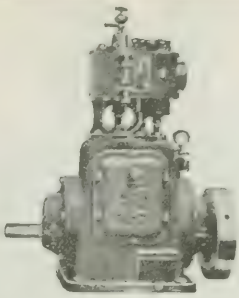
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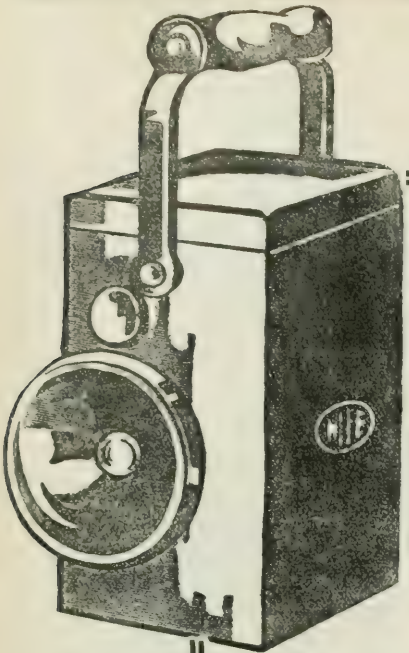
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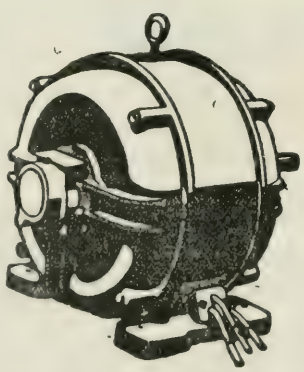
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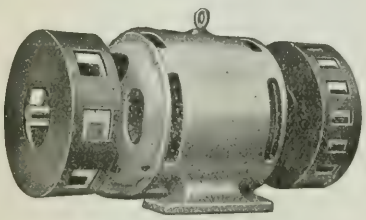
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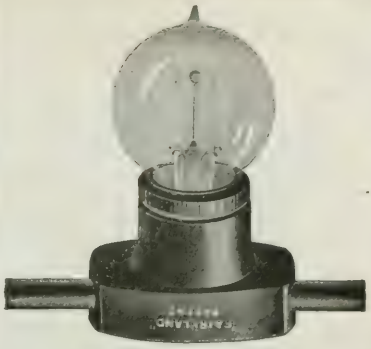


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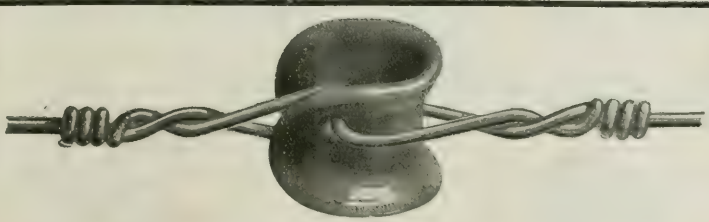
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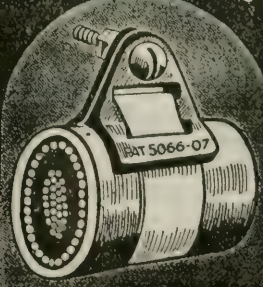


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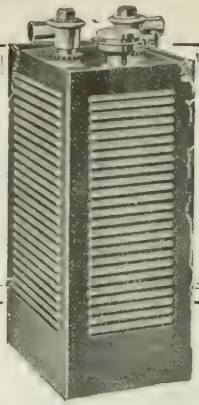
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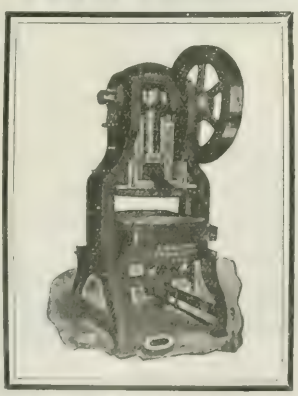
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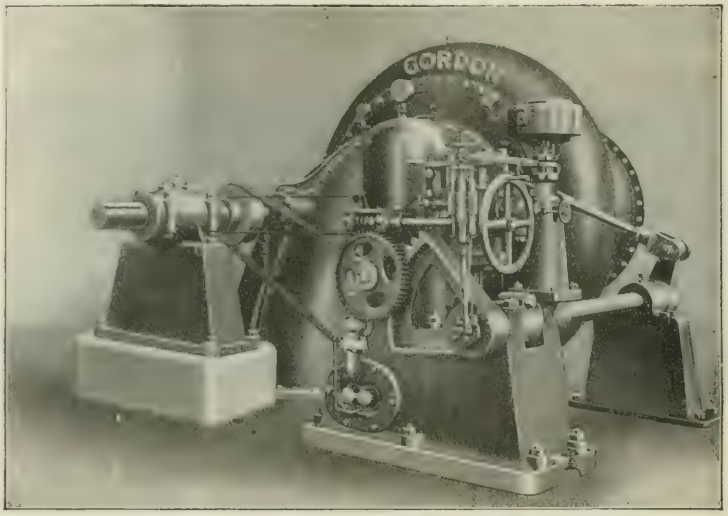
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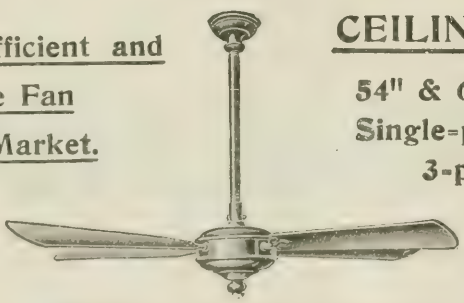
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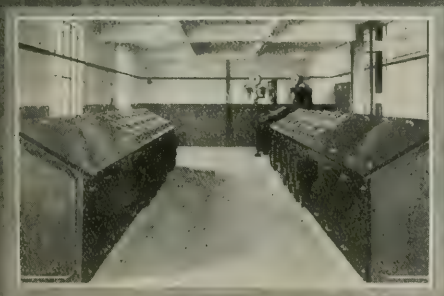
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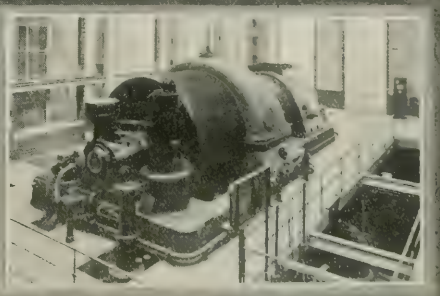
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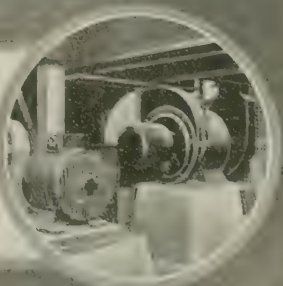
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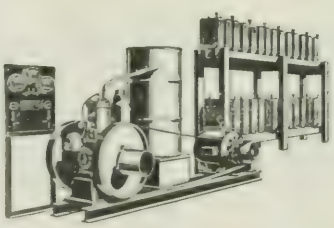
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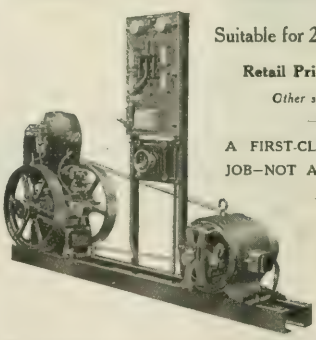
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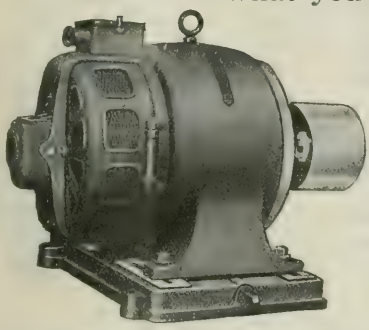
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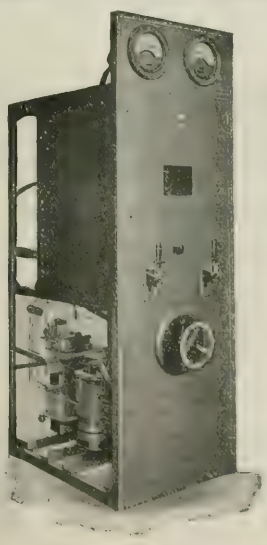
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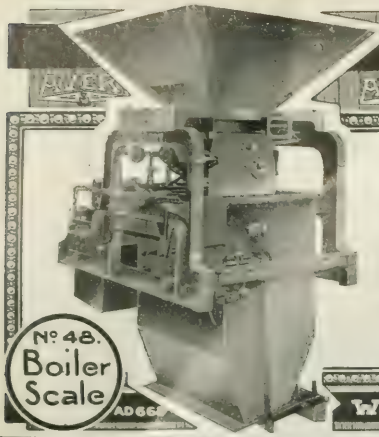
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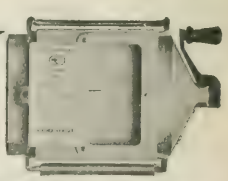
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ELECTRICAL REVIEW.

VOL. XCI. DECEMBER 29, 1922. No. 2,353.

ELECTRICAL REVIEW.

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THE REWARD OF INDUSTRY.

At the end of our leading article of November 3rd we indicated our intention of resuming the consideration of efficiency in industry, with particular reference to the bearing of reward upon the subject.

As our readers know, we have frequently expressed ourselves as being in favour, on general lines, of the dependence of the reward upon the services performed. There is more in this question than piecework, or the payment for the job in the shop, and there is more than profit-sharing, or the division of the surplus that remains out of revenue after expenses have been paid.

People engage in industry for the purpose of producing wealth, and wealth can only be produced by the application, direct or indirect, of labour to land. The land is the original capital, and the labour applied may produce crops, in which case no diminution of capital is entailed, or it may be devoted to the winning of coal to be burned, when diminution of capital occurs. It may also bring about changes in the form of the original capital, as when clay is made into bricks. In such cases as this, there is no increase or decrease in the amount of the capital, but there is an increase of availability, or immediate usefulness. It may be cynically observed that the chief motive for work of any description is personal profit, but since personal profit cannot (taking the broad view) be gained without the production and exchange of wealth of various kinds, we are justified, when taking, as we must, a brief survey of the present situation, in confining our attention to the wood rather than the trees.

All who co-operate in the production of wealth are entitled to reward for their services, and it seems clear that it would be reasonable if that reward had to depend, within limits and subject to certain conditions, upon the value of those services. The so-called capitalist, whose function is the supplying of a fund wherewith the work of preparing for and carrying on the process of production may be paid for, is entitled to payment for what he does, and to security against the loss of what he has provided. In other words, he is entitled to a reasonable return, or interest, on his money, and to insurance against the risk of some of his enterprises proving failures. It is clear that labour and management must be paid for their services, and it will be equally clear, we think, that the community is entitled to be supplied with whatever is produced at a price which is as low as possible consistent with the discharge of the obligations previously referred to. We assume, for the present, that the community consists of persons who are engaged in the pursuit of increasing the availability of wealth in one way or another, and if the producers of one kind of commodities demand excessive quantities of other commodities as their reward, other producers will follow in their footsteps, and the use of the articles produced will be restricted.

We have arrived, then, at the fact that all ought to be paid for their services, and that there is, or ought to be, a surplus available for division. Dealing first with the question of wages, or direct payment week by week or month by month for current work, there is room for variety in the methods by which the reward of labour shall be distributed. In some trades it is the custom to pay workers individually in accordance with what they produce. The cotton trade is an example of this. In others, regard is had to what is produced by the operatives as a whole, and a standard wage is fixed so that every worker receives the same amount, neither more nor

[illegible] The engineering trade unions have always been averse to any form of payment by results, and some workers have called such a method of payment "a protectorial system." It must be assumed that a worker is not so inefficient or non-productive as to merit discharge from his employment; but the effect upon an individual worker, of smartness and efficiency above the ordinary (unless, indeed, promotion to a better position can be obtained) is so remote that there is no inducement towards its attainment. For this reason there seems little doubt that payment by results leads directly to an increase of effort. We are not impressed by the suggestion that it would lead to scamped work, which could be prevented by a proper system of inspection, or to over-production and consequent dislocation, which would not occur if there were a Progress Department to lay the various processes out in advance.

Dealing next with the division of profits, it is clear that this must take place at less frequent intervals than those at which wages are paid—in fact, generally once a year. A more general interest, on the part of those employed in them, in the prosperity of industrial undertakings, seems to be required, and the subject has lately received a good deal of attention from many writers of experience.*

Mr. Seebohm Rowntree includes an interest, on the part of the worker, in the success of the industry in which he is engaged (or, to come nearer home, in the prosperity of his own employer) as one of the five essential *minima* by which industrial unrest is to be avoided, and a spirit of co-operation fostered between employers and employed. Summarised, these are: (1) sufficient earnings; (2) reasonable hours; (3) economic security throughout working life and in old age; (4) a reasonable share in the determination of working conditions; and (5) the interest previously referred to. He argues that the surplus profit ought to be shared between capital, labour, management, and the community. He does not appear to draw any distinction between those of the community who use the commodity which has produced the surplus—in other words, between the customers and the others; but the whole community, users and non-users, gets some advantage from the prosperity of a manufacturing or trading concern, through the medium of the corporation profits tax and the income tax. It may therefore be assumed that what Mr. Rowntree means is that some portion of the anticipated profit for the next trading year shall be devoted to a reduction in the price. In certain industries, such as that of gas supply, this is enjoined by law, and dividends are limited. He is in favour of giving a liberal share to management, and we are glad to find that he recognises the fairness of this course. The administrative staff, although, as Sir Lynden Macassey has said, it has not risen adequately to the greatness of its position, can do much to make or mar the success of a business, and it is time it was recognised that trained brain-workers ought to be able to get at least as much out of the practice of their profession as people get out of small businesses for which no special knowledge or aptitude is required. Yet many an engineer would be financially better off selling something that people *must* have, such as food or clothes, than in doing the work for which he is qualified by his expensive training.

We shall deal with Mr. Bowie's book in our "Review" columns, but it may be remarked here that its trend is towards co-partnership of a contributory kind, so that labour and management, like other shareholders, would receive their share of profits as dividend. .

The prosperity of the nation depends upon the prosperity of the nation's industries. High demand and consumption must coincide with plentiful and cheap supply, and the two requirements are inextricably bound up together. Cheap commodities can only abound if we have the best manufacturing plant and work it efficiently, practise personal economy, have the best selling activities, and, above all, willing and contented workers. The result of the General Election has shown that the majority of the voters did not share the view that the capital levy would be efficacious in bringing about an improvement in the situation. This item of the Labour Party's programme was put forward with so little explanation, and the explanations that were offered were so conflicting, that no surprise can be felt at its non-acceptance. Manufacturers know only too well that capital is not being spent with any freedom at the present time, and any measure that savours of confiscation can only have the effect of increasing its shyness. It is natural to feel annoyed at the profiteer, and many would like to see him made to disgorge his ill-gotten gains; but the effect upon the financial situation of a move against monetary wealth in general could only be disastrous.

The Situation of the German Industry.

An unfavourable influence upon the German electrical industry has been exercised by the depreciation of the mark and the consequential suspension of industrial and private building activity. Orders for home account, according to a correspondent of a German newspaper, are only coming to hand in a scanty manner. This statement applies not only to large machines, but also to motors, meters, small electrical apparatus, heating and cooking appliances, lamps, switching apparatus, insulated conductors, telephones, &c. In general, customers complain of a scarcity of money and the lack of credit; in these circles it is not known where to get the means for making purchases, as the banks manifest great reserve. On the other hand, agriculturists, whose products command high prices, are still in the pleasant position of being able to equip themselves with electrical machinery and plant.

Concerning the export trade, it is stated that foreign orders are also diminishing, although this is assumed to be mainly due to the generally unfavourable situation of world economy. Besides the falling off in orders, the German electrical industry is unfavourably affected by the rise in the prices of raw and semi-finished materials of all kinds, particularly in the case of metals, the final result being naturally an increase in the costs of production.

Credit conditions between buyers and sellers have become so bad that the latter demand the payment of 50 per cent. of the value on the acceptance of a contract, but charge to the customers the prices prevailing on the day of delivery, as, for instance, in the case of brass sheets; and these conditions also exist in the electrical industry.

The Action of Light on Colours.

A question of some importance was raised in a paper read by Sir Sidney F. Harmer before the Royal Society of Arts recently, namely, the fading of colours of objects in museums due to the action of light. As director of the Natural History Department of the British Museum, the author has had opportunities of studying this effect, which is naturally of importance in the case of unique specimens of considerable value. It appears that a long series of investigations made by Dr. Russell and Sir Wm. Abney led to some important conclusions. It was found, for instance, that light (and not moderate heat) was the chief factor in producing fading, and that the rays at the violet end of the spectrum were most prejudicial. This

* Industrial Unrest: A Way Out." By B. Seebohm Rowntree. London, 1922: Longmans, Green & Co. Pp. 48. 1s. net.

Practical Profit-sharing: A Survey of Existing Schemes in Home and Abroad. With an Introduction by Seebohm Rowntree. Manchester, 1922: The Manchester Guardian, Ltd. Pp. 67 + x. 1s. net.

Sharing Profits with Employees: A Critical Study of Methods in the Light of Present Conditions." By James A. Bowie, M.A. London, 1922: Sir Isaac Pitman & Sons, Ltd. [illegible] Industrial Administration Series, edited by A. P. M. Fleming, C.B.E., M.Sc.Tech., M.I.E.E.). Pp. x + [illegible]. 4s. net.

is fairly well recognised. But it also appears that the effect does not take place in vacuo, *i.e.*, if water-vapour and oxygen are excluded.

One line of investigation that naturally suggests itself is to use glasses for museum cases which check the injurious ultra-violet rays. Window glass transmits practically the whole of the spectrum, including ultra-violet rays, but there are varieties of Crookes and other glass which are much more effective in absorbing ultra-violet light. The trouble is that a glass which is sufficiently useful in this respect has a somewhat deep yellow-green coloration, and is therefore not very suitable for cases containing coloured objects; the colours would inevitably be distorted. Moreover, while such special glasses do check the fading, they do not eliminate it; the effect is slowed down, but is not banished. Some colours are more fugitive than others. Some moths and butterflies change appreciably in colour after only a few weeks' exposure to sunlight, but dark-coloured furs of animals may resist action for years. The general belief that oil paintings are more permanent than water colours is not always borne out by experience.

The most interesting point elicited, however, was the fact that electric light (from incandescent lamps) is much less prejudicial than diffused daylight, which is itself far less dangerous than direct sunlight. Hence it would seem that there is a good deal to be said for the use of electric light for the artificial illumination of rooms where objects that are liable to fade are on view.

Empire Resources and Empire Trade.

It is hardly possible to attach too great importance to the Economic Conference which the Government is calling for next year. Experienced men who know at first hand the resources of the Dominions will come Home to us sympathetically disposed toward the development of inter-Imperial Trade, anxious to secure the development and utilisation of their great natural wealth and resources as a means to that end, and emphasising once more their need of population for these great purposes.

It is a pity that when there is so large a population here waiting for work this Conference cannot take place at once, but the fact has to be recognised that the political situation in some of the British Colonies has occasioned delay in making arrangements so that it may not be possible for the gathering to take place until next summer. That prospect affords poor food for those who are pressingly hungry, and irritates those who are anxious to "get a move on," for unless something tangible can be prepared before the actual Conference takes place, whatever decisions are arrived at can hardly become effective for the winter of 1923-24, and it is now that the call for relief is loudest while employment schemes are being commenced and signs of trade improvement are about to develop into practical advance. We hope that though representatives cannot actually meet until next summer, everything that can be will be done in advance by cable, by postal communication, and by compilation of available information in convenient practical form so as to simplify the adoption of policies and expedite schemes. We have had reports of value on the water-power resources of the Empire, blue books on the general resources of the Empire and the need for cheap postal and electrical communication, and these are not documents which get so out of date as to be valueless. The views of some of the most experienced Colonial authorities on the interests of the Empire, as placed before previous conferences, are recorded therein. Later events of pressing and all-absorbing urgency—the late war, for instance—make men more or less excusably forget the existence of such books and their recommendations.

One of the matters on which it is contemplated the Government might take action in advance of the Conference is the encouragement of the circulation of British magazines and other British literature containing British advertisements by cheaper Colonial postage rates. For how many years has that cause been championed also the appeal for means of electrical communication to be cheapened and multiplied! It is practically certain that these and other measures like them, which could be arranged for without Empire delegates meeting face to face to re-discuss them, would do something to assist Imperial trade, and so make work. Let this "Peace and Tranquillity" Government take early steps to justify that title in ways such as these.

Mr. Amery, First Lord of the Admiralty, speaking at the British Empire Union last week, urged the adoption of means which would make it easier for the British investor to invest in an Empire security than to send his capital into other countries where it would certainly not be used for purposes which would assist British trade. The success of issues of fairly recent date suggests that the capital would be forthcoming.

But perhaps the point which appeals most to the imagination of those who desire to lessen unemployment at home, where at present, alas! we are sadly overcrowded, and who have visions of the grand and glorious future of the Empire when the population is there to develop those resources, is the encouragement of suitable emigration.

Nothing hastens degeneracy more than unemployment, and nothing breaks the heart and spirit of a British man or women more easily than the fear of a future without promise—a dead end without an outlook yielding occupation and contentment. Let us get on as quickly as may be with already sanctioned Empire settlement schemes. There are plenty of men and women who would be only too glad to go and help to develop the Colonies and add to the trade prosperity of their kith and kin who remained behind, if only they could obtain trustworthy information showing where they could find work such as they can do, and if reasonable assistance could be afforded them. Our own "Correspondence" columns and post-bag contain plenty of evidence that electrical men are willing enough to go and try their fortunes elsewhere. Is it impossible for anything which will satisfy their thirst for information to be expeditiously and authoritatively accomplished? In years gone by the Press used to have periodical reports, sometimes warnings, sometimes useful encouragements. Do any of the Dominions want anybody just now? If so, why are not publicity and propaganda being made use of to the full? Not pictures of the vastness of virgin soils, of farms and homesteads, with cows, a horse, and a child, but facts of a specialised trade or handicraft description.

British Broadcasting.

Elsewhere in this issue we give an account of the first three broadcasting stations to be set in operation in England. The commencement of the service inaugurates a new epoch in the development of radio-telephony in this country, which has done so much to promote the use of the Hertzian waves. Even five years ago the wonderful possibilities of radio-telephony could hardly have been foretold; now it has taken its place with aviation, almost as youthful an art, amongst the miracles of science that the twentieth century has brought forth, and will soon have become as matter-of-fact as the gramophone.

Obviously the system can be very effectively used for the purposes of propaganda, and in fact it was so used in the last elections in the United States, where it is not subject to control as in this country; State control has the advantage that the broadcasting of undesirable communications can be restricted, but on the other hand, the control exercised by the Government of the day might conceivably be exercised in favour of a political party. The whole question of what shall and what shall not be broadcasted will call for mature consideration.

Turning to the commercial aspect of the subject, the experience already gained in the United States is bound to be of value to those who are taking up the manufacture and distribution of receiving apparatus in this country, and we commend to their attention the able article which we reprint elsewhere, on "Radio Merchandising."

THE BRITISH RADIO BROADCASTING STATIONS.

In view of the general public interest in the development of radio telephony and the forthcoming establishment in this country of further broadcasting stations, in addition to the three existing ones, some particulars of the transmitting apparatus used will doubtless be acceptable. The British Broadcasting Co., Ltd.,* was incorporated on December 15th under the chairmanship of Lord Gainford to conduct the service, but the complexity of the problems that will have to be overcome will naturally necessitate the lapse of some time before the development of its full possibilities can be achieved.

Considering the extremely small amount of energy that is involved and the numerous transformations which it has to undergo, it will be conceded that from the electrical point of view the results already obtained are very satisfactory. The difficulties encountered are, however, more acoustical than electrical, and much improvement in this respect is hoped for; microphones, "loud-speaking" devices, and other components will be bettered, and it may even be found necessary to institute schools for the instruction of singers and speakers in the correct control of their voices, and in the use of the microphone, &c. Music may have to be re-written, and the acoustic properties of the transmitting studios are only a few of the many very complex problems that will require solution for the attainment of the most desirable conditions. Meanwhile broadcasting stations will suffer criticism on the score of the apparatus not functioning properly, whereas the real trouble will lie with the artists, for everybody is not suited to the work. Radio artists will have to evolve a new technique, something that is not yet fully understood.

In the United States, over 500 stations are broadcasting, largely without reference to each other, the result being interference and confusion. Much time and thought have been given in this country to developing a scheme which, by pooling transmission patents, limiting the number of stations, and co-ordinating their operating conditions will preclude the possibility of such troubles arising in England. The popularity of radio-telephony in America may be judged from the fact that over two million receiving sets have been sold in two years. The British Broadcasting Co., Ltd., will ultimately operate at least eight stations respectively in London, Manchester, Birmingham, Newcastle, Cardiff, Plymouth, Glasgow, and Aberdeen.

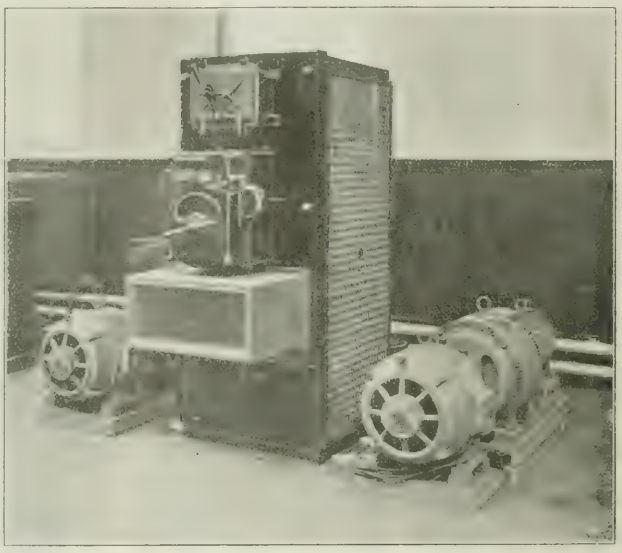


Fig. 1. Power Generators at the Manchester Station.

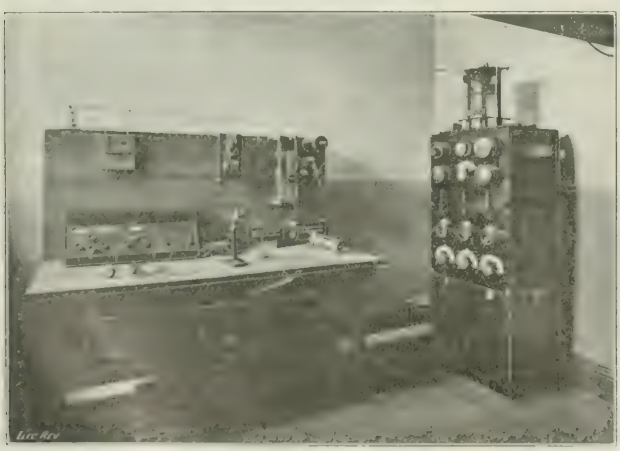


Fig. [illegible] Broadcasting Room at Manchester.

The Manchester Station (call signal: 2 ZY; wave length: 385 metres; power: 1,500 watts) is situated in the Research Department at the works of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park.

The power for the radio transmitting set is supplied by a small generator in the works power house at 440 volts, 50 cycles, 3-phase, and is employed to drive one of two triple sets, the second being a spare, consisting of an induction motor, h.p. generator, and exciter supplied by Messrs. Newton Bros., Derby (fig. 1). The h.p. generator is rated at 2.5 kW at 5,000 volts, and runs at 1,500 r.p.m. Suitable filter circuits are provided at the h.p. generator to remove the commutator ripple. The field of the generator is fed from the exciter through a potentiometer-type field regulator that enables stable adjustments to be obtained even down to very low voltages, which are occasionally required for test and experimental purposes.

Further details of these machines will be found on p. 851 of our issue of December 1st, 1922.

The transmitter panel (fig. 2) was installed by the Radio Communication Co., Ltd., London, and employs Mullard [illegible] valves. The h.p. d.c. supply at 5,000 volts is fed directly to the anodes of the valves, and suit-

* See "New Companies," this issue; p. 525, October 13th; [illegible] October 27th, 1922.

able gear protects the generating set against short circuits. The power plant is remotely controlled from the transmitting room and, while a special listening station is provided some miles from Trafford Park, the character of the modulation is checked also in the transmission room. The filaments of the transmitting valves are heated from a 30-volt battery, and an artificial aerial is provided to enable tests to be carried out with a minimum of interference with other users of the ether.

The studio (fig. 3) is accommodated in a spacious room adjoining the transmitting room. The walls are draped with suitable hangings, and the floor has been carpeted, to avoid the resonance and echo from the floor and walls encountered in ordinary rooms. The equipment comprises a Steinway grand piano with a Welte player attachment, an Edison gramophone of the diamond-disk type, and an Aeolian Vocalion Graduola cabinet gramophone. The studio is connected to the transmitting room by multi-core cables, which may be used for microphone or other control circuits, the latter being run in a separate cable to avoid inductive interference.

The music and speech from the studio are picked up by microphones, or other suitable apparatus, supported on convenient stands. These sounds are given pre-



Fig. 3.—The Manchester Studio.

liminary amplification in the studio before being passed through the microphone cable to the transmitting room, where further amplification is carried out before the amplified currents are impressed on the aerial.

The aerial used is of the cage-type, and is suspended between the top of the well-known water-tower and the highest point of the main works buildings. The "lead-in" from the centre of the main aerial drops into one of the research laboratories. Each cage has six wires supported by suitable loops, the average height being about 160 ft. The station has worked, since its inception, on 800 watts, but the power is being increased almost immediately to 1,500 watts, the full power for which it is licensed.

A small experimental station, capable of transmitting 100 watts, has been erected at Hale. A single-phase induction motor on the Altrincham public electricity supply mains, driving a generator of 1,500 volts at 1,500 r.p.m., is used with an exciter. This station acts partly as an independent experimental station and partly as a control for the main broadcasting station, and is equipped with various receiving sets for "listening-in." The aerial is 150 ft. long, and comprises a triple wire with 12-ft. spreaders at a height of 75 ft.

The London Station (call signal: 2 LO; wave length: 369 metres; power: 1,500 watts) is situated at Marconi House in the Strand, the premises of Marconi's Wireless Telegraph Co., Ltd.

Power is taken from the public electricity supply mains at a pressure of 200 volts d.c., and the supply may be changed over from the ordinary network to the London theatre supply main; two separate and distinct sources of supply are thus available. The d.c. is taken through a switchboard to a 10-h.p. motor directly coupled to a 6-kilowatt single-phase, 300-cycle alternator, which supplies power at 500 volts a.c. The motor-alternator sets are in duplicate, and their two remote-control automatic starters are operated from a room at the top of the building, where the a.c. is supplied to the primary of a 6-kilowatt transformer (which, again, has a second transformer installed beside it with a change-over switch), the secondary winding giving a normal working potential of 22,500 volts.

The transmitter consists of four separate panels. The first is the rectifying panel, and its function is to convert the a.c. into d.c. at a pressure of approximately 10,000 volts by the use of two thermionic rectifying valves. The filaments of these valves are lighted from a highly-insulated transformer, the primary of which is connected to the 500-volt a.c. supply through variable and compensating inductances; the former regulates the filament voltage, whilst the latter compensates for line drop when the power load is thrown on to the line. This is accomplished by means of an automatic switch which short-circuits the compensating inductance the moment the load is switched on. The secondary winding of each power transformer has a central connection which is joined to the earth of the radio system. The two ends of the secondary winding are joined to the anodes of the rectifying valves, the filaments of which become the positive h.p., d.c., pole of the radio circuit. As soon as the alternating voltage is applied to the rectifier-lighting transformer, the filaments are lighted and the a.c. is applied to the rectifier anodes. The current passes through the rectifying valves in one direction only, alternating first through one and then through the other at the frequency of the alternator, *i.e.*, 300 times per second through each valve in such a manner that both sides of the alternating wave are rectified, resulting in a unidirectional current having a ripple on it of 600 per second. This current is then applied to the smoothing, or filtering, system, consisting of a condenser connected between the earth and the positive d.c. pole, which tends to smooth out the ripple that is on the top of the d.c. The current then flows through an iron-cored inductance, and so to a second smoothing condenser of a similar capacity to the former. Directly connected across the last condenser is a high resistance with a voltmeter in series with it, which measures the d.c. voltage and automatically discharges the condensers after the current has been interrupted. This prevents danger from shock which would occur if this leak were not connected. The h.p. d.c. passes through a milliammeter to the second panel that consists of an oscillatory circuit (the drive oscillator), composed of an inductance and condenser—one end of the inductance and one end of the condenser being connected to earth, whilst the high potential end of the condenser is connected to the anode of the oscillating valve, and the grid of the same valve is inductively coupled to the same inductance. The grid is also connected to earth through a high resistance across which is a small condenser. The anode of this valve is fed from the positive h.p. d.c. busbar through a milliammeter, whilst the valve filament is connected at one end to the negative earth busbar and at the other through a variable resistance to the positive l.p. busbar. The positive and negative l.p. busbars are continuous throughout the drive panel as well as the amplifier panel and the modulator panel. They are connected by means of a switchboard to a battery of 40 volts and 330-ampere hour capacity. The amplifier panel is in many respects identical with the drive panel. In it are mounted a closed oscillating circuit, consisting of an inductance and capacity, one end of the condenser and one end of the inductance being connected to the earth busbar as in the drive panel. Connected to the high potential end of the inductance is the anode of the second valve, which, in its turn, is again fed from the h.p. busbar, whilst its grid is connected back to the drive panel, and is there taken through an inductance coupled to the oscillating circuit of that panel. At

the same time this grid is connected to another inductance coupled to the closed oscillating circuit of the amplifier. Thus the transmitting valve grid potential is controlled from two sources, *i.e.*, the drive or the amplifier. The setting of these two reaction coils is of considerable importance, and should be so arranged that the grid is maintained in a state of varying potential by the oscillator, whilst the other reaction coil coupled to the amplifier is used merely to stabilise this action.

In the positive h.p. lead to this valve is inserted a large inductance (speech choke), by means of which the potential to the anode of the oscillating valve is varied. Each variation is carried through to the aerial, and this superimposes on the carrier wave from the aerial a complex ripple corresponding to the speech modulation. The aerial circuit (also connected in this panel) consists of an aerial terminal and variable inductance known as the aerial variometer and a coupling coil coupled inductively to the primary oscillating circuit. The end of this coil is connected throuh an aerial ammeter to the negative earth busbar.

The modulator panel consists of two valves—the control and sub-control valves. Both are lighted from the common l.p. busbars connected to the accumulator. The anode of the first valve is connected through the high resistance and through a protective choke to the speech choke, which is also connected to the positive h.p. busbar. The grid of this valve is connected through a resistance to the negative busbar and also through a condenser to the anode of the second valve. This valve also takes its h.p. current for the anode through a resistance and the protector choke from the positive h.p. busbar, whilst its grid is connected through a transformer to the negative busbar. The primary of this transformer is connected to the microphone in the concert room.

The aerial consists of two cage- or sausage-type aerials, each of which has four wires stretched between two masts nearly 50 ft. above the roof and approximately 100 ft. apart. The lead roof of the building, the steel framework, and the lightning conductors are bonded together to form a common earth for the system.

The microphone is arranged near the centre of the concert room and various instruments are grouped around it. Other facilities which are already in use, or are contemplated, consist of a private line direct to Reuter, so that the latest news may be received whilst transmission is actually in progress, and it is hoped that a line may be connected direct with the Greenwich observatory, so that time signals may be radiated.

The Birmingham Station (call signal: 2 WP; wave length, 425 metres; power: 1,500 watts) is located at the Witton Works of the General Electric Co., Ltd.

The equipment was installed by the Western Electric Co., Ltd., and the transmitter includes four 250-watt and one 50-watt valves; the total plate current and potential are 1.25 A and 1,600 V, and the total filament current and potential 28.4 A and 14 V respectively. The valves have oxide-coated filaments that operate at a dull red heat. The filament-heating current is supplied by a constant-potential generator, and is adjusted and held constant by means of the generator field rheostat.

The transmitter is essentially a generator of radio frequency energy (an oscillation generator), with means for modulating this energy in accordance with current variations produced by a microphone operating in conjunction with an amplifier and auxiliary equipment. The oscillator comprises vacuum tubes and a tuned circuit, including the antenna system, which determines the frequency and wave length of the radiated energy.

The frequency of the transmitted energy (wave length) is controlled by the value of the inductance in the oscillatory circuit which is adjusted by means of a variometer, a portion of the oscillator coil included in the antenna circuit being arranged to turn on an axis at right angles to its normal axis so that the inductance of the movable coil either aids or opposes the inductance of the remainder of the coil. The movable coil also serves to vary the coupling between the antenna circuit and that portion of the coil system which is connected to the plates and grids of the oscillator tubes in a manner to ensure satisfactory operating conditions throughout the frequency range for which the transmitter is designed.

A variable condenser across the plate coil controls the plate current through the oscillator tubes, and to a large extent the output of the tubes. It consists of a variable unit in parallel with two fixed units which may be switched in or out of the circuit as required.

In order to prevent distortion, the grid circuits of the modulating and speech-amplifying tubes are given a negative bias by means of a resistance connected between the negative terminal of the high-potential generator and the tube filaments.

The plate circuits are supplied with d.c. from a high-potential generator, and a noise filter is used to eliminate commutator noises. Under certain conditions, if the plate circuit is closed before the filament circuit, a destructive rush of current through the tubes may occur. To prevent damage due to this cause, a delayed-action relay is provided, which is operated by the filament current and requires approximately 20 seconds to function.

Power supply is obtained from a three-unit motor-generator set consisting of one high-voltage and one low-voltage d.c. generator, both connected direct to a 1,750-r.p.m. 5.5-h.p. driving motor on a common base plate.

Reception.—It was desired that, as far as possible, the B.B. Co. should be free from the risk of patent litigation, and it was therefore finally decided that the best plan would be for Marconi's Wireless Telegraph Co., Ltd., to grant licences under various letters patent for the specific purpose of the broadcasting scheme. The present service afforded by the three temporary stations described above should not be judged too severely, because until the B.B. Co. has come to agreement with the Press, with associations controlling copyrights, and kindred matters, high-grade programmes cannot be arranged for. Meanwhile, four British Press agencies (Reuter's, the Press Association, the Central News, and the Exchange Telegraph Co.) furnish each evening summaries of the world's news; the Meteorological Department of the Air Ministry supplies weather reports nightly, and in addition music and children's bed-time stories are broadcast.

It will be recognised that the educational possibilities of the service are appreciable, and in the future it will probably be preferable to broadcast a series of programmes, say, of dance music, grand opera, an educational lecture, perhaps a public speech, a news bulletin, and other suitable matter—all transmitted simultaneously, but at different wave lengths. It will then be possible for each "listener-in" to select the particular programme he is interested in by merely adjusting his receiver, and not be bothered with matter he does not wish to listen to.

Care is required in the selection of a receiving set; an ordinary licence holder's apparatus must comply with the requirements of the Post Office authorities (the Postmaster-General's approval, however, does not imply a guarantee of the efficiency or workmanship of any particular set), but an experimental licence allows some measure of freedom. The type required depends largely on the situation in which it is to be used with respect to the broadcasting station, and many of the sets which are on the market have been designed rather for experimental purposes than for practical telephonic reception. Some disappointment may therefore occur if purchases are made without full consideration of all the conditions.

Crystal sets are useful under ordinary circumstances within a comparatively small radius of the broadcasting station, although reception has been accomplished with them in exceptional cases over fairly long distances. If it is required to hear more than one station or to receive long-distance transmission, it will probably be necessary to use, in all cases, one of the larger sets employing a varying number of valves.

INTERNATIONAL ARBITRATION IN COMMERCIAL DISPUTES.

The Activity of the Court Established in Paris.

On various recent occasions we have referred to the establishment of a commercial court of arbitration in connection with the International Chamber of Commerce in Paris, and through the courtesy of M. Edouard Dolléans, general secretary of the Chamber, we are now able to give official information on the question as set forth in a pamphlet issued by this institution.

The creation of the court is the result of the labours in 1921 and 1922 of an influential committee composed of representatives of a number of countries, and its preliminary work was brought to a conclusion by the drawing up of a plan of conciliation and arbitration between traders of different countries. The principles embodied in this plan were approved by the London congress of the International Chamber in June, 1921, which congress authorised the Council to prepare a definite scheme for the organisation of the court. Regulations were subsequently drawn up by the committee, and these were approved by the Council of the Chamber in July, 1922, when it was decided to publish them and put them into operation.

As was mentioned in a previous issue, the scheme includes the formation of a National Committee for each country; each such committee groups together within the country concerned the different members of the International Chamber, and 16 such national committees were in operation last October. Each national committee appoints an Administrative Commissioner resident in Paris to work in collaboration with International Chamber's headquarters.

All correspondence with the parties to a commercial dispute will have to be carried on through the organisation members of the International Chamber if there is no national committee to undertake such communications. As organisation members, the Chamber accepts chambers of commerce and similar institutions, and bankers', manufacturers', or traders' associations, in countries where there is no national committee, pending the formation of such a committee; and a number of organisation members is enumerated in the pamphlet.

Coming to consider the composition of the court of arbitration, it is found that M. Etienne Clémentel, president of the International Chamber, also occupies the presidency of the court. Mr. W. Clare Lees, president of the Manchester Chamber of Commerce, and Señor Carlos Prast, president of the Madrid Chamber of Commerce, are two of the three vice-presidents, while the third had yet to be appointed on the publication of the rules two months ago.

The members for Great Britain are: Sir Albert J. Hobson, Sir Arthur Shirley Benn, Sir Algernon F. Firth, Dr. Walter Leaf, Sir Felix Schuster, the Hon. J. G. Jenkins, Mr. A. Barton Kent, Mr. Arthur Balfour, Mr. W. Clare Lees, Mr. H. L. Symonds, Sir Henry Whitehead, and Mr. O. E. Dodington. Among the American members of the court appears the name of Mr. Owen D. Young, chairman of the board of the New York General Electric Co.

The number of members of the Executive Committee corresponds to the number of countries affiliated with the International Chamber; and the member of the court appointed to sit upon the Executive Committee by each National Committee must be resident in Paris.

The Question of Conciliation.

The functions of the court, whose services are available to manufacturers and traders and financiers of all countries for facilitating, as far as possible, the settlement of commercial disputes, are divided into two parts, namely, conciliation and arbitration.

In the case of conciliation, any one of the parties to a dispute may request the good offices of the Administrative Commission of the International Chamber, and the party so desiring may request the intervention of the International Chamber in writing through his national committee, submitting at the same time a copy of the contract in question, together with copies of the complete documentary record of the transaction. On the receipt of the application, and the documents in support, the chairman of the Administrative Commission will enter into correspondence with the other party, through the national committee concerned, asking him, provided he accepts the services of the Chamber, to submit his statement of the case, supported by a complete documentary record.

The chairman of the Administrative Commission will associate with himself one or more members of the Commission depending upon the nature and importance of the case. After having rendered himself familiar with the documents submitted and having collected all possible information, the chairman, on behalf of the Commission, will communicate with the parties through their national committees, with a view to arriving at a basis of agreement acceptable to all the parties. In the event of failure to bring about a conciliation of the parties, the latter will be free to have recourse to arbitration or to submit the case to the proper courts; and nothing that has been done, said, or written in the attempt to reach a basis of conciliation shall affect their dispute in any manner whatsoever upon arbitration or before the courts.

The Arbitration Procedure.

The rules on arbitration are divided into two sections. The first applies to cases where at least one of the parties is a national of a country which does not provide legal sanction for the execution of arbitration awards, while the second deals with cases where all the parties are nationals of countries which provide legal sanction for the enforcement of awards. With the exception of two articles and one special article, the rules are exactly alike, and 18 articles are therefore common to both sections.

The court of arbitration or international committee on arbitration, as it is also termed, to which all questions connected with arbitration will be referred, will request the National Committees to furnish it with the names of technically-qualified arbitrators, as and when required, for appointment as arbitrators in cases submitted, and from among them the court will proceed to make the appointment. With the assent of both parties, the court may delegate any specific arbitration to any chamber of commerce or other organisation member of the chamber which maintains an organisation for arbitration. Whenever the parties have agreed to arbitration, the jurisdiction of the court is obligatory upon the contracting parties, and upon the refusal or failure of one of the parties to present his case before the arbitrators an award by default may be made.

It is provided that the arbitration shall take place in the country and town determined by the court, after examination of the request for arbitration and before the appointment of arbitrators; and all communications between the court, the arbitrators, and the parties concerned will be made through the medium of the national committees or the organisation members.

The court will appoint one arbitrator to try the case submitted to it, unless the parties desire either two arbitrators and one umpire, or three arbitrators. When two arbitrators and an umpire are appointed, the decision of the umpire will be binding; when there are three arbitrators the decision of the majority will be binding, or if no such majority is obtained, three new arbitrators are to be appointed to hear and determine the case afresh. Awards are to be given in a period not exceeding 60 days, although the court reserves the right to extend this period as circumstances may warrant.

If possible, the arbitrators are to utilise for clerical assistance the services of the staff of the organisation members of the chamber. The arbitrators may similarly take or obtain any legal or technical advice in reference to a dispute; the remuneration of such services and any expenses connected with them will be part of the costs. The court of arbitration may require all or one of the parties to pay or deposit such a sum of money as may be deemed necessary for the payment of any fees, costs, and expenses which may be incurred in the course of the proceedings.

It is further provided by the rules that all parties are in honour bound to carry out the award of the arbitrators. In the case of default, the court will have the right to request that the name of the defaulting party shall be published in the official publications of the International Chamber and in those of the National Committees, together with the text of the award so remaining unexecuted.

The Executive Committee of the court recommends all traders to insert the following clause in their contracts: —"The contracting parties agree to submit to arbitration, in accordance with the arbitration rules of the International Chamber of Commerce, the settlement of all disputes in connection with the interpretation or the execution of this contract."

In conclusion, it may be mentioned that the court is now in operation, and awards have already been made in the case of international disputes. The offices of the International Chamber are at 33, Rue Jean Goujon, Paris, where copies of the rules may presumably be obtained.

THE HICK, HARGREAVES CLOSED FEED SYSTEM.

A considerable amount of attention has been directed in recent years to the effective de-aeration of boiler-feed water to do away with much of the corrosion of boiler tubes which is caused by surplus oxygen in solution in the water.

Chemical methods have seldom proved really satisfactory, and this has led to the consideration of closed feed systems. These have also frequently proved difficult of adjustment and a source of expense in operating staffs. To do away with this, Messrs. Hick, Hargreaves & Co., Ltd., have designed a system that, it is claimed, is purely mechanical, automatic in operation, and readily understood by station staffs.

The essential features of the system are illustrated in the accompanying diagram (fig. 1).

Condensate is withdrawn from the main condenser A by an extraction pump B, and delivered into the steam-sealed feed



Fig. 1.—The Hick, Hargreaves Closed Feed System.

tank D from which the air pump E takes its supply of water and delivers it through a feed heater or house turbine condenser N to the suction of the feed pump F. As it is necessary to provide a head of water at the suction branch of the feed pump, the feed tank D is provided in an elevated position for the purpose and overflow pipe Z, which is taken into the auxiliary tank H. The make-up supply is also taken into this tank under the control of a float operated by the rise and fall of the water in the main feed tank D. The water in the auxiliary tank H is passed into the main condenser A by a pipe Y under the control of a float valve, the valve being opened as the feed rises in the tank H, allowing of any water which may collect in the auxiliary tank, and ensuring the de-aeration of the make-up supply in the main condenser. To ensure the extraction pump B being always supplied with condensate and stabilised under all conditions of load on the main turbine, a pipe W is connected from the feed tank D to the main condenser A. The flow along this pipe is controlled by a float which rises and falls in the chamber L in accordance with the rise and fall of the water in the extraction pump suction pipe.

To recover the heat in the drips from the feed heater or house turbine condenser N, a heater may be placed between the latter and the lift pump discharge. By this means the heat in the drips is given up to the boiler feed instead of being lost in the circulating water of the main set. This arrangement adds to the thermal efficiency of the system, and assists in the obtaining of a satisfactory heat balance.

The operation of the system is as follows: Assuming that the amount of condensate from the main condenser A is less than the requirements of the boiler house due to the main set being on light load, the amount of feed required will be provided from the main feed tank D, where there is an ample supply of water for the lift pump E to draw from. Under these conditions the float in chamber L will fall, allowing an increased supply of water to pass from the tank D along pipe W into the condenser, and thence to the suction of the extraction pump B, thus keeping the latter fully charged and stabilising its operation.

Should the demand in the boiler house continue to be in excess of the amount of condensate discharged from the main condenser, the level of the water in tank D will fall, lowering the float controlling the make-up supply valve and admitting an increased supply of make-up to the system. This passes along pipe Y into the main condenser, where it is de-aerated and afterwards withdrawn by the extraction pump B, thus making up the deficiency due to the extra amount of water withdrawn from the feed tank D. It may be that the demand in the boiler house is less than the amount of water delivered into the feed tank D by the extraction pump, in which case the excess water will flow down the overflow pipe from tank Z and thence back to the auxiliary tank H, from which it is drawn into the main condenser as before. This will have the further effect of raising the water level in the suction pipe to the extraction pump B, and closing the float valve operating in tank L, diminishing the by-pass water from the feed tank D to the surface condenser. It will thus be seen that any water fed to the boilers under varying loads on the main machine is de-aerated and kept from contact with the atmosphere, and by passing the condensate through the house turbine condenser the heat of evaporation in the steam condensed is added to the feed water on its way to the boiler feed pumps. An ample circulation of water through the condenser is assured, independently of the amount of condensate from the main set, so that the house turbine can operate under maximum load no matter what the demands in the boiler house may be, or what load is being carried by the main machine.

An Electric Boiler.—In a recent issue of *Power*, an electric boiler designed by the General Electric Co. (U.S.A.) was described. This consists of a cylindrical steel shell divided horizontally into two compartments. The upper compartment or electrode chamber is where the steam is actually generated, while below this is a hot well into which the water is fed and the surplus water from above returns. The water entering the hot well is forced into the upper compartment by means of a centrifugal pump. The boiler is arranged for three-phase working and the electrode chamber contains three large cylindrical iron electrodes rigidly fixed to the roof of the shell, the supporting rods being brought through specially-designed insulating bushes. These insulators are provided with a small duct leading to the open air, so that if steam succeeds in leaking through the packing into the upper section of the bushing it passes out freely instead of setting up a pressure which might blow out the side of the insulator. Normally, the electrodes are submerged in the water, and the three-phase current passes from electrode to electrode and also through the water to the sides of the tank and the neutral of the system. The mechanical circulation of the water by the centrifugal pump keeps the temperature of the water in the system uniform. If the steam pressure is lowered owing to an increased demand, rapid steam generation, due to the high temperature of the water and the degree to which the electrodes are submerged, quickly brings the pressure up again.

These electric steam generators have been designed for pressures ranging from 200 lb. maximum to 15 lb. minimum. Tentative layouts have also been made on generators of 3,000-kW capacity operating at one pound pressure. These generators can be designed for any boiler pressure now being used, up to 50,000-kW capacity and down to 250 kW. Below the latter limit generators of this type would probably not be so economical to build as some sort of immersion type using a metallic resister.

Russian Peat for Generating Electricity.—Interesting experiments have been carried out with peat fuel at the Schatursk electric station, where, with the Makaryeff stoking system, under the supervision of P. M. Botcharoff, engineer, and in the presence of a special committee of experts, &c., using two boilers of 340 m² heating surface each, with an average load of 1,000 kW on the turbines, the product was 9.7 kWh per pood (36 lb.) of peat. The consumption per kWh was 1.7 kg. of fuel. The experiments are to continue, but enough is known to base great hopes on the new system, called the "Chain" system, for the use of peat fuel, says an important Russian journal.

POWER PLANT TESTING.

In connection with the recent engineering exhibition at Cardiff, which was held under the auspices of the South Wales Institute of Engineers, a conference was held at the same time at the Institute, at which several papers were read and discussed, amongst them being the one abstracted below, which was closely followed by a large number of engineers from South Wales, and also from England, who visited the exhibition. Mr. David E. Roberts (president S.W.I.E.) presided, and the lecture was illustrated with lantern slides.

The author, Mr. W. M. Selvey, Wh.Sch., M.I.E.E., dealt briefly with his subject under two headings.

Section 1: The Principles Involved.—Between the performance of the plant under "test conditions" and under "running conditions" there is a very important difference. Two classes of apparatus may be made to the same specification, and yet be of such a nature that one lends itself to misuse by indifferent operation, while the other may be so designed that any misuse leads to such obvious failure to do the required duty that such incorrect operation becomes at once noticeable, and the scope of the personal equation of the operator is thereby greatly limited. Wear, in many cases, and sometimes small damage, which do not prevent the running of machines and may for a time escape notice, cause considerable loss in efficiency. All these matters should properly be discovered at an early date by "routine testing." This branch of testing does not always receive the attention which it economically merits.

In the past very little attention has been paid to sectionalising the plant, so that data necessary for expert operation can readily be obtained.

There is no particular difficulty or expense in providing such sectionalisation in a new plant, and it is done by designers to-day when the purchasing engineer has clearly in his mind that he is buying plant to run, not only effectively, but efficiently. Thus, three main considerations arise:—

(*a*) The need of definition in the specification to enable the carrying out of adequate "acceptance tests."
(*b*) The need of facilities for examining the capability of the plant to meet best the conditions of every-day working leading to "operation tests."
(*c*) The need of facilities for continuously watching the performance and condition of the plant as it fouls, wears, or depreciates, leading to "routine tests."

Specification.—Much difficulty has arisen in practice through want of definition in specifications for power plant. Many engineers have put requirements in a specification, which, bluntly, have represented what they would like. Often they are of such a nature that it would be impossible to prove whether the plant fulfils such requirements, or alternatively, the proving would require such a large expenditure that they would be the first to recoil from calling for such proof. Such clauses are worse than useless, and it is perfectly easy for any manufacturer to ignore them, fully realising that they will never have to be faced.

The second, and more frequent matter, is to call for a requirement which can only be met under some ideal conditions, seldom, if ever, occurring. Many attempts are made to meet such circumstances by adding to the specification complicated correction curves, dealing with the effect on the performance of the plant of variation from the conditions assumed as "standard." Such procedure may meet with a measure of success if the purchasing engineer is advised by someone who has been connected with the use of such correction curves. It is common experience to find, however, when settling up particular points before the "acceptance tests" are run, that some main matter has been overlooked or omitted (generally in quite good faith) and the legal effect of varying the "contract terms," even by agreement, may often be surprising to the engineer. Referring to the inadvisability of responsible managers spending too much time on details belonging more properly to the province of the expert, since 1914 much good work has been done in this direction by the British Electrical & Allied Manufacturers' Association (B.E.A.M.A.), which has led to much standardisation and uniformity of reasonable requirements, and this is reflected in many of the specifications of the Association (B.E.S.A.).

It is advisable, therefore, when drawing up a specification (which calls not only for steel and cast iron, but for plant to do certain work, at a certain cost for doing it) to specify very clearly what are the essential guarantees, and to express them in a form which an independent engineer can "take hold of," for the purpose of proving compliance or non-compliance.

Bonus or Penalty Clause.—Large sums have, in practice, been added to or deducted from the contract price under such clauses. It is, however, very unfair and risky to implement such a clause without a test by an independent expert, especially so if (as in some cases) the tolerance of inefficiency furnishes only a narrow margin between acceptance and total rejection. During the war such clauses were practically in abeyance, but when normal times are reached and free competition returns much is likely to be heard of them.

Section 2: Apparatus for Testing.—This is a very considerable matter. From the scientific point of view all measurements have ultimately to be referred to standards of weight (*i.e.*, mass) length, and time. More often than not what is actually measured is a "rate," and instruments for measuring rates are now becoming very elaborate.

The operations in certain tests (fuel, oil, &c.) are generally and preferably conducted by an independent chemist, but the onus of sampling is on the engineer conducting the test. This is a matter for great consideration.

Routine Testing.—Smaller stations and industrial plant have very little provision for such work, and in this direction much improvement may yet be hoped for.

Conclusion.—The author has attempted, in hurriedly reviewing a very large subject, to point out:—

(*a*) The necessity for clear definition in the "specification" of all matters which it is intended to put to the proof at the time of the "acceptance test."
(*b*) The need for, and value of, many special tests during the life of a plant, directed towards ascertaining the best method of operation, which tests have been termed "operation tests."
(*c*) The growing need for, and value of, instruments which define the conditions under which a plant is run and record as far as possible the results obtained therefrom, so that without special preparation attention can be particularly directed to any doubtful points leading to what has been termed "routine tests."

In the discussion which followed Mr. C. T. Allan (Cardiff) expressed the view that for practical testing it would be worth while for the apparatus to be all in one testing room. In some of the big stations all the long-distance recorders could be brought to one place, and probably a film taken, and then the staff could take the records from them. As to the acceptance test in power stations, no doubt most of them knew that that was a "blind between the purchase and the supply," and nothing else. He emphasised the value of a certain degree of efficiency.

Mr. Regan (Powell Duffryn Co.), contended, with regard to practical testing, that the more preferable way would be to see that the plant was always running under test conditions, and he did not think spasmodic testing, except experimental, was of much use. As to recorders, he considered they should be of a robust type.

Mr. Crosswaithe expressed the opinion that makers of instruments had done their best to put up a race for scientific control. He mentioned that a glass CO_2 recorder which he fixed on a Japanese ship went all the way out to the East and back, and a record was kept every day, the whole thing proving quite satisfactory. With regard to the use of scientific instruments, it was recognised by his firm, and he believed by some other firms, that the engineers of large iron and steelworks and such like undertakings were the "hardest nuts to crack" with their scientific talk. They found they could get on easier with toffee makers, &c.

Mr. E. J. Lea remarked that it had always been plain to him that the supplier and the municipal engineer were in two different camps, and he considered it would be of greater advantage to both if there was a little more co-operation. In all the works he had been in there always was a fued between construction and maintenance men, which was, to his mind, a great misfortune.

As a manufacturer of electrical instruments, Mr. Knowles viewed the future with optimism, and expressed the opinion that as regarded measurement the position would soon be such that they would be able to get instantaneous. He maintained that no mechanical method for collecting a large number of results in no way gave such facilities as electrical methods did.

Mr. W. M. Selvey briefly replied to the discussion.

Awards to Inventors.—The Second Report of the Royal Commission on Awards to Inventors (Cmd. 1782; 6d. net) contains particulars of 145 cases in which awards have been sanctioned or refused for articles patented and used for the public service. Claims on the part of inventors in the service of the Crown have been approved where it has been considered that their inventions have been made outside the scope of their duties. Among the awards made in respect of electrical inventions the following are included: Mr. H. Leitner (£3,500), and Messrs. Joseph Lucas, Ltd. (£2000), dynamos for aeroplanes; Messrs. G. H. Nash, R. A. Mack, B. B. Grace, and G. E. R. Penney (£6,000—Nash "Fish" hydrophone and Western Electric hydrophone equipment; and Professor J. S. E. Townsend (£1,000), portable electric wavemeters for use in radio-telegraphy. Claims for radio-telegraphic and telephonic inventions, made by Messrs. Marconi's Wireless Telegraph Co., Ltd., and the Lodge Muirhead Syndicate, Ltd., were adjourned generally.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Rotary Switch with Overload Release.

Messrs. Van Wijk & Visser, of Geldermalsen, Holland, have designed a small-capacity switch, with a snap action, fitted with a simple overload release device. It is particularly suitable for private lighting installations, being arranged to deal with a normal current of 6A at 250 V, the release action operating at 50 per cent. overload—9 A. The movement may, however, be adjusted to operate at any current between 6 and 10 A. A larger size for normal currents of 10 A is also made. The switch mechanism is free of the

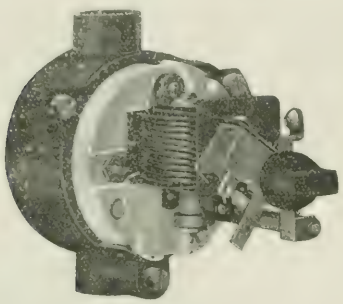


Fig. 1.—Small Switch with Overload Release.

handle, and is thus opened on an overload although the handle be held. The release is effected by means of an electro-magnet coil, which attracts a small steel core. This moves a rocking arm, at the upper end of which is a pawl engaging with a spring ratchet arm. The latter bears one of the switch contacts and the movement of the rocking arm allows the ratchet arm to spring forward and break contact. Through an opening in the front of the case can be seen a small indicator,



Fig. 2.—View of Exterior.

which shows the switch's position. The mechanism is protected by a slight but substantial case, and is mounted on an unglazed base; being provided with terminal pins, it can be removed from the socket and replaced by another with ease. Apart from its use to do away with fuses, which cause trouble in replacement, the appliance would serve well as a current limiter in installations where energy is charged for on a maximum-current basis. Fig. 1 shows the switch with the cover removed and mounted on a conduit box. Fig. 2 is an exterior view. The agents for the switch are the N.V. Electrische Maatschappij, Boompjestraat, Rotterdam.

New Automobile Ammeter.

An automobile ammeter, very simple and rugged in construction, has recently been introduced by the Westinghouse Electric & Manufacturing Co. Although designed primarily for automobile use, its compactness and reliability make this instrument, which is known as the type "BT" ammeter, particularly well adapted for use also on motor boats, aerial craft, farm lighting plants, radio sets, and for charging batteries. The design of the [illegible] involves a radical departure from the principles used in all previous ammeters, in that no wire or magnet coil is used. The case of the instrument has a magnetic yoke or loop projecting to the rear, through which is passed the current-carrying cable or wire, which functions as a coil. The yoke has pole pieces extending into the inside of the ammeter. These poles vary in magnetic polarity and strength, corresponding to the direction and strength of the current passing through the wire and, being made of a special alloy steel, act without any residual magnetism error which would change the zero of the instrument. There is also a fixed permanent magnet inside the instrument with poles located at right angles to the poles formed by the yoke. Pivoted on a shaft in the centre of this group of poles is a soft iron vane which takes up a position

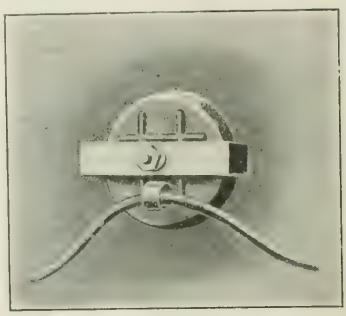


Fig. 3.—Westinghouse Type "BT" Ammeter.

corresponding to the relative strength of the permanent and the electromagnetic poles. The shaft carries the usual pointer which indicates the value of the current on a dial. The movement is so balanced that car shocks or swaying will not cause the pointer to swing.

This peculiar construction makes installation extremely simple, for, instead of wiring the meter to the car system by means of two pieces of wire or cable with connections and clips, the only operation necessary is to pass the dashboard cable through the opening in the back of the instrument, as shown in fig. 3.

A New "Magnet" Cooker.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has recently developed a new type of portable electric cooker (fig. 4) designed for cooking meals for from 6 to 8 persons. The appliance is substantially constructed of sheet metal, it is double-cased, and finished in black enamel with

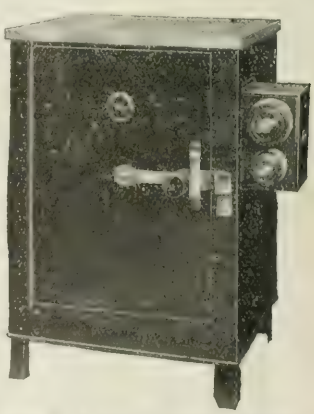


Fig. 4.—A New "Magnet" Cooker.

bright metal relief. It is 25½ in. in height, 18 in. wide, and 15½ in. deep; the oven space measures 17½ in. by 10½ in. by 12½ in. There are three heating elements, totalling 2,700 W, two at the sides of the oven and one at the top. The last is used not only as an auxiliary heater for the oven, but also for grilling, toasting, and boiling. By means of the heat controls, the effective loading can be brought down from the maximum of 2,700 to 300 W in 15 steps.

LEGAL.

Cooper *v.* Marks.

In the Mayor's and City of London Court, on December 19th, before Sir Ernest Wild, K.C., Recorder, Mr. Charles A. Cooper, manufacturer of electrical appliances and metal worker, 35, Kensington Hall Chambers, claimed against Mr. Hyman Marks, 19, Ludgate Hill, E.C., surveyor, £20 14s. damages, for breach of covenants in a lease to keep 48, Stamford Street in repair. Defendant paid £6 into Court with a denial of liability. Mr. Green, for the plaintiff, said that he had a lease of the premises for nine years at £75 a year in 1919. Plaintiff undertook not to carry on any business except that of a manufacturer of electrical appliances and metal worker. Defendant agreed to keep the main timbers in good repair and condition. Soon after plaintiff started his business he found the joists were not as they should be and he called defendant's attention to it. Nothing was done and as plaintiff was afraid that the ground floor would fall in and possibly kill some of the workers, he had the premises put into what his architect advised was a safe condition. Defendant said that the plaintiff must do the work at his own expense, and that if he put too many machines into the premises he must take the consequences. Mr. Picciotto, for the defendant, said that he had not broken his covenants. The joists complained of were not main timbers. The premises were never out of repair. Plaintiff had used the premises unreasonably. £6 was quite enough to satisfy plaintiff's claim. The Recorder said it was easy to cut down another man's bill. Defendant covenanted to keep the main timbers in good repair and that was not done. He found that the joists were main timbers and he gave judgment for the plaintiff for £16 18s., and costs.

Theft of Electricity.

Albert Frederick Hughes, an employé of the Liverpool Tramways Department, was fined £5 on December 20th, for the fraudulent consumption of electricity. It was stated by the prosecution that the defendant inserted two needles in an electric cable and used the energy for lighting his hut. The Stipendiary in fining Hughes, said that he refrained from sending him to prison only because he would no doubt lose his employment.

Mica & Asbestos Insulating Co., Ltd., *v.* Fellows Magneto Co., Ltd.

In the King's Bench Division, on December 18th, 19th, 20th and 21st, Mr. Justice Coleridge was engaged in hearing an action by plaintiffs, of Leroy Street, Old Kent Road, in which they claimed from the defendants, of Cumberland Avenue, Park Royal, two sums amounting to £2,460 for goods sold and delivered. In the alternative the plaintiffs claimed damages for alleged breach of contract by defendants in refusing to accept the goods, consisting of mica disks and plates used in the construction of magnetos.

The plaintiffs' case was that under three contracts they supplied to the defendants 2,600,000 mica plates, which they said were cut to the specification of the defendants. The plates were of no marketable value for any purpose other than that for which the defendants required them, except as waste scrap material.

The defendants admitted the order given to the plaintiffs, and said that the contracts contained a clause giving them the right of rejection in case the plates were found to be inferior in quality or in any way defective. They alleged that the plates delivered were, to a large extent, inferior in quality and defective and unfit for the purpose for which the defendants required them. Defendants further said that they were badly cut and otherwise did not comply with the specification. Defendants also pleaded that they had returned the goods, and that under the circumstances they had the right to reject them.

Plaintiffs, in reply, denied that defendants had the right to reject the goods, and denied defendants' allegations as to the plates being of inferior quality or defective in any way.

A great deal of evidence having been taken on both sides,

Mr. Schiller, K.C., in summing up the case for the defence, contended that there were defects in the mica which made the plates absolutely useless, because those defects destroyed the non-conducting quality of the substance, a fact which he said had been fully borne out by the witnesses. If there happened to be any conducting substance on the surface or the edges of the plates, then non-conducting properties would be destroyed, and the electricity would escape, and in this case a total defect in the plates was that they were of such varying thickness that they could not be put into the magnetos. The limitation of tolerance in many cases had been far exceeded, and when a portion were found to be so defective the defendants were entitled to reject the whole, as it was impossible from a business point of view to examine all.

His Lordship, in giving judgment, said he accepted the view that the contract was both by sample and description, but it was an unfortunate fact that defendants had destroyed the samples, and he was consequently unable to make a comparison. He adopted the view that it was a sale by sample plus description, and the basis of the contract was that the goods must be fit for the purpose for which they were required —that the mica must be free from bubbles and of good quality, and that the plates should not vary in thickness. It was admitted that some of the goods were not according to contract, but the rejected goods seemed to a large extent to have been the goods of other people. He had come to the conclusion that some of the goods were not according to sample, but there never had been any reluctance on the part of the plaintiffs to rectify any deficiency. In the end his Lordship gave judgment for the plaintiffs for £2,203 11s. 1d. with costs, and dismissed the counterclaim with costs.

A stay of execution was granted on the usual terms.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Conditions in Australasia.

I am a single man, 25 years old, and I should like to know if any readers of the Electrical Review can give me any information as to what conditions are like in Australia or New Zealand for power maintenance and armature winding and all electric motor repairs, as I have had a good deal of unemployment, and I would like to try somewhere else. I am not a graduated scholar, therefore I should not expect too much pay for a day's work.

E. Ranger.

Sale, *December 18th*, 1922.

Improvement of Power Factor.

With reference to the discussion which is at present taking place in your "Correspondence" columns on the above subject, Mr. Rogers is apparently under a misapprehension regarding the application of condensers on circuits of 200 or 400 volts. If a condenser is designed for, say, 600 volts working pressure, there is nothing to prevent the use of an auto-transformer to transform up the supply pressure from either 200 or 400 volts to the 600 volts. This arrangement is not covered by any master patents, and to give some idea of the respective costs, taking a case where a condenser applied to 600 volts costs £200, this condenser could be applied to a 400-volt circuit and give the same leading kVA for the additional cost of about £60, which is the cost of a suitable auto-transformer. If the circuit in question should be 200 volts, the approximate additional cost of the auto-transformer would be about £90.

It is agreed that 600-volt cases without the use of an auto-transformer are cheaper than either the 200- or the 400-volt case, but even with the increased cost, the condensers used in conjunction with auto-transformers are being applied very extensively, and effect savings as high as 100 per cent. per annum, and even greater than this.

Out of a total of nearly 30,000 kVA of static condensers, with which I am closely associated, a great percentage of this has been applied in conjunction with auto-transformers, and has effected savings sufficient to pay the cost of the equipment in from one to two years' time.

Other means of raising the voltage across condensers can be employed and have their applications, but there is certainly no question of master patents in reference to the application of an auto-transformer to raise the voltage across the condenser. This arrangement is very flexible in that the equipment can be applied to any part of the circuit where power-factor correction is required.

H. Higham.

Helsby, *December 18th*, 1922.

With further reference to correspondence relative to the above subject in your issue of December 15th, I would inform Mr. Rogers that I have recently compared the question of costs of static condensers for installations at 400 to 3,000 volts, at 50 and 25 cycles, and in every instance a profitable return on capital outlay has been shown.

In my own particular case, the condensers are connected direct at 600 volts; whilst I cannot give any information regarding condensers on 200-volt circuits, as such low voltage supply for power has not come within my sphere as yet, I look forward to seeing Mr. Dorey's figures relative to this voltage, as he evidently has had actual practical experience with it.

C. Jones.

Chasetown, *December 16th*, 1922.

I have been very interested in the recent correspondence in your columns under the heading "Improvement of Power Factor," and have derived useful information therefrom.

I should like to refer particularly to a letter on page 896, from Mr. W. E. Rogers, in which he makes use of a cryptic remark concerning the examination of master patents.

I have been associated with the manufacture and application of static condensers for power factor improvement for some years. I am quite unable to determine which patent he refers to, and I feel that there must be others to whom this particular remark is equally unintelligible.

May I, therefore, trespass on your space to ask Mr. Rogers if he would be kind enough to state more fully the actual patent which he considers to be a master one, in connection with the application of static condensers to power-factor improvement.

L. F. Fogarty.

Ruislip, *December 20th*, 1922.

The Duty of Engineers in Parliament.

A leading daily paper recently complained that not a single person distinguished in scientific research had been elected to the new Parliament, and remarked that even the Universities had sent politicians. But on examining the list of members it is encouraging to find quite a goodly company of men directly interested in engineering construction. There appear to be no fewer than nineteen engineers, nineteen directors of engineering or iron and steel-producing companies, two architects, four contractors, and eight trade unionists representing workmen in constructional and engineering trades; altogether some 52 members. These 52 men make up a formidable phalanx, and their influence is certainly very strong in proportion to their numbers.

Although belonging to different parties, they have a common interest in helping the engineering and constructive trades, which are suffering badly, into activity once more. The writer suggests that they should come together and form a special Parliamentary Committee for Engineering Construction, pledging themselves to help forward, irrespective of party considerations, all useful public works and private enterprises which offer any hope of restoring prosperity to their trade. In so doing they would help to cure their country of one of its sorest wounds. All through the war these trades worked day and night for victory; and in spite of the wretched treatment of managers, foremen, designers, and others, whose salaries were forbidden to be raised, these men worked up to the limit of human endurance, Saturdays and Sundays alike, for four years. Their reward is in many cases to find themselves out of a berth.

The first business of Parliament to-day is to set the constructional and engineering trades going again. Without bias in favour of any party, the greatest hope of this new Parliament is that it will prove to be practical and constructive, and that the Government will devote itself chiefly to good administration rather than legislation.

The great electrical and other schemes do not require Government money, nor Government management. All that is required is a Government guarantee of interest on the capital for a reasonable term of years. This would cost the Government nothing, and would enable the money to be raised.

Special mention might be made of the super-power stations, which, if completed, should give us an electrical development worthy of the country, as that, of course, is the subject of most interest to electrical readers, but there is plenty of other work urgently required, which only wants Government sanction, and in some cases the backing of Government credit (not necessarily cash) to be put in hand. The canals would provide work for a large proportion of the unemployed, if they were freed from the domination of the railways and properly equipped and extended.

Village and country water supplies are urgently required, as well as electric lighting, heating, and power. If the villages and small towns were properly equipped, one great cause of the migration to the big towns would be removed. Drainage and refuse disposal, housing, and transport all require the attention of the nation. One of the greatest obstacles to agriculture to-day is the lack of transport and distribution at reasonable rates. It is a scandal that good produce should be ploughed in within a few miles from London, while the price here is prohibitive to the majority of Londoners. Roads and railways are being developed to some extent at last, but it is a scandal that beautiful and healthy residential districts round London should remain practically inaccessible to the daily worker, owing to the inadequate travelling facilities.

It seems that in the application of practical science we are twenty years behind the times. And this is not the fault of our engineers nor our contractors. It is the fault of our Parliament and politicians. They have neglected to equip this country as a modern civilised state which ought to be fit to rank with Germany, the United States, Switzerland, Norway, Sweden, and Denmark in the use of applied science.

Let the fifty-two see to it and help materially toward settling the question of unemployment and many of the financial problems which weigh us down. What is required is to use the country's credit wisely and promptly to promote its prosperity, before the remains of our credit follow our cash into limbo. It requires courage and common sense, and the immediate strangulation of anyone who stands up in his place to repeat the inevitable formula that we must "Cut our coat according to our cloth," a silly saw which every duffer uses to obstruct sound enterprise. What John Bull requires is a good suit of clothes befitting his position in the world, and it should be cut to fit his own stout figure, and, without waste, sufficient cloth should be provided for the purpose.

Critic.

Advertising Gas by Electricity.

I am interested to see the ingenious way in which the gas industry has got over the difficulty of fire risk and fumes. In the showroom of a celebrated furnishing house in the Tottenham Court Road area, in the centre of one of the windows displaying drawing-room furniture is to be seen a gas fire. I noticed that there was no flue, also that the gas outlet at the back of the fire was close up to a highly-polished table. Further investigation disclosed a flexible wire running to the back of the gas fire, and then the truth was revealed. The gas fire radiators were lit up by "Linolite" lamps, but to the casual observer the gas fire had the appearance of being alight.

Thus does electricity come to the aid of gas.

W. B. Clarke.

Ponders End, *December 18th*, 1922.

Possibilities of Underground Transmission at 100/150 kV.

With reference to the discussion which took place at the Institution of Electrical Engineers on the 7th inst., it is apparent, from comments which have been made to me from certain directions, that I did not succeed in putting my case as clearly as I should have done either in the paper or in the discussion. This is unfortunate, for I claim that in the paper proposals are made which represent true and considerable progress, and as the comments which have been made may prejudice the reception of my paper at other centres, I would ask you to be good enough to insert the following brief *résumé* of what I claim can be deduced from the paper.

In my reply to the Institution discussion I shall show that:

1. By using intersheaths in the manner advocated in Table III (on page 17) it is possible to apply something approaching 70 per cent. greater voltage to a given total depth of insulation than in any non-intersheath cable.

2. The use of this extra voltage enables me, for the same current density and for half the amount of copper, to reduce the thermal gradient on the innermost core to 72 per cent. of that in a non-intersheath cable, with greatly improved life of the cable.

3. The thermal gradient for a single-core non-intersheath 100,000-volt cable of a given diameter, as compared with a 3-core, non-concentric, 55,000-volt cable of the same diameter, is of the order of 40 per cent. of that for the latter.

4. The thermal gradient in an intersheath cable on my principle is further improved by some 20 per cent. by the fact that the copper heat is liberated nearer to the circumference of the cable.

5. Combining items 2, 3, and 4, we get a total reduction of temperature on the innermost core (and on the insulation) of nearly 75 per cent.

(Alternatively, I might raise the voltage by perhaps another 20 per cent. or 30 per cent., because a cooler insulation can bear a higher voltage gradient, with again further diminution of the copper temperature and consequent further relief of the insulation.)

6. The extreme importance of temperature is emphasised by the lantern slide which I exhibited, showing connection between resistivity and temperature, and by the calculations (on page 17 of the paper) dealing with conductance leakage.

7. On the score of complication, I do not think it has been appreciated that I can entirely drop the so-called "major-star" system, and my system then simply becomes, at the sending end, three double-star transmission systems, and would compare practically as favourably, as regards switchgear arrangements, as three ordinary three-phase step-up transformers.

8. It is only necessary to add that the outermost intersheath, which in my system forms so important a feature from the point of view of the reliability and efficiency of the cable, *could not be operated* by the "straight tap" method of feeding intersheaths.

A. M. Taylor.

Birmingham, *December 22nd*, 1922.

The Longest Overhead Power Transmission.

I shall be obliged if your readers will inform me of any overhead power transmission line in this country giving a regular supply of electric energy 50 miles or more distant from the generating station producing the supply. If a "ring" system is used, the distance in miles from both directions should be given, stating whether or not the "ring" is regularly used.

William T. Taylor.

London, N.10, *December 23rd*, 1922.

[Several letters have been received too late for insertion in this issue.—Eds. Elec. Rev.]

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XCI of the Electrical Review, which will shortly be printed, will be supplied only to those who specially apply for it through the post. To these it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—H. N. Miles (Sheffield and Midland Schools of Wireless Telegraphy), wireless instructor, Central Chambers, High Street, Sheffield.—First meeting December 27th, at the Official Receiver's offices, Sheffield. Public examination January 11th, at the Court House, Sheffield.

H. J. W. Embury and K. S. Embury (H. & K. Embury), electrical and mechanical engineers, 110 and 29, Queen Street, Newton Abbot.—Receiving order made December 18th on debtors' own petition.

W. Price & Co., electricians, 29, Russell Street, Plymouth.—Receiving order made December 18th on creditor's petition.

A. C. Ince (formerly carrying on business as the Newcastle Electrical Engineering Co., now with a partner under the style of the Tyne Electrical Industries), electrical contractor, 21, Fenkle Street, Newcastle-on-Tyne.—Last day for proofs for dividend, January 11th. Trustee: Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

Company Liquidations.—The British and Allied Electrical Agency, Ltd., 13, Charterhouse Street, London, E.C.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of creditors was held recently at the offices of Messrs. Clarkson & Bennett, I.A., 16, Devonshire Square, London, E.C. Mr. St. John Bennett, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs which showed liabilities of £4,245, all of which were due to unsecured creditors. The assets were estimated to realise £95. from which had to be deducted £60 for preferential claims, leaving net assets of £35, or a deficiency as regarded the creditors subject to the costs of liquidation, of £4,211. The assets consisted of cash in hand £1 5s. 6d.; book debts estimated to realise £51; stock £22; and furniture and fittings £118, expected to produce £20. The liquidator stated that the liabilities included a claim by the Inland Revenue in respect of E.P.D. amounting to £870. If that claim was in order, and it had to be regarded as preferential, there would be no assets available for the creditors. The liabilities also included the following cash claims: Messrs. H. H. & A. T. Pollock, £168; Messrs. A. W. Pollock & Sons, £1,208; Messrs. A. & W. Pollock & Sons, Ltd., £885; Mrs. Pollock, £17; and Mr. Santell, £147. A private conference of the company's creditors was held on September 12th last. The creditors were then asked to postpone their claims for a period of 12 months with a view to giving the company an opportunity of pulling itself round. One creditor refused to fall in with the proposal, and commenced proceedings. The company had then no alternative but to pass a resolution for voluntary liquidation.

In answer to a question the liquidator stated that there was a book debt for £2,000 due to the company with regard to a deal in connection with insulated tape, but it was very doubtful if anything could be recovered without proceedings being commenced.

The creditors decided to confirm the voluntary liquidation of the company, with Mr. Bennett as liquidator.

Electrads, Ltd.—Winding up voluntarily. Liquidator: Mr. G. F. R. Baguley, 133, Moorgate, E.C. Meeting of creditors, December 29th, at this address.

Electro-Metallurgical Extraction, Ltd.—Winding up voluntarily. Liquidator: Mr. J. A. Charlton, Bank of England Chambers, Tib Lane, Manchester. Meeting of creditors, January 4th, at the offices of the liquidator.

School Syndicate, Ltd.—Winding up voluntarily. Liquidator: Mr. R. H. Porter, Austin Friars House, Austin Friars, E.C. Meeting of creditors, January 5th. Particulars of claims to the liquidator by January 31st.

P. S. Doherty (Engineers), Ltd.—Winding up voluntarily. Liquidator: Mr. E. Woodroffe, 9 & 10, Pancras Lane, E.C., to whom particulars of claims should be sent by January 5th. Meeting of creditors, January 5th.

Midland Electric Rotary Blowing Co., Ltd.—Meeting of members is called for January 23rd at 46, Cherry Street, Birmingham, to hear an account of the winding-up from the liquidator, Mr. J. Wood Massey.

George Airey & Co. (Electricians), Ltd.—Winding up voluntarily. Liquidator: Mr. J. Hancock, 57, Surrey Street, Sheffield. Meeting of creditors, January 4th, at the liquidator's offices.

Dissolutions of Partnership.—Young & Goodall, radio engineers, 186, Above Bar, Southampton.—Mr. J. Young and H. R. Goodall have dissolved partnership. Mr. Young will attend to debts and continue the business alone.

Kissack & Yates, electrical and mechanical engineers, 179, Gt. Howard Street, Liverpool.—Messrs. A. M. Kissack, A. Yates, and A. H. G. Mowatt have dissolved partnership. Debts will be attended to by Messrs. Kissack & Yates, who will continue the business under the same style.

Barrington & Ferry and/or The Strandlite Lamp & Electrical Co., 37 and 38, Strand, W.C.—Messrs. W. M. Barrington and C. Ferry have dissolved partnership.

Private Arrangement.—Claude H. Verity, trading as Edwin Verity, 168 and 169, Briggate, Leeds, electrical dealer, &c.—A largely attended meeting of the creditors of the above was held on December 18th at the Victory Hotel, Leeds, when Mr. C. Turner, of Birmingham, was elected to the chair. Mr. Robinson, solicitor, of Albion Street, Leeds, who had issued the notice convening the meeting, explained the necessity which had arisen for the calling together of the creditors, and a statement of affairs was presented which had been prepared by Messrs. Fuller, Higgins & Co., 39, Albion Street, Leeds, showing the position as at December 7th last. The statement disclosed ranking liabilities of £40,041. Of that amount £14,614 was due to the trade, £12,852 to cash creditors, and £12,574 to partly secured creditors. The claims of the partly secured creditors totalled £14,074, but they held securities of the estimated value of £1,500. The assets were estimated to realise £14,849, from which had to be deducted £557 for preferential claims, leaving net assets of £14,291, or a deficiency of £25,749. The assets consisted of cash in hand, £231; stock in trade at cost £8,395, estimated to realise £6,716; trade fixtures, fittings, utensils, &c., £1,118, expected to produce £300; motor wagons, £627, valued at £200; synchroniser and Veritiphone £7,251, estimated to realise £1,000; patent stove, £704; shares, £65; insurances paid in advance, £21 16s. 6d.; good book debts £3,656, expected to produce £3,291; doubtful and bad debts £126, valued at £60; and surplus from securities in the hands of creditors fully secured, £2,260. The claims of the fully secured creditors were £7,970, but they held securities of the estimated value of £10,230. With regard to the preferential claims, they included rates, taxes, and wages of £503. For the purposes of the statement the good book debts had been depreciated by 10 per cent., and the other assets had been written down to what it was thought they would produce. The statement was explained in detail by Mr. G. Higgins, who reported that the debtor had carried on business for a number of years. Up to two or three years ago the business was a profitable one, but more recently it had ceased to be so owing to the general trade depression, and the abnormal slump which had taken place in that particular trade. The debtor had also expended a considerable amount of time and money on his personal invention—the synchroniser and Veritiphone. That was an instrument for producing the sound of the human voice for use in conjunction with films, the sound coinciding with the lip movements on the film and so producing a speaking film. The debtor had anticipated a company being formed to put his invention on the market, but unfortunately the necessary capital was not forthcoming. The debtor thought that the trade depression was responsible for the company not being formed. The position disclosed was discussed at some length, and eventually it was decided that a deed of assignment should be executed, with Mr. G. Higgins and another as trustees, for the general benefit of the creditors, together with a committee of five of the principal creditors.

Trade Announcements.—Messrs. H. Jones and C. E. Overton announce that, having severed their connection with Messrs. Hudson, Sheed & Towell, Ltd., they have fitted up premises at 6, Windmill Street, Tottenham Court Road, London, W., under the title of Metalcraft, Ltd., for the manufacture and sale of electric light fittings and accessories. A stock of fittings will be carried and a plant is installed for the renovation, replating, and relacquering of every type of metal-work.

Messrs. P. L. Dwyer & Co., wholesale electrical suppliers, of 66, Victoria Street, S.W., have removed to 90, Grosvenor Place, S.W.1; stores entrance, Chester Mews, Wilton Street, S.W.1.

Messrs. O'Sullivan & Sons have started as motor, electrical, &c., engineers at Lynch's Quay, Queenstown, Ireland, and they wish to receive catalogues and lists.

Messrs. Parmiter, Hoff & Sugden, Ltd., have removed their head offices and works to Fluvent Electrical Works, Vernon Street, Longsight, Manchester, to which address all communications and goods should be sent. New telephone number: "Rusholme 1486."

Catalogues and Lists.—Messrs. Crompton & Co., Ltd., Chelmsford.—Export List 536, illustrating and describing silent-running a.c. fans. Fully priced.

The Underfeed Stoker Co., Ltd., Coventry House, South Place, E.C.2.—An illustrated brochure, describing the "I" multiple retort stoker.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—Two illustrated folders, dealing respectively with shop-window lighting with X-ray reflectors, and glassware for decorative electric lighting.

Calendars, Diaries, &c.—THE RADIO PRESS, LTD., of [illegible] London, W.C.2, have published a [illegible] and diary for 1923 containing a quantity of [illegible] with numerous diagrams, much general information, and an insurance coupon.

From THE KEY ENGINEERING CO., LTD., of 4, Queen Victoria Street, London, E.C.4, we have received one of their celluloid calendars for 1923.

[illegible] monthly slips for 1923 has been received from the Liverpool Electric Cable Co., Ltd., of Limacre Lane, Bootle, Liverpool. The pictorial feature is a view in colour of the entrance to Canning Dock, Liverpool. [illegible] is the title of a coloured picture of [illegible] which appears on a wall calendar (monthly date slips) issued by MESSRS. FRED. HODGSON & CO., LTD., of 24, Queen Victoria Street, London, E.C.4.

We are indebted to THE DIAMOND BLOWER CO., LTD., of 91-93, Bishopsgate Street, London, E.C.2, for useful seasonable souvenirs in the shape of pocket matchboxes.

THE HART ACCUMULATOR CO., LTD., of Stratford, London, E.15, has prepared a large wall calendar; the figures on its monthly date sheets are very boldly printed. The firm has also sent us, as before, one of its desk blotting pads with the 1923 dates arranged on the right and left hand of each sheet.

MESSRS. C. A. PARSONS & CO., LTD., Heaton Works, Newcastle-on-Tyne, have sent us a set of date refill cards suitable for the calendar issued by them a year ago.

From MESSRS. DOWNES & DAVIES, 1 and 3, Stanley Street, Liverpool, we have received a large wall sheet calendar with monthly slips for 1923.

MESSRS. FRANCIS POLDEN & CO., LTD., 56, Cannon Street, London, E.C., have issued a "Crown" diary for 1923, with three daily engagement spaces per page. A good deal of general information is given, also an insurance coupon.

A small booklet of squared paper has been received from THE FRANCO SIGNS, LTD., of 25, Oxford Street, London, W.1, and refills are afterwards provided as required.

From MESSRS. JOHN ARMSTRONG & CO., of Barton Square, St. Ann Street, Manchester, we have received a wall card calendar of convenient size for the year 1923. It has also a block of "Midget" daily date slips.

A bright desk calendar (red and gold) with monthly cards (and on the back a complete calendar for the year 1923) has been issued by MESSRS. C. A. BESLEY, BAILEY & CO., LTD., of Hope Street Lane Works, Cardiff.

A wall calendar, with monthly tear-off slips, has come to hand from the LOUGHBOROUGH COLLEGE, Leicestershire.

MESSRS. RUSTON & HORNSBY, LTD., of Lincoln, have issued a serviceable wall calendar with monthly date sheets, each of which contains a half-tone picture illustrative of the company's manufactures.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LXI. No. 313. December, 1922. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—This issue contains the inaugural address by the president, Mr. F. Gill, and the addresses of the chairmen of the following Centres and Sub-Centres:—Mr. F. Tremain, Western Centre; Mr. F. G. C. Baldwin, North-Eastern Centre; Mr. W. B. Woodhouse, North-Midland Centre; Mr. R. D. Archibald, Dundee Sub-Centre; Mr. B. Welbourn, Liverpool Sub-Centre; and Mr. W. Pearson, East Midland Sub-Centre; also the following papers:—"The Production of Noise and Vibration by Certain Squirrel-cage Induction Motors," by Mr. F. T. Chapman; "An Electrical Timing Device for Short Intervals," by Prof. D. Robertson and Mr. N. F. Frome; "The Engineer and Manufacturing Costs," by Mr. F. C. Lawrence; "The Testing of Materials," by Mr. C. Dawson; "Observations of the Field Strength of Horsea Wireless Station," by Mr. E. B. Moullin; "Telephonic Repeaters and Long-distance Telephony," by Mr. J. A. Cooper; and "Automatic and Semi-Automatic Railway Signalling," by Mr. H. S. Petch.

"Steam Vessels" (60 pp.). Manchester: The National Boiler and General Insurance Co., Ltd. Price 2s.—This is a copiously-illustrated treatise upon the design, construction, and working of vessels subjected to steam pressure, pipes, valves, &c.

The current number of the *Decimal Educator* (The Decimal Association; 6d.) contains an account of the general meeting, including the report of the activities of the Association during the previous year presented to the members. The president's [illegible] and reviews of several books make up a more than usually interesting number.

"The Henley Manual" (190 pp., illustrated). London. Messrs. W. T. Henley's Telegraph Works Co., Ltd. Price 10s. 6d.—This is a reference book of convenient size, which should prove of service to all concerned with transmission systems. It is divided into five sections. Part 1 (66 pp.) gives useful formulæ and data of conductors, and includes [illegible] of standard types of cables, &c. Part 2 reproduces the Standard Specification for insulated cables. Part 3 deals with underground [illegible] direct, solid and [illegible] and embraces protective systems and colliery installations. Part 4 treats of overhead construction, giving B.O.T. (Ministry of Transport) and Post [illegible] regulations, notes on erection, [illegible] &c. The last part (36 pp.) describes various types of cable—v.i.r., v.b., paper, &c.—and concludes with sketches and descriptions of cable accessories. A comprehensive index and several pages of decimal-squared paper complete the volume.

"The Henley Telegraph," December, 1922. Price 6d. net.—The quarterly staff magazine of Messrs. W. T. Henley's Telegraph Works Co., Ltd., is, as usual, full of bright articles and notes, and the issue has been enlarged. An account of a presentation to Sir George Sutton, Bart., occupies several pages, and notes of recent important contracts appear.

"The M. & C. Apprentices' Magazine," Christmas Number, 1922. Glasgow: Messrs. Mavor & Coulson, Ltd. Price 4d.—A number of interesting articles and pictures are embodied in this issue, including "The Unemployed Employer," by Mr. Sam Mavor.

"The Brown, Boveri Review," November, 1922. London: Messrs. Brown, Boveri & Co., Ltd.—The two articles contained in this issue are "The Behaviour of Metals subjected to Mechanical Stress," and "Disturbances in Electrical Plants due to Lightning." Both are well illustrated. The latter article is based on an analysis of 33 failures due to lightning in transformers, generators, and other parts of installations.

"The Practical Engineer Electrical Pocket Book and Diary for 1923." London: H. Frowde and Hodder & Stoughton. Price 2s. 6d. net.

"Electric Power Plant Engineering," by J. Weingreen, Third edition. Pp. xi+511; 305 figs. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

South African Railways and Harbours Magazine, Christmas, 1922. Price 2s. 6d.—This is a bulky issue, containing numerous good stories and pictures.

"Internal-Combustion Engines," by J. O. Kill. Pp. xi+126; 27 figs. London: Sir Isaac Pitman & Son, Ltd. Price 3s. net.

The Portuguese Electrical Market.—Although the Portuguese market for electrical goods is not among the most important, it is yet by no means one to be neglected. The city networks of Lisbon and Oporto are growing concerns, and many industries which had their own electrical installations have found it better to become customers of the municipalities.

Of electrical material Portugal makes only porcelain (for switches); the rest of her wants must be satisfied from abroad. Quite lately the customs tariff has been raised; but whereas increases have been numerous in the bulk of the imports, those of electrical material have been reduced. Thus, since the beginning of this year, the customs charges on dynamos, motors, and transformers have been reduced as follows: Up to 50 kg., 6 centavos per kg.; from 50 to 100 kg., 5 centavos; 100 to 500 kg., 2 centavos.; 500 to 1,000 kg., 3 centavos; and beyond 1,000 kg., 4 centavos.

The countries of origin of the imports are at present about as follows: Dynamos, alternators, and commutators: America, Switzerland, Germany, Belgium (a few). Static transformers (over 2,000 kVA): America, Belgium, Hungary. Motors: Germany and France. Meters: France (for the most part), Germany, Switzerland. Lamps: Holland, Germany, and France. Armoured cables: Germany, Italy, and France. Rubber-covered wire: Germany, Italy, Spain, France, and Belgium. Smaller apparatus: Germany, Switzerland. Household apparatus, electric irons, fans, &c.: Germany, France, and Spain.—*L'Electricité pour Tous.*

Inquiries Regarding Trade with Argentina.—Mr. H. O. Chalkley, H.M. Commercial Secretary at Buenos Ayres, will be in attendance at the Department of Overseas Trade for a few days from January 18th, and will be pleased to interview manufacturers and merchants interested in trade with Argentina. Applications for interviews should be made not later than January 17th to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Manchester Engineering Trade.—At the annual meeting of the Manchester District Engineering Trades Employers' Association, in the Memorial Hall, Manchester, Mr. Joseph H. Stubbs was re-elected president for the second year, and Mr. F. C. Gibbons vice-president. Alderman F. J. West was reappointed treasurer. Contrary to the experience of twelve months ago, there is at present no outstanding difference in the engineering trade with the trade unions. Whilst the industry in the Manchester district cannot be said to show very marked signs of reviving trade, the tendency is no longer steadily downward. "It could not be definitely proved," declared one employer, "that the upward curve has arrived, but many of us are of the opinion that the bottom has at last been reached."—*Manchester Guardian.*

German Export Duties.—*The Deutsche Allgemeine Zeitung* learns from a reliable source that the Export Duty Committee of the Provisional Economic Council, in view of the situation of export business, has decided unanimously in favour of a reduction of the supplement of 30 or 60 per cent. in force since September 3rd, 1922. Owing to the reaction in the exchange rate a reduction in the supplement has become an urgent matter for German industry. The journal understands that the reduction will apply to nearly all articles appearing in the tariff.—*Reuter's Trade Service* (Berlin).

The A.E.U.—The December *Journal* of the Amalgamated Engineering Union contains a review of the year's developments and activities. The year commenced with a total membership of 409,219, but this has fallen to 357,871—a decrease of 12.8 per cent. It is considered that the decrease is due to the gradual "deflation" of the numbers which entered the various branches of engineering industry during the war. Prior to the war the members numbered less than a quarter of a million. It is stated that probably the only way in which the loss will be made up will be the re-admission of former members who have left for economic reasons.

Bulgarian Government Contracts.—We understand that on various occasions British firms have approached the Department of Overseas Trade respecting the conditions of payment, inspection, &c., attached to the submission of tenders for material required by the Bulgarian Government. British firms have in general found these conditions difficult, and firms have in some cases submitted tenders on terms other than those stipulated by the Department of the Bulgarian Government concerned. The Secretary in charge of Commercial Affairs at H.M. Legation at Sofia has now called attention to this practice, and has pointed out that it is useless to submit offers which do not comply with the conditions laid down by the Bulgarian State Departments. He states that it is impossible to induce the Bulgarian Government to vary these conditions so long as competing firms of foreign nationality are prepared to accept them, as is at present the case. Particulars of the general conditions can be ascertained at the Department of Overseas Trade. The Commercial Secretary strongly recommends that such British firms as are desirous of submitting tenders should appoint agents in Sofia provided with powers of attorney to sign eventual contracts in their name. The Department of Overseas Trade is prepared to advise firms in the appointment of representatives who could be instructed in case of need by telegraph in the event of a favourable opening presenting itself.

The British Empire Exhibition.—The Duke of Devonshire, the chairman of the Executive Council of the Exhibition, has given the following undertaking:—

"Provision will be made in all contracts and in every other way possible for Empire materials only to be used in the construction of the Exhibition buildings, and for Empire products only to be used in the restaurant, and no exception will be made unless it is certified by the British authorities and the Dominion representatives that such Empire products are not available."

The inquiry by Sir W. Joynson Hicks is still proceeding, as there are several other matters upon which criticism has been offered.

Local Exhibitions.—The Edinburgh Corporation Electricity Committee has decided to take a stand at the second Scottish Ideal Homes Exhibition which is being held in the city from January 31st to February 14th.

East Anglian Electricity, Ltd., of Felixstowe, Stowmarket, &c., recently held an electrical exhibition at their Beccles (Suffolk) branch. Demonstrations of cooking were given, using ovens by the General Electric Co., Ltd., Belling & Co., and also with the "Lightning" oven invented by Mr. Napier Prentice, which is so constructed that the whole oven is bodily raised on a counterweight when inspecting the progress of cooking, thus conserving the heat when the oven is open or raised. Demonstrations were also given with a "Eureka" vacuum cleaner notable for its small compass. Demonstrations were given by the Singer Sewing Machine Co. with electrically-driven sewing machines. Labour-saving apparatus for all purposes was shown. The local manager, Mr. Sharratt, reports satisfying results, and hopes to repeat the exhibition on a larger scale again next spring.

E.D.A. Activities.—The latest publication of the Electrical Development Association (E.D.A. 330) gives advice upon the cleaning of aluminium saucepans and the better advice to "Use Electricity for the Cooking of Food."

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Individuals and firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below. In the case of foreign firms, the name and address of the British representatives to whom objections, if any, are to be sent are also given.

Aeriola. No. 426,513. Class 8. Apparatus for wireless telegraphy, wireless telephony, radio instruments, and parts thereof.—The Aeolian Co., Ltd., Aeolian Hall, 131-137, New Bond Street, London, W. December 20th, 1922.

Magnavox (lettering and design). No. 429,679. Class 8. Electrical sound amplifying devices, loud-speaking telephones, aircraft telephones, audion-frequency amplifying cabinets, &c.—The Magnavox Co., 2725 East 14th Street, Oakland, Cal., U.S.A. (Feeny & Feeny, 73a, Queen Victoria Street, London, E.C.) December 20th, 1922.

Iris (lettering and design). No. 430,309. Class 8. Instruments for use in wireless telegraphy and telephony.—Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C. December 20th, 1922.

Bell-Blazo. No. 430,392. Class 13. Gas and electric metal fittings.—George Abel-Harry, trading as the Gordon Bell Co., 131, Essex Road, Islington, London, N.1. December 20th, 1922.

Lucifer. No. 426,455. Class 18. Magneto electric lighting sets.—La Société des Magnetos Lucifer, 11, Rue de St. Jean, Carouge, near Geneva, Switzerland. (Haseltine, Lake & Co., 28, Southampton Buildings, London, W.C.) December 20th, 1922.

Metrovick. No. 428,500. All goods in Class 40.—Metropolitan-Vickers Electric Co., Ltd., 4, Central Buildings, Westminster, S.W. December 20th, 1922.

A Telephone Card.—In accordance with its usual practice, the County of London Electric Supply Co., Ltd., has sent us a card for recording telephone numbers. This year's illustration depicts a family group basking in the rays of an electric fire.

The Human Thermostat.—Messrs. George Nobbs, Ltd., have sent us a neat little thermometer for use where their "Genii" radiators are employed. The instruction is to economise electricity by switching off one or more of the radiators when a "healthy temperature" is indicated on the thermometer—namely, 60 to 65 deg. F. for living rooms, 50-55 deg. for bedrooms, and 60 deg. for nurseries. The idea is excellent; the Genii radiator supplies the heat, the Genii thermometer indicates the temperature, and the *genius loci* performs the functions of automatic switchgear.

South African Railway Electrification.—The Steelwork Contract.—The latest *Bulletin* of the General Manager of Railways states that the erection of locomotives will take place at Maritzburg, and as far as possible certain of the labour will be supplied by the administration. In the case of the overhead equipment of the permanent way, labour will also be supplied as far as possible by the administration. Arrangements have been made for the use of South African manufactured steel for the structures for the overhead equipment of the permanent way. Negotiations have been completed with the Union Steel Corporation of South Africa, Vereeniging, in conjunction with Messrs. Gilbert Hamer & Co., Durban, for this work, and it is anticipitated that the contract will shortly be signed. Over 3,000 tons of South African manufactured steel will be used in connection with this contract. The number of European employés at the Union Steel Works, Vereeniging, will be increased by about 18 per cent., while the joint contractors (Messrs. Gilbert, Hamer & Co.) will require to double the number of mechanics employed at their works. The Union Steel Corporation will purchase, in connection with this contract, from 1,000 to 2,000 tons of scrap from the administration's stocks at Durban. The *Bulletin* says that the erection of the steel frame power house buildings will be carried out entirely by South African labour by Messrs. Wade, Dorman & Co., Durban; the provision of quarters for the power station staff at Colenso has been authorised and work commenced. The contractor's engineers for the overhead equipment of permanent way have arrived in South Africa and preliminary work is in progress. Certain alterations to sidings and signals at various stations on the section to be electrified will shortly be put in hand. All contracts provide for the use of South African material and labour wherever this is practicable and reasonably possible.—*South African Mining and Engineering Journal.*

French Telephone and Cable Manufacture.—The report of the Société Industrielle des Téléphones states that the company was able to traverse the industrial crisis in 1921-22 without having been specially affected by it; with the exception of the telephone department all the works had been provided with sufficient orders to maintain normal working. As the Administration of Posts, Telegraphs and Telephones did not obtain the credits necessary for developing and improving the equipment, no orders had been placed by that department, with the result that the telephone manufacturing industry had been completely paralysed. There was, however, reason for believing that some of the schemes before the Chamber would be adopted shortly, and that large orders would result to the works producing cables and telephone apparatus. Since the beginning of the new financial year the company had acquired works at Berzons adjoining its cable factory and works at Clichy. It was proposed to transfer the manufacture of telephone cables to the new shops at Berzons and to produce technical rubber products at Clichy. After having made provision for depreciation, the accounts show net profits of 5,125,000 fr. for 1921-22, and a dividend at the rate of 45 fr. per share has been declared, compared with 40 fr. in 1920-21.

Protection in Finland.—The Finnish Electrical Co. (Gott. Stromberg) has made application to the Council of State asking for the protection of the native industry by an increase from the present 10 per cent. ad valorem to 25 per cent. in the duties on small electrical machines up to a maximum weight of 10 cwt. It is pointed out that although the difficulties in the Finnish electrical industry would not be entirely overcome by the suggested augmentation, the latter would render it possible to compete with foreign industry in the production of the machines in question.

Electricians' Wages.—The National Joint Industrial Council for the Electrical Supply Industry has decided that the present sliding-scale agreement bearing upon the wages of electricians, mechanical fitters, &c., shall be continued for one calendar month from January 1st, and that the employers and employees on each District Council shall have the right to put forward the schedules of wages which they consider equitable to their respective District Councils. These proposals are to be in the hands of the district secretaries by January 6th, and if no agreement is reached by January 13th the points of disagreement shall be submitted to the N.J.I.C. at a special meeting on January 19th. Any points undecided at this meeting will be referred to the Industrial Court which will sit locally.

Dust-Removing Plant.—At the recent annual meeting of the British Vacuum Cleaner & Engineering Co., Ltd., the chairman made mention of the plant installed at the Gennevilliers power station for the removal of dust accumulations in boiler and economiser chambers and flues without shutting down the boilers for the purpose. This, the first of its kind, had proved so satisfactory that the Union d'Electricité had placed a further substantial contract with the company.

Swiss Aluminium Industry.—In an article in the *Bulletin* of the Swiss Electrical Engineers' Association the following particulars are given regarding the Swiss aluminium industry. From 10,000 tons per year in 1913, the Swiss output rose to 15,000 tons in 1917 and 1918, or an increase of 50 per cent. The share of Switzerland in the world's output was, in 1914, 11.75 per cent.; in 1921, 8.68 per cent.; and this year it is reckoned it will only be 5.85 per cent.

Unemployment.—The Employment Exchange returns for the week ended December 18th show that the number of unemployed was smaller by 29,541 than in the preceding week. The total was 1,359,100, and there were 54,700 workers on short time as compared with 54,927 on December 11th.

At the end of November the number of unemployed in the engineering and shipbuilding trades was 123,894, or 27.3 per cent. of the membership of the trade unions represented.

Wage Reductions.—The December *Ministry of Labour Gazette* records the wage reductions which have been effected during the first eleven months of the year. The total weekly sum involved is £4,170,100, and this affects 7,456,000 workpeople. On the other hand, there has been a total increase of £11,400 weekly distributed among 73,600 persons. In the engineering and shipbuilding industries the number of people affected is 1,305,000, the total weekly reduction mounting to £1,178 200.

German Competition in Argentina.—It is well to draw attention to a statement which was made by the chairman of the London & River Plate Bank in the course of his address to the shareholders at the annual meeting on December 19th. Speaking of Argentina, he stated that industrialism is becoming steadily developed, and a feature of this is that most of the machines imported are sent from Germany. The machines are usually of light power, electrically driven, and capable of being easily tended by technically unskilled labour.

Metropolitan-Vickers New Showrooms at Birmingham.—The Metropolitan-Vickers Electrical Co., Ltd., recently opened new showrooms and a sales depôt at Daimler House, Paradise Street, Birmingham. The premises are conveniently situated near the Town Hall and the General Post Office, and close to the industrial and shopping centres and railway stations. The large rooms, which are distinctive by reason of their dignity and artistic finish, contain a well-selected stock of high-class electrical fittings and domestic appliances. The stores, situated in the basement, carry a very large stock of domestic heating and cooking apparatus, lamps and fittings, and there is also an industrial showroom where the firm demonstrates in a very effective way the industrial application of electricity. An old-established firm of brassfounders—Messrs. Harcourts, Ltd.—is one of the firm's subsidiary companies, and the latest ideas are exemplified in artistic and well-designed electric bowl pendants, lamp standards, candle brackets, push buttons, tumbler switches, and many other articles in cast and pressed metal work. Messrs. Harcourts have a [illegible] staff of modellers, and the hope is entertained that architects and others on big undertakings will consult the firm in relation to ornamental or special designs. On the [illegible] a model electric kitchen has been constructed, and at this demonstrations will be given showing the advantages of cooking by electricity. The kitchen equipment appears well selected to suit the average small household, where labour saving and economy are of importance; and examples are given of [illegible] domestic appliances. A 2 kW [illegible] is exhibited in various periods. A model is shown also of the [illegible] broadcasting station at [illegible] Park, and [illegible] and equipment are prominently displayed.

The Peruvian Market.—A large demand for electrical machinery and plant is reported to have existed in Peru for some months past, particularly in view of the intention to utilise the water powers of the country. Old machinery in the sugar mills is being replaced by electrical plant, and important orders for generators, motors, &c., are said to be in prospect in the near future.

Holidays.—The works of Messrs. Daniel Adamson and Co., Ltd., will be closed from to-day, December 29th, until Tuesday next, January 2nd, for the New Year holidays.

Vulcanised Fibre.—The Board of Trade Committee formed in May last, in accordance with the Safeguarding of Industries Act, to investigate complaints made by the B.E.A.M.A., on behalf of Messrs. Sutcliffe, Ltd., that American vulcanised fibre was being sold in this country below the British production cost, has issued its report. It was stated in evidence that there was an agreement in existence between importers and certain British manufacturers fixing the selling price of the American product at 1s. 7d. per lb. Messrs. Sutcliffe were not a party to this agreement, but admitted that they could not complain so long as this price was maintained. However, they asserted that there had been evasions. The Committee considers that no serious evasion has been proved, and recommends that no action shall be taken.

Indian Trade in October.—H.M. Senior Trade Commissioner in India (Mr. T. M. Ainscough, O.B.E.) has forwarded to the Department of Overseas Trade a note issued by the Director of Statistics relating to India's overseas trade during October, 1922, in which he says that the trade returns of British India for the month showed an improvement in the values of imports and exports as compared with the preceding month. As compared with October, 1921, the imports of food, drink, and tobacco decreased by Rs.1,87 lakhs, and raw materials by Rs.60 lakhs, while manufactured articles rose by Rs.2,19 lakhs. Of manufactured articles, the imports of cotton piecegoods increased in quantity and value, but there were decreases under railway plant and rolling stock (Rs.68 lakhs) and electrical instruments (Rs.13 lakhs), while all other important items in this group showed an improvement.

Commercial Fair in Madagascar.—The British Chamber of Commerce in Paris learns that the first official Commercial Fair (samples) is to be held at Antananarivo (Tananarive) from August 15th to September 15th, 1923. The fair will be held under the auspices of the Government of the Colony, and British firms will be permitted to exhibit. The exhibits will comprise machines and machinery, oils, metallurgical products, hardware, textiles, china and glassware, foodstuffs, and various general merchandise. Full information concerning the fair can be obtained from the British Chamber of Commerce at Tananarive.—*Reuter's Trade Service* (Paris).

Patent Restoration.—An order has been made restoring Patent No. 148,524 of March, 1918, granted to Gesellschaft für Drahtlose Telegraphie m.b.H. for "Improvements in electric conducting coils."

Social Events.—The Social Club in connection with the Midland Electric Manufacturing Co., Ltd., held its annual Christmas dinner and concert at the White Horse Hotel, Birmingham, on December 20th, Mr. W. L. Barber presiding. Nearly 150 members of the works and staff were present, and the musical programme was entirely provided by members.

The Osram and Robertson Club is holding a dance at the Osram-G.E.C. Lamp Works, Hammersmith, tomorrow evening, and a long and varied programme has been received from the secretary, Mr. E. V. Vanhinsbergh.

Industry in the United States.—According to *Power*, there are numerous indications of a revival in industry throughout the United States. Twelve of the fourteen principal groups into which industry is divided show increased employment, and among these are the iron and steel, non-ferrous metals, and vehicle industries. Fifty-six of the principal cities report a diminution of unemployment, and the returns from New York State are most encouraging. It is stated that business in Chicago has reached the largest volume since the spring of 1920.

LIGHTING AND POWER NOTES.

Abergele.—Electricity Supply.—The Urban District Council has received a report from the North Wales Power Co. regarding a proposed electricity scheme. The company stated that the transmission lines would be ready in the course of three months, and that it would erect a transforming station at the company's expense at the nearest point to Abergele. The cost of the scheme to the Council would be £10,000, and the company was prepared to supply electricity at £6 per kW plus ¾d. per kWh on the Council's output. The Council has decided to obtain expert advice on the scheme.

Almondsbury.—Electricity Supply.—The Electric Light and Supply Co. has applied to the Parish Council for permission to erect poles for overhead mains for supplying electricity to the district. The Council has decided to raise no objection provided the poles are erected at certain points.

Amesbury.—Inauguration of Electricity Undertaking.—The electricity undertaking was formally opened on December 8th by Mr. H. C. James, managing director of the Amesbury Electric Light & General Supply Co.

(*Continued on page* 982.)

THE LEICESTER ELECTRICITY UNDERTAKING.

INAUGURATION OF NEW STATION.

The formal opening of the new electricity generating station at Leicester on December 8th, 1922, followed closely upon the completion of the first year in which the electricity supply department of the city was governed by a committee separately appointed to control this most important branch of the City Council's activities.

The Corporation first undertook the supply of electrical energy in 1894, when the Aylestone generating station was erected on the gas works site and supplied single-phase current, principally for lighting purposes. The late Mr. Alfred Colson acted in the dual capacity of gas and electric lighting engineer, and the Gas and Electric Lighting Committee continued in charge up to the end of 1910, when it was relieved by the Tramways and Electricity Committee.

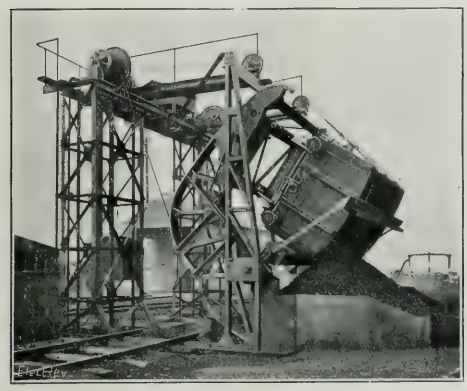


Fig. 1.—Coal Wagon Tippler.

However, in 1904, the Tramways Committee had erected its own generating station at the Lero for the purpose of giving a d.c. supply to the tramway system established in that year. From this station, in 1908, the first serious attempt was made, under the direction of Mr. T. R. Smith, M.I.E.E., to meet electrically the demand for motive power, and the expedient of connecting power consumers to the 500-volt d.c. mains proved successful. In 1911 electricity supply was placed under the sole management of Mr Smith, and it soon became necessary to supplement the plant both at the single-phase Aylestone and at the Lero d.c. stations. Three-phase turbo-alternators were installed from time to time at both works, and in 1917 the services of Mr. C. H. Wordingham, C.B.E., M.I.E.E., were enlisted with a view to the preparation of a scheme for extending the electricity supply. Although the war prevented the realisation of the project, a number of Mr. Wordingham's recommendations were embodied in the scheme ultimately carried out, and the result of Mr. Smith's visit to the U.S.A. is shown in the design of the new station in the Freemen's Meadow, Aylestone.

The progressive policy of the department is evidenced by the new showroom in Market Street. The number of lighting consumers at the end of 1922 was nearly 9,000, while motors developing well over 25,000 h.p. consumed some of the 29 million kWh that had been generated up to October this year.

Fig. 6 shows the site of the new station on the right bank of the canalised River Soar, on which work was started in May of last year. The main contract was awarded to the English Electric Co., Ltd. The boiler-house equipment and the whole of the pipework were entrusted to Messrs. Babcock & Wilcox, Ltd., while the coal and ash-handling plant and wharf construction were placed in the hands of the Mitchell Conveyor and Transporter Co., Ltd. The portion of the station now completed accommodates one 10,000-kW turbo-generator,

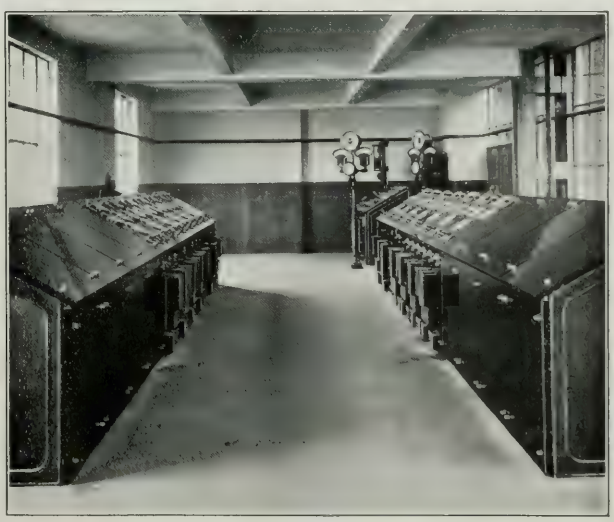


Fig. 2.—Control Room.

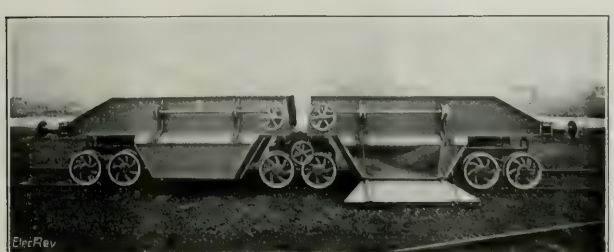


Fig. 3.—Ash Wagons.

with the necessary steam-raising and auxiliary plant, but a total capacity of 65,000 kW is aimed at.

Rail-borne coal is unloaded by a "Mitchell tippler," fig. 1, operated by a 10-h.p. motor, which device consists of a cradle which rotates and carries the wagon with it and discharges its contents into a hopper underneath. The whole operation of tipping and returning the wagon takes less than two minutes. River-borne coal is unloaded by means of a grab-crane into railway

trucks, which are then dealt with by the tippler. The coal is raised by means of a skip-hoist, and distributed by a belt conveyor into the bunkers. The ashes fall into hoppers, so that ash wagons, fig. 3, of special design,

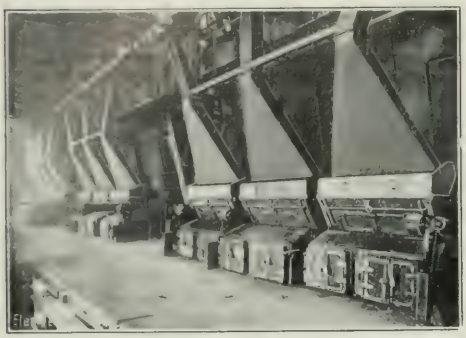


Fig. 4.—Leicester Boiler House.

but of standard railway gauge, can be run underneath.

The four Babcock & Wilcox boilers, fig. 4, each have a steaming capacity of 45,000 lb. per hour at a pressure of 275 lb. per sq. in., superheated to a total temperature of 700 deg. F. Each is fitted with an integral superheater and superimposed steel tube economiser. There are three mechanical stokers to each boiler, of the chain-grate type, designed to burn low-grade coal under balanced-draught conditions or on natural draught when higher-grade fuel is used.

The 10,000-kW impulse turbine, fig. 5, is coupled to a 6,600-volt, 50-period, 3-phase alternator supplied with cooled air from a closed-circuit air cooler installed immediately below in the concrete foundations, and the steam, after being condensed, is passed to the boilers on what is known as the "closed feed" system; a Prache and Bouillon automatic self-clean-

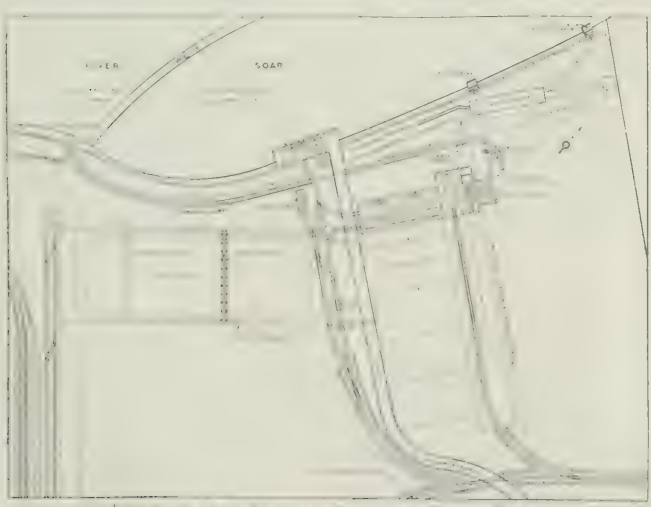


Fig. 6.—Leicester Distributing Section Site.

feed, consisting of an automatic self-cleaning double condenser, pre-heater, thermo-compressor, accessories, and the necessary electrically-driven pumps. The condenser, as well as its auxiliary pumps, was supplied by Messrs. W. H. Allen, Son & Co., Ltd., and contains 6,030 brass tubes each $\frac{3}{4}$ in. in diameter and 15 ft. long.

The circulating water is passed through disk-type self-cleaning water screens manufactured by Messrs. F. W. Brackett & Co., Ltd. Each of the two screens is capable of dealing with two and a-half million gallons of water per hour, and is complete with the necessary pumps for producing the jets of water for cleaning. The capacity of this and the coal-handling plant is sufficient for a further 10,000-kW generating set when installed.

The whole of the high-pressure switchgear is in a separate building, and the oil switches are operated by electrical means from the control room, fig. 2, in an annexe to and overlooking the turbine room. The e.h.p. switches are arranged in separate cubicles, each provided with a pair of iron doors in the external walls of the building through which alone access can be obtained.

The whole of the switchgear was supplied by the

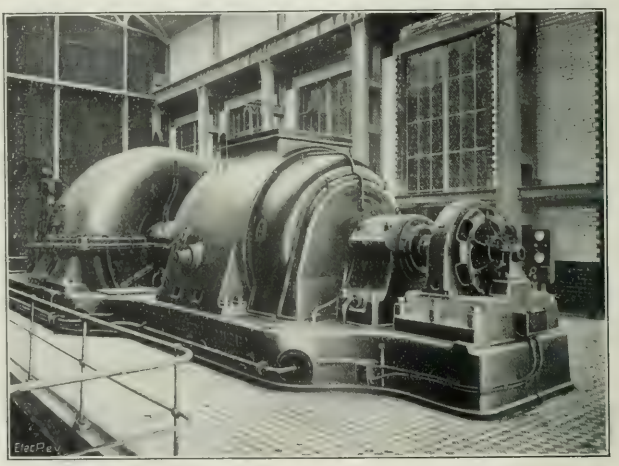


Fig. 5.—English Electric 10,000-kW Turbo-Generator.

English Electric Co. The new station, which has cost nearly £500,000, may ultimately constitute an important link in the general scheme of electricity supply for the East Midlands Electricity District, the idea having been propounded (although nothing upon that score has been yet definitely settled) that a connection may with advantage be established between Leicester, Derby, Nottingham, and other towns, the whole matter being now under review by an Advisory Committee. At Derby important works have been quite recently completed, and although the larger project which is now in progress in Nottingham cannot possibly be finished for a considerable time, substantial progress in the matter is being made in the metropolis of the lace industry.

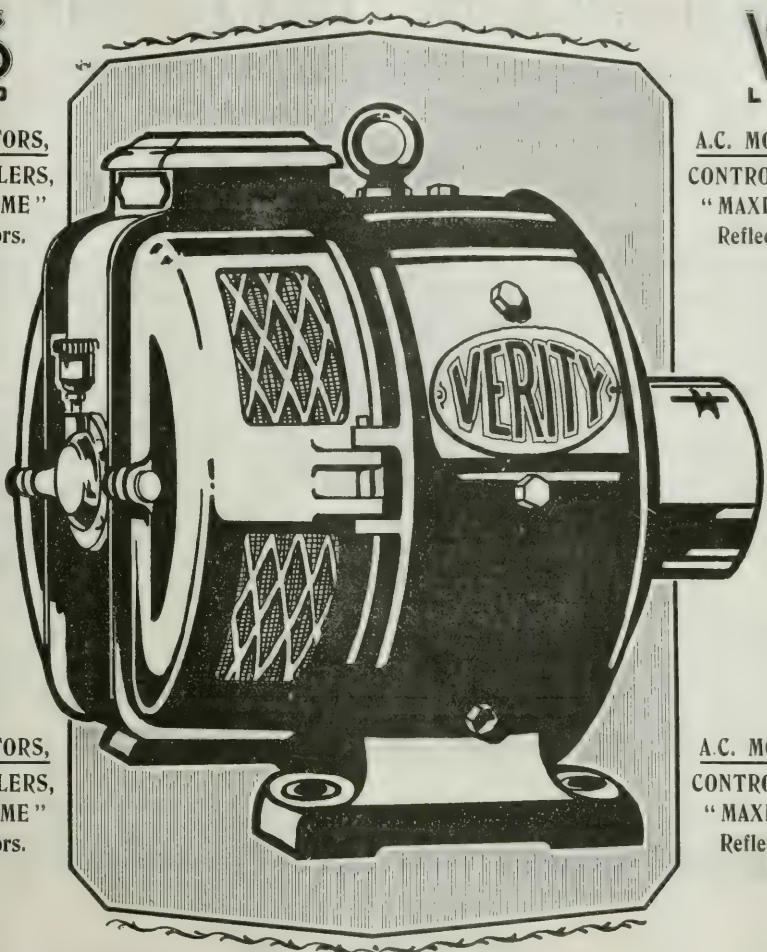
There was a large and representative gathering at the opening ceremony, among the visitors being Ald. E. Huntsman, chairman of the Joint Electricity Board of the East Midlands Electricity District. Ald. E. Flint, chairman of the Electricity Committee.

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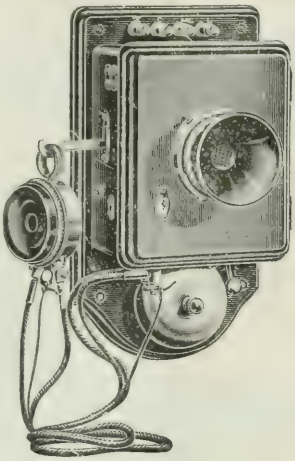
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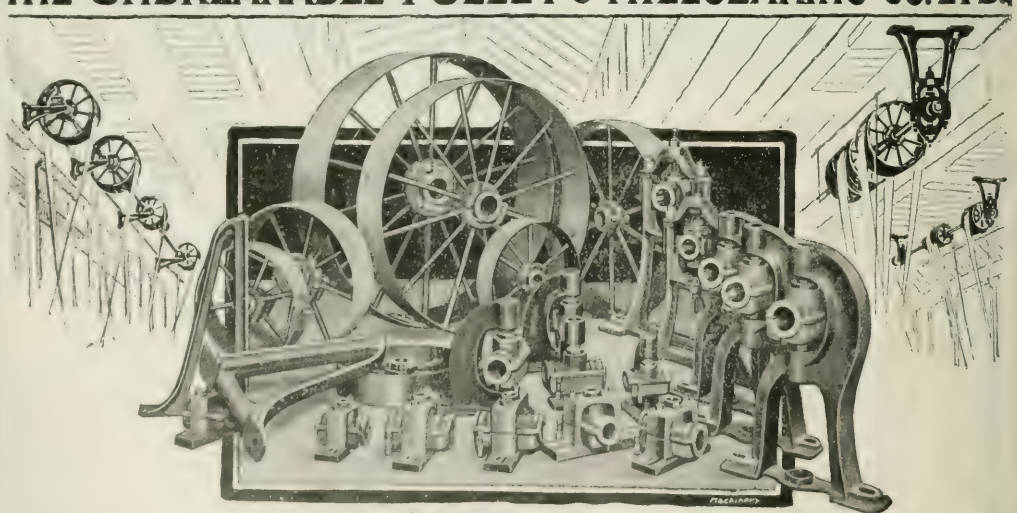
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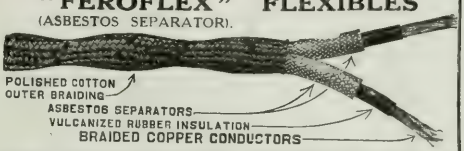
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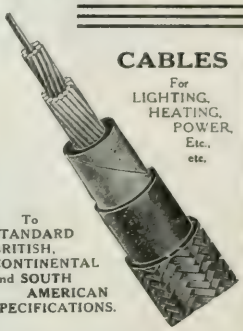
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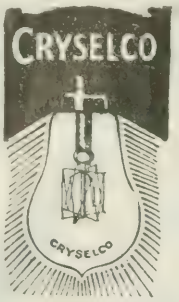
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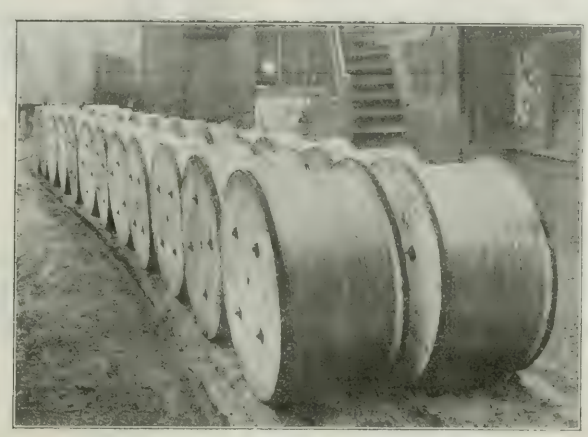
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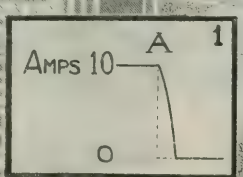
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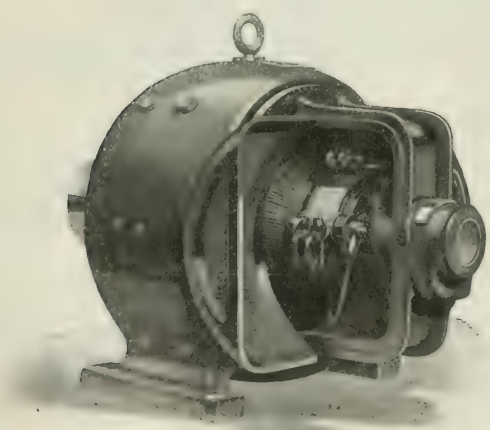
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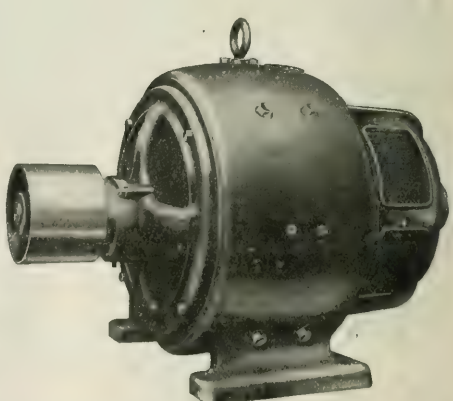
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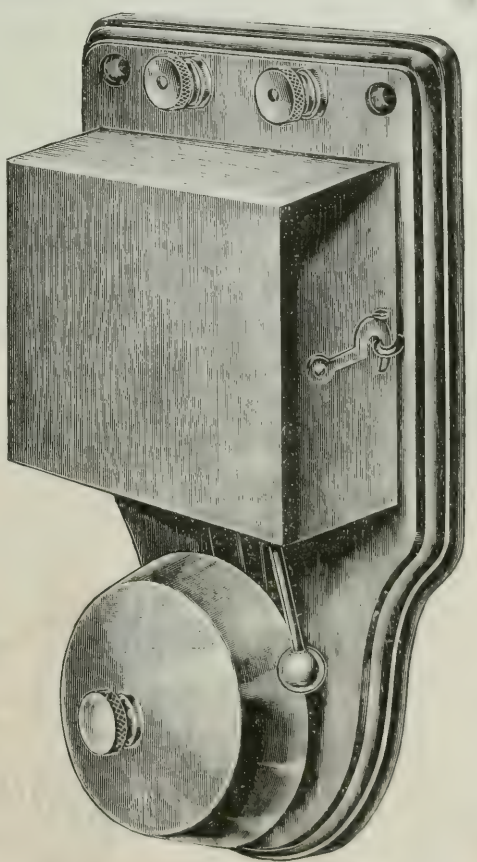
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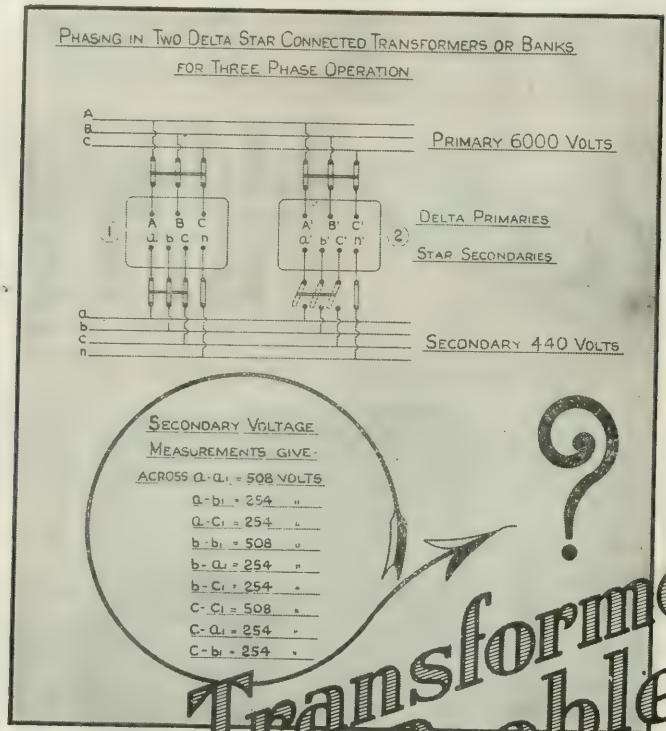
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One of the "J & P" pages



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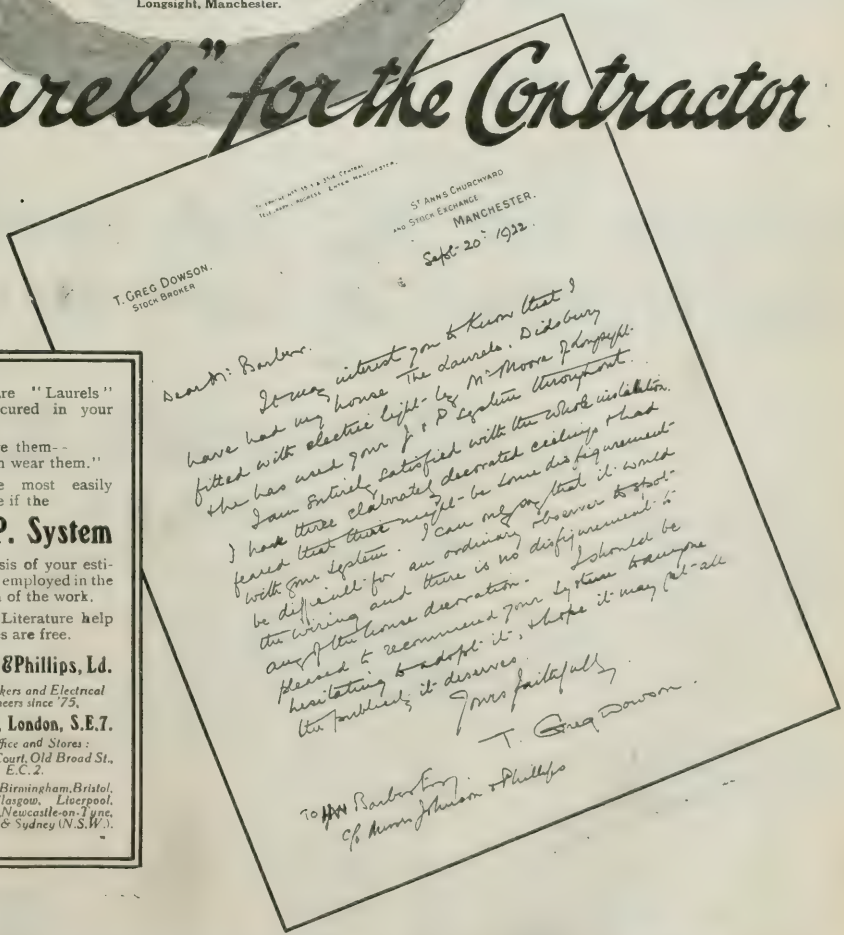
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J. & P. SYSTEM,
by Mr. R. Moore, 868, Stockport Road,
Longsight, Manchester.

"Laurels" for the Contractor


T. GREG DOWSON.
STOCK BROKER

St Ann's Churchyard
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Sept. 20th 1922.

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Yours faithfully
T. Greg Dowson.

To H.W. Barlow Esq
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"Wire them—
then wear them."

They are most easily attainable if the

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is the basis of your estimate and employed in the execution of the work.

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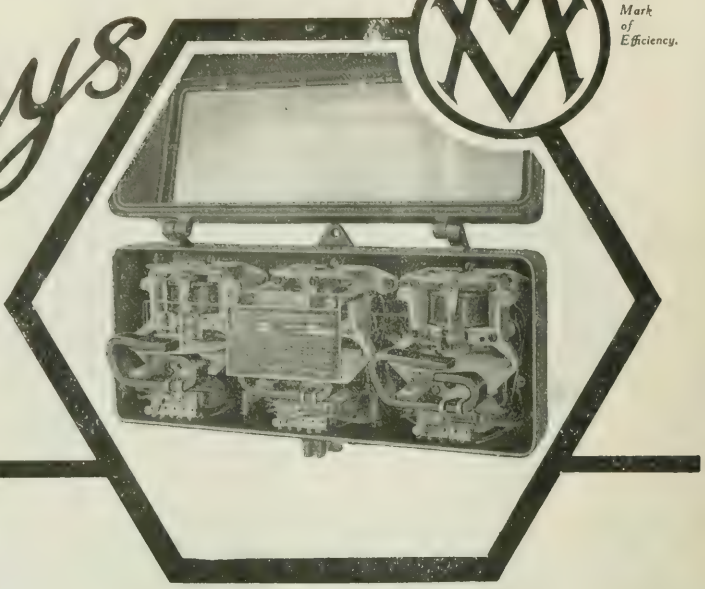
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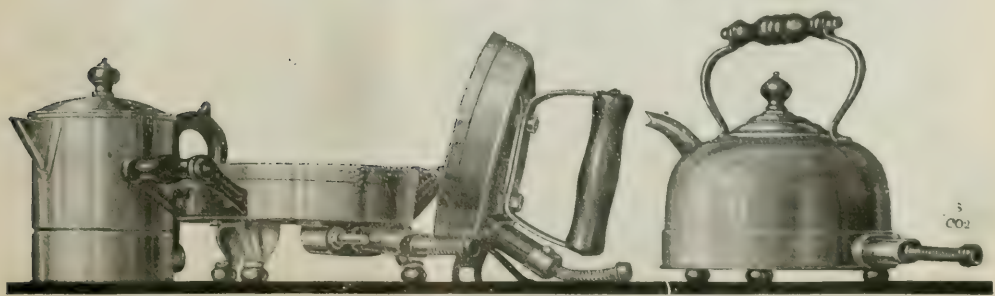
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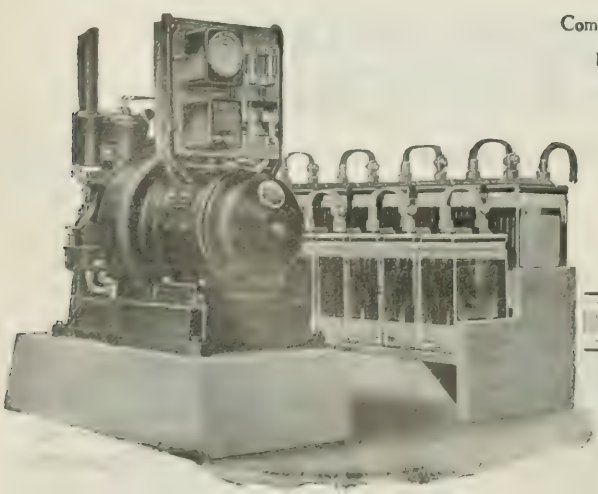
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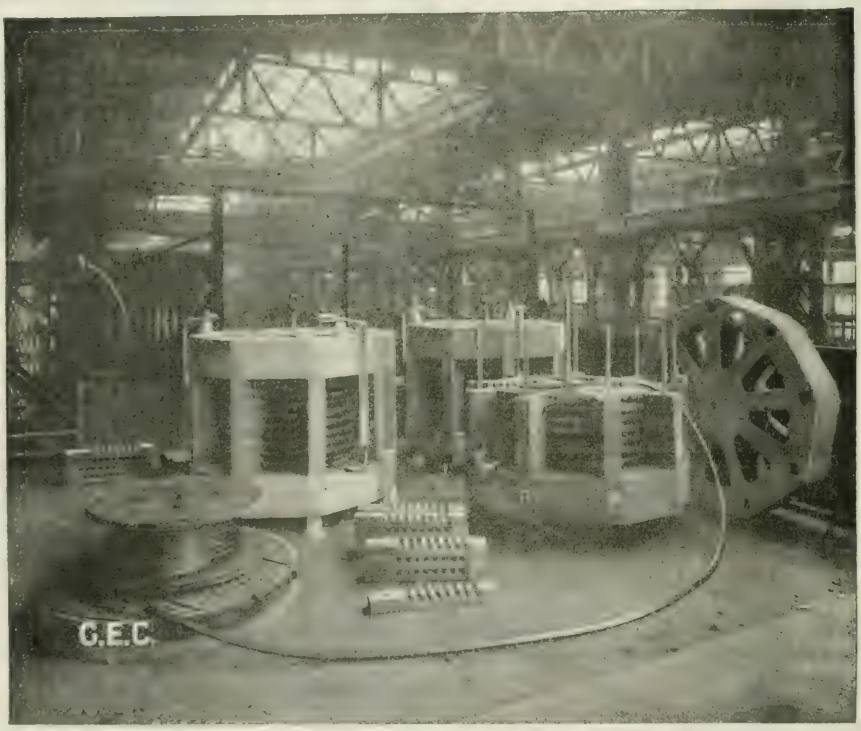
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WANTED immediately, for Thursday evenings, an Instructor in Electrical Installation and Wiring.

Salary at the rate of 10s. per hour for the first two hours, and at the rate of 5s. per hour for any period exceeding two hours, together with travelling expenses.

Applications, stating age, present occupation, qualifications, teaching and trade experience, and accompanied by copies of testimonials, to be forwarded to the Technical Institute, Kingston Hall Road, Kingston-on-Thames.

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COMPETENT Fitter-Driver wanted, used to Robey semi-Diesel oil engines, for small power station, South coast. —Apply, stating age, experience, wages required, and enclose copies of testimonials, to 2576, Electrical Review, 4, Ludgate Hill, London.

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Five thousand Carbons.

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Every Machine in Our Own Stock.

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Two 3 h.p., 955 revs., squirrel cage, B.T.H.
One 3 h.p., 565 revs., squirrel cage, Westinghouse.
One 5 h.p., 960 revs., squirrel cage, Westinghouse.
One 5 h.p., 475 revs., squirrel cage, Westinghouse.
One 6 h.p., 2,850 revs., squirrel cage, Fuller.
Five 6 h.p., 1,460 revs., squirrel cage, G.E.C.
Four 6 h.p., 950 revs., slip ring, Westinghouse
Ten 7½ h.p., 1,440 revs., slip ring, E.C.C.
Five 7½ h.p., 1,460 revs., squirrel cage, G.E.C.
One 7½ h.p., 565 revs., squirrel cage, Westinghouse.
One 8½ h.p., 960 revs., slip ring, Brush.
One 9 h.p., 1,450 revs., squirrel cage, E.C.C.
One 10 h.p., 960 revs., slip ring, Brush.
One 10 h.p., 720 revs., slip ring, Crompton.
One 10 h.p., 720 revs., squirrel cage, Westinghouse.
One 12 h.p., 960 revs., slip ring, Brush.
Three 15 h.p., 960 revs., slip ring, Brush.
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Two 1½ h.p., 1,700 revs., shunt wound, G.E.C.
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One 45 h.p., 1,100 revs., shunt wound, Verity.
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Twelve 60 h.p., 600/900 revs., shunt wound, Royce.
Three 65 h.p., 700 revs., shunt wound, Laurence, Scott.
Twelve 70 h.p., 600 revs., shunt wound, Royce.
Two 80 h.p., 600 revs., compound wound, Siemens.
Two 100 h.p., 560 revs., shunt wound, Siemens.
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5-h.p. second-hand d.c. Motor (Cutting Bros.), 100 volts, 1,100 revs., £10.
60-h.p. Brook slip-ring Motor (new), 500 volts, 50 cycles, 480 revs., 3-phase, £140.
50-h.p. Brook slip-ring Motor (new), 200 volts, 50 cycles, 480 revs., 2-phase, £120.
90-h.p. Brook slip-ring Motor (new), 400/440 volts, 50 cycles, 580 revs., 3-phase, £150.
75-h.p. Brook slip-ring Motor (new), 400 volts, 50 cycles, 480 revs., 3-phase, £150.
50-h.p. Brook slip-ring Motor (new), 400 volts, 50 cycles, 580 revs., 2-phase, £120.
50-h.p. Brook slip-ring Motor (second-hand), 200/400 volts, 50 cycles, 720 revs., 2-phase, £100.
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2047, Electrical Review, 4, Ludgate Hill, London.

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One 1,500 kW, British Westinghouse, mixed pressure, 440 volts, 50 period, 3-phase, built in 1915, with Rotherham electrically-driven Jet Condenser.

One 1,000 kW Willans-Parsons-E.C.C., 6,600 or 3,300 volts, 50 period, 3-phase, with Surface Condensing Plant, complete.

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One 1,000 kW, mixed pressure, 550 volt, 50 period, 3-phase, with surface condensing plant.

One 1,000 kW, B.T.H.-Curtis Turbo Alternator, 180 lb. steam pressure, 440 volts, 50 cycles, 3 phase, 3,000 r.p.m., 1,640 amps., with Jet Condensers, by Mirrlees Watson.

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One 600 kW, Westinghouse Impulse Reaction type, 440 volts, d.c.

One 600 kW, mixed pressure, Parsons-Siemens, 230 volt, d.c.

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One 400 kW Westinghouse-Parsons, 440 volts, d.c.

One 200 kW, 220 volt, Belliss Turbo-Generator, with Surface Condensing Plant.

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Two 300 kW Belliss-A.E.G., 2,200 volts, 25 cycles, 3-phase.

One 250 kW Belliss-Silvertown, 440/500 volts.

One 250 kW Belliss-Silvertown, 460/520 volts.

One 200 kW Allen, 250 volts, shunt interpole.

One 175 kW Boveri, 250 volt, 50 period, 3-phase, single bearing.

One 175 kW Belliss-Ahmanna, 525 volt, 25 cycle, 3-phase.

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Three 120 kW Browett-Thomas, 480 volt, d.c.

One 120 kW, Browett-Dick, Kerr, 480 volt, d.c.

One 105 kW Howden-Laurence Scott, 110 volts.

Two 93 kW Belliss-Mather, Platt, 460/550 volts.

One 75 kW Belliss-Boveri, 250 volt, 50 period, 3-phase.

One 60 kW Browett-Thomas, 480 volt, d.c.

Two 52½ kW Howden-Laurence Scott, 110 volt, with spare armature.

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One 7.5 kW Belliss-Lancashire, 220 volt, d.c.

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One new 22 and 5 h.p., enclosed-ventilated, shunt interpole, 1,000 revs.

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440	10	1150	Baxendale.
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220	25	545	Phœnix.
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220	16	960	English Electric.
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MOTOR-Generator, by Newton Bros; motor 220 volts, 62 amps., 1,000 revs., rating cont.; generator, 90 volts, 90 amps., 1,000 revs., rating cont. Complete with Starter, Reducer, Voltmeter, and Ammeter. Condition new. £65, free on rail.—Dickson Brothers, Graham Street, Dundee, N.B. 8219

MOTORS.—One new 15-h.p. Electric Motor and Starter, 440 volts, 3-phase, 50 cycles, 940 r.p.m., squirrel cage, by British Westinghouse, Manchester. To be sold at low price to clear.—The Bute Works Supply Co., Ltd., Cymric Buildings, Cardiff. 2145

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TWO 11-kW, 220-volt, d.c. Generators, by Mawdsleys, 1,000 r.p.m., protected type, shunt wound, new 1916. Bargain.—Harry H. Gardam & Co., Ltd., Staines. 2314

TWO Allen Vertical enclosed high-speed Steam Engines, compound type; 75 h.p., cylinders 8 in. and 14 in. x 6½ in. stroke, 275/330 r.p.m. Real bargain.—Harry H. Gardam & Co., Ltd., Staines. 1754

1-KW Robey-Electromotors Steam Generating Set, 110 volts, compound wound; new condition; bargain.—Harry H. Gardam & Co., Ltd., Staines. 2312

10-KW Steam Generating Set, comprising Clarke-Chapman Engine, coupled direct to 110-volt, d.c. Dynamo; nearly new; bargain.—Harry H. Gardam & Co., Ltd., Staines. 2313

11 BRAND new, 230-volts, d.c., ½-h.p., 2,000 r.p.m. Motors, £5 each or £50 for the lot.—S. Jackson & Co., 55, Briggate, Shipley. 2517

20-KW, d.c. Generator, by E.C. Co., 850 r.p.m., 220 volts, Slide Rails and Pulley, compound wound, perfect condition, and as new. £60 f.o.r. Young, Windsor House, Shrewsbury. 8279

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26¼-KW Howden-B.E.P. Steam Generating Set, 110 volts, d.c., compound, h.s. Engine; a magnificent job: new 1915; bargain.—Harry H. Gardam & Co., Ltd., Staines. 2311

30-KW direct-coupled oil-driven Generating Set, comprising six-cylinder Oil Engine coupled to Mawdsley Dynamo, 220 volts, d.c., on heavy cast-iron base. Very low price.—Harry H. Gardam & Co., Ltd., Staines. 1756

41-B.H.P. "Ruston" Crude Oil Engine, electric-lighting type, single flywheel, all accessories, modern, low price. —Harry H. Gardam & Co., Ltd., Staines. 2315

75-KW Steam Generating Set, comprising high-speed compound steam Engine, coupled direct to 250-volts, d.c. Generator by The Electrical Co., Ltd., London; 290 r.p.m.; new condition; low price.—Harry H. Gardam & Co., Ltd., Staines. 2029

FOR SALE.—*Continued.*

80-V. 100-A. Dorman-E.C.C. Generating Set, complete, £95. —White, 140, Southwark Street. 8059

100-KW d.c. Generator, 500 V, direct coupled to Belliss and Morcom steam engine, available immediately for quick sale at bargain figure.—Richards, Stafford House, Trentham Road, Longton. 1

100-H.P., 3-phase, 50 periods, 400 volts, 290 r.p.m., slip-ring Motor, two bearing, half-coupling, new: £300. —E. P. I., Ltd., 2, Inner Temple, Dale Street, Liverpool. 1678

750-KW Belliss-Dick, Kerr, coupled Alternator Set, 2,200 volts, 50 periods, or could be rewound to suit client's requirements; first-class condition.—Harry H. Gardam and Co., Ltd., Staines. 292

1050-KW Turbo-Alternator Set, 6,000 volts, 50 cycles, 3-phase, complete with Contra-flo, surface-type condensing plant; any reasonable offer accepted, and plant in almost new condition throughout.—658, Electrical Review, 4, Ludgate Hill, London.

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A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone: Dalston 2278; Telegrams: "Frangible, Lowclap, London," buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Inquiries solicited. Established over 50 years. 7701

DELCO-Light Power Stand wanted, ¼ h.p., 32-volt motor on stand. Must be cheap.—Hawnt, 110, Colmore Row, Birmingham. 8268

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PLATINUM Scrap wanted for cash; highest market price given. Call, or parcel by post, prompt cash by return. —L. Stern, Rotunda Buildings, 5, Bold Street, Liverpool. 8276

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£20 per oz. given for Platinum Scrap, in large or small quantities. Call and be convinced before selling elsewhere. Parcels by post, prompt cash per return. The original firm.—The Depôt, 156, Charing Cross Road, London, W.C.2. 8275

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A COMPANY with a large wholesale electric business, with branches throughout the United Kingdom, is prepared to negotiate for Agencies for electrical goods of merit.—2476, Electrical Review, 4, Ludgate Hill, London.

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Specification No. 23/6—*Ash and Dust Extraction Plant.*

Charge: £2 2s. for the first two copies of tender form, conditions of contract, and specification complete. This charge will be returned on receipt of a *bona-fide* tender. A third or any further copies will be supplied for the sum of £1 1s. each, not returnable.

Preliminary Deposit: A preliminary deposit of £50 is required to be lodged with tender.

The Commission does not bind itself to accept the lowest or any tender.

Tenders, on prescribed form, properly endorsed, and addressed, must be delivered to the undersigned in Melbourne not later than 5 p.m. on March 7th, 1923.

R. LIDDELOW,
Secretary.

State Electricity Commission of Victoria,
Melbourne, Australia. 2487

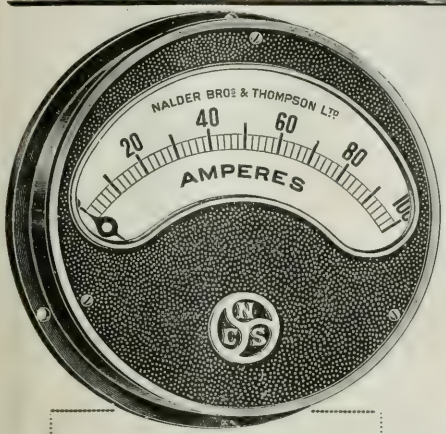


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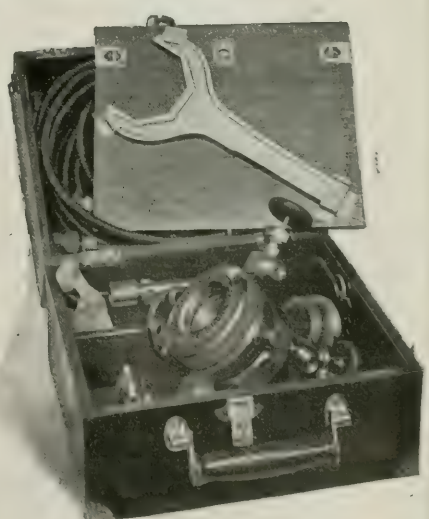
Telephone—Dalston 2365 (3 lines). *Codes—Western Union (Universal and Five Letter Editions) and B.E.A.M.A.* *Telegrams—"Occlude" Kinland, London.*

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Berry's Electric, Ltd., Oozells Street, Birmingham.
Berry's Electric, Ltd., 85-86, Newman St., Oxford St., London, W. 1.
Wm. McGeoch & Co., Ltd., 28, West Campbell St., Glasgow.
Robert Bowran & Co., Ltd., 4, St. Nicholas Buildings, Newcastle-on-Tyne.
Simpson, Baker & Co., 4, St. Augustine's Place, Bristol.
Berry's Electric, Ltd., Donegal Square South, Belfast.
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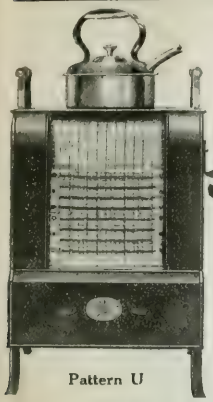
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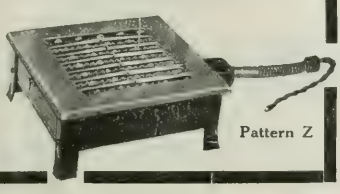
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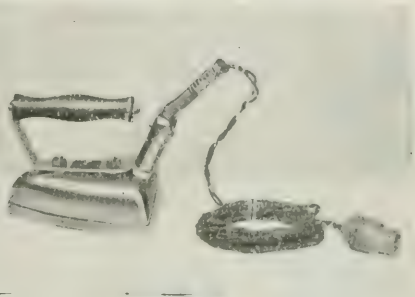
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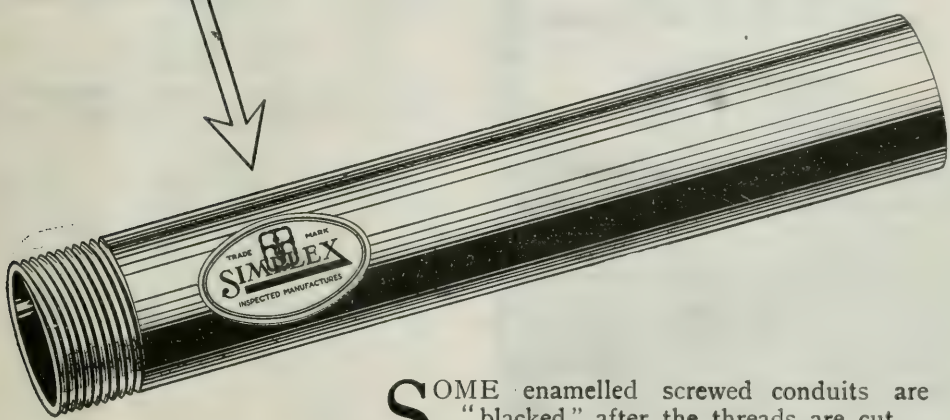
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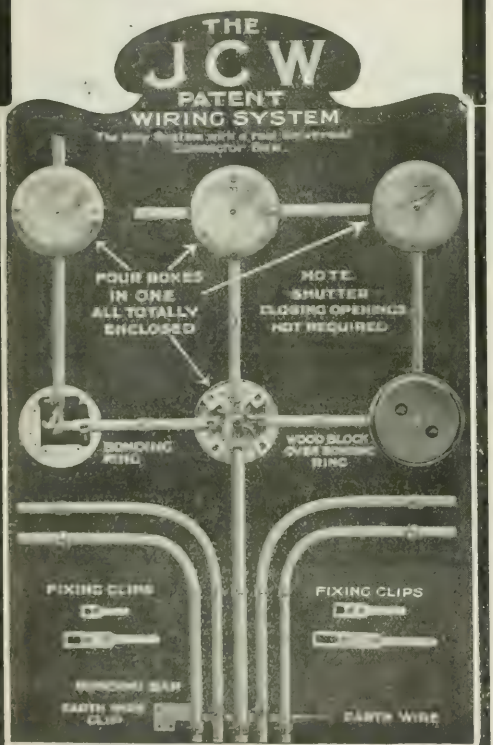
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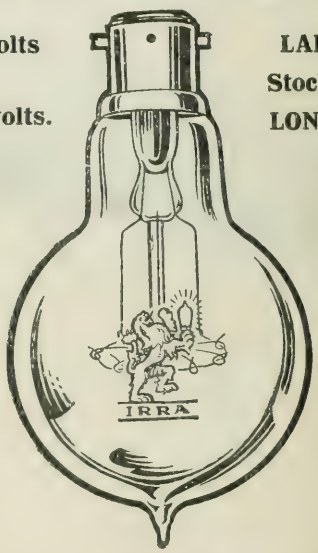
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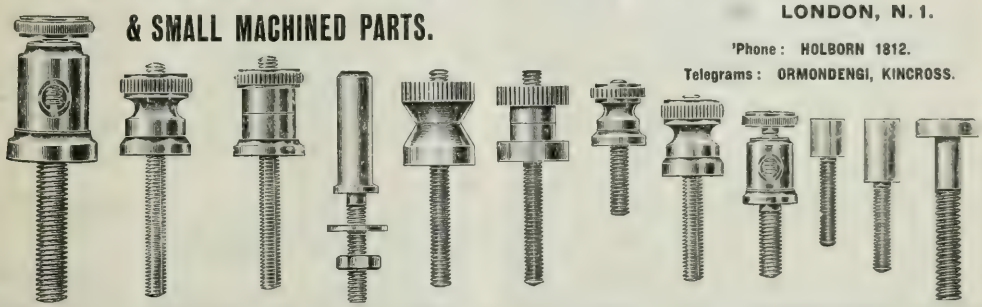
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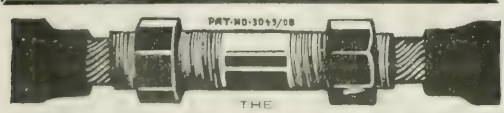
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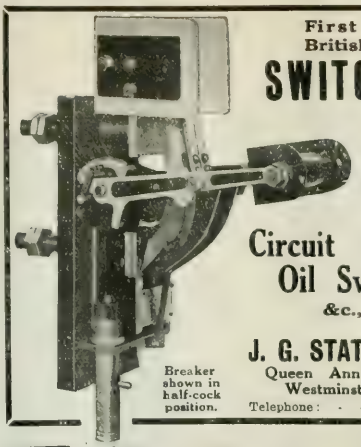
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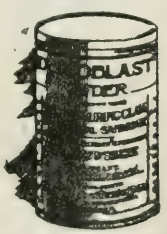
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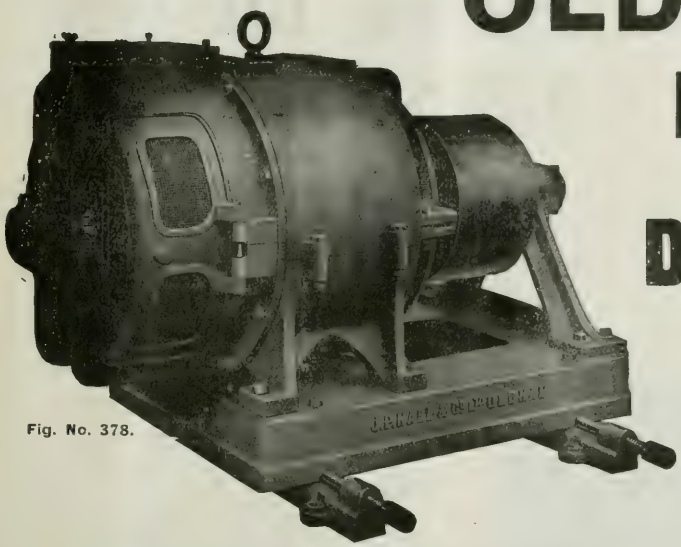


Fig. No. 378.

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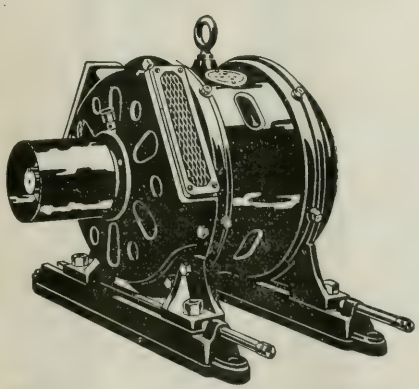
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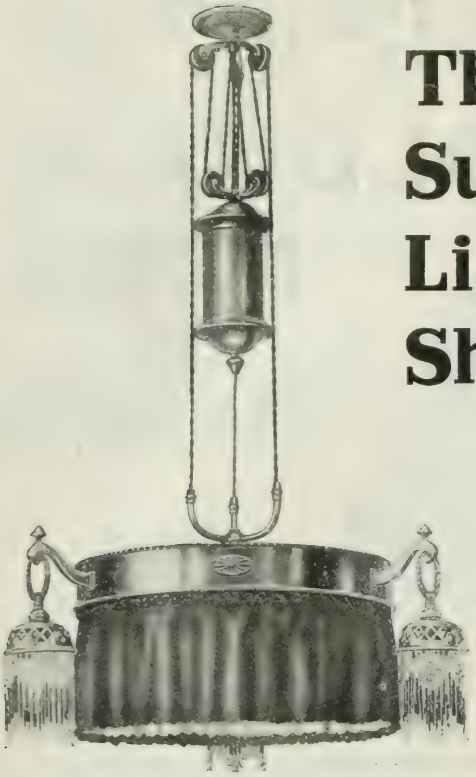
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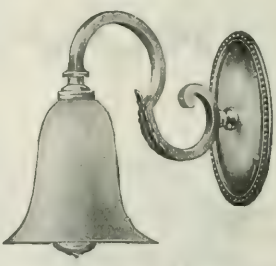
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on behalf of the Committee and the Corporation, thanked the Electricity Commissioners for the assistance which they had afforded. From its central position, and connected as it was with four main lines of railways, there was every reason to anticipate Leicester's further prosperity. The maximum power of the works in 1914 was 7,300 kW; this, he said, had risen to 24,250 kW. It used to entail 7½ lb. of coal to produce 1 kWh of electricity, but the amount of coal needed had been reduced to from 2½ to 3 lb., and might possibly be further reduced by the new plant. The domestic load, if properly treated, might become as great as the power load. The Committee had submitted a scheme to the Corporation with regard to this aspect of the matter and the Corporation had given it its strong approval.

Mr. T. R. Smith, City Electrical Engineer, referring to the visit which he paid to America, at the request of the Committee, observed that whilst the generating stations which he had the opportunity of inspecting there were necessarily all on a large scale, it was not in that respect they excelled, but in their elaborate system of boiler-house control, and in that sense an endeavour had been made to follow their example in the new Leicester works.

THE WALSALL ELECTRICITY UNDERTAKING.

INAUGURATION OF NEW PLANT.

The Walsall Corporation was granted a Provisional Order to supply electrical energy in 1890, and the undertaking was commenced in 1895.

In 1913-14, upon the advice of Mr. E. M. Lacey, M.I.E.E., the Corporation decided to provide a new generating station at Birchills, and to change over to a 6,600-volt, three-phase system. The work was commenced in 1914, at which date Mr. H. A. Howie, M.I.E.E., was appointed engineer and manager of the undertaking.



Fig. 1.—Birchills Generating Station, Walsall.

A popular feature was the application of a bulk supply two-part tariff for medium-pressure supplies to factories with a demand of not less than 20 kW. The method of measuring the maximum demand is of interest in that it is designed to give the consumer the benefit of a high power factor and *vice versa*. In 1921-2 the net number of consumers was 2,108, the total connections representing 14,948 kW, and the capacity of the station being 13,000 kW. The total cost per kWh sold, including capital charges, was 2.47d., the total amount

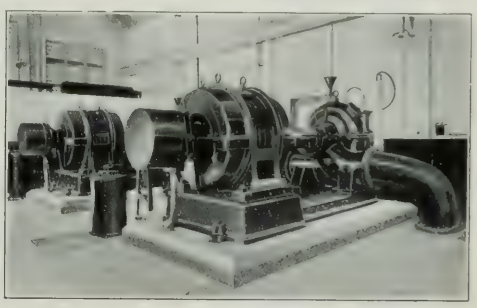


Fig. 2.—The Anson Pumping Station.

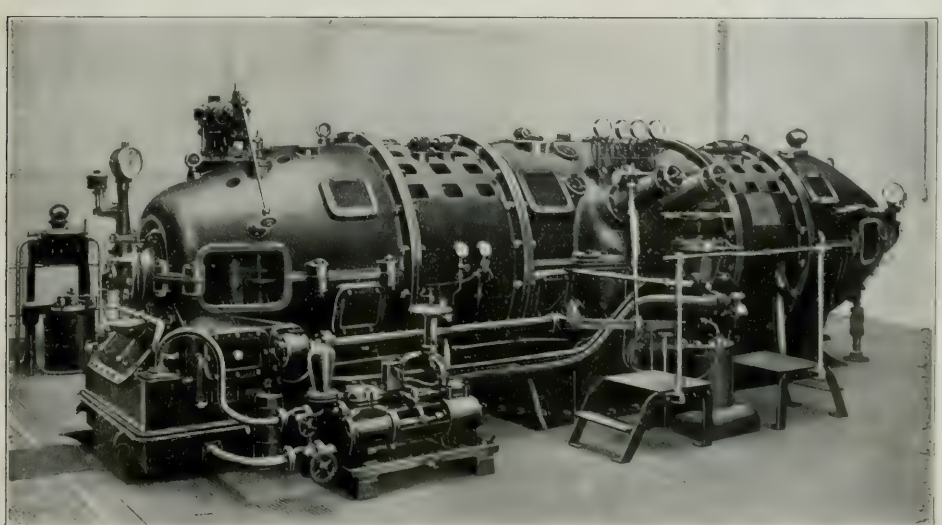


Fig. 3.—A 5,000-kW Brush-Ljungstrom Turbo-Alternator.

of energy sold being 8,095,885 kWh and the maximum load 4,050 kW.

In South Staffordshire there are no large rivers, so the Birchills station was erected on the Wyrley and Essington branch of the Birmingham Canal Co.'s system, and

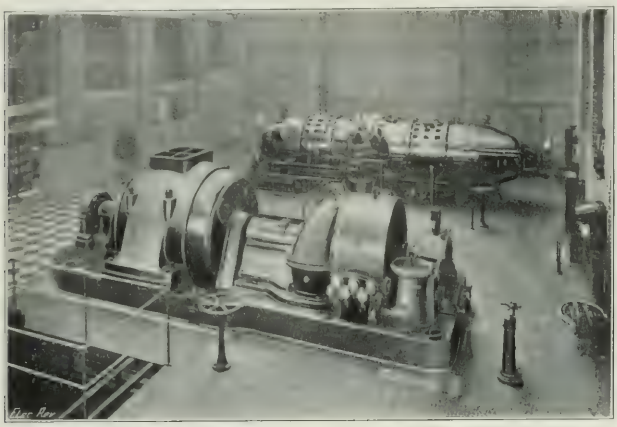


Fig. 4.—Turbo-Generator Room, Walsall.

the cooling water for condensing purposes has, up to a recent date, been taken from this canal. With this water the efficiency of the station was, as in shown by Table I, p. 981, considerably above the average, having regard to the conditions of load. However, in order to further increase the efficiency and to provide for the rapidly increasing load, provision was made for obtaining a considerably larger volume of cooling water by means of the Anson pumping scheme, which is an important feature of the extensions that were officially inaugurated on December 15th.

The canal is on what is called the Wolverhampton level, approximately 63 ft. above the level of the canal system through Walsall. In order to maintain the water at the Wolverhampton level, the Canal Co. has found it necessary to raise continuously a large quantity of water from the Walsall level. These pumping operations have, on occasions, interfered with the flow of the canal at Birchills so as to cause the high-temperature water from the condenser discharge to bank up to the inlet, thereby raising the temperature of the inlet water, and thus reducing the vacuum.

Therefore the Corporation undertook to raise from the lower canal level all the water required for the higher level canal, and for these services an annual sum is payable by the Canal Co. The agreement also provides for the Corporation to pass the whole of this water through the condensers at Birchills for a small annual contribution. The total volume of water necessary to maintain the higher canal level is approximately 550,000 gallons per hour, which is more than sufficient for present condensing water requirements at Birchills. In addition, the Canal Co. has provisionally agreed that the Corporation may, as the necessity arises, pump up to 1,200,000 gallons per hour.

Fig. 5 shows a portion of the canal system at Walsall. The pumping station has been erected in the position shown on the Anson branch of the low-level canal system, and the high-temperature water discharged at the high level can flow back to the low level, either *via* the Walsall or the Wolverhampton Canal systems, the distance being approximately three and a half miles in either direction. Only part of the water discharged through the condensers at Birchills to the high-level canal system is returned as described above to the Anson branch. A large quantity is entirely passed away from the Walsall canal system to the Wolverhampton canal [illegible] cold mine water to the low-level system.

The water flows to the pump house by way of an open concrete channel, at one end of which there is a circulating water screen supplied by Messrs. F. W. Brackett and Co., consisting of a perforated disk 20 ft. 4 in. in diameter, rotating at low speed, with cleaning jets, are arranged to wash away all débris collected on the mesh. The screen passes 1,500,000 gallons of water per hour.

The pumping station (fig. 2) consists of two Mather and Platt medium-lift circulating pumps, each capable of delivering 7,400 gallons of water per minute against a total head of 110 ft. when running at a speed of 980 r.p.m. Each pump is driven through a flexible coupling by a 330-h.p., three-phase, 50-period, 400-volt enclosed ventilated slip-ring induction Brush motor.

The transformers and e.h.p. switchgear at the pumping station were supplied by the Metropolitan-Vickers Co., Ltd., and the chlorinating plant by the Paterson Engineering Co.

The capacity of the Birchills station has been increased by the installation of a Brush-Ljungström turbo-alternator set (fig. 3), with a steam pressure of 180 lb. per sq. in. at the turbine stop valve, 245 deg. F. superheat, and exhausting into a vacuum of 28¾ in. The set is capable of an overload of 25 per cent., or



Fig. 5. The Canal System.

6,250 kW, for a period of two hours. The two alternators have a combined output of 5,000 kW at 6,600 volts, three-phase, 50 cycles, 0.8 p.f.

The turbine is equipped with an auxiliary steam-driven oil pump, fitted with a Mason regulator set so as

to bring the pump into operation when the oil pressure of the main pump falls below a predetermined value.

The Brush surface condenser has a cooling area of 12,000 sq. ft., a capacity of 58,500 lb. of exhaust steam per hour, is supplied with 7,400 gallons of cooling water per minute, and is capable of maintaining a vacuum of 28¾ in. when the cooling water enters at a temperature of 60 deg. F.

The condenser auxiliaries comprise a four-throw Brush-Edwards air pump driven by a three-phase, 365-volt, 50-period, enclosed-ventilated Brush induction motor rated at 42 h.p., and a lift pump, driven off the air-pump crankshaft, pumps the condensate to the hot-well.

Cooling air for the alternators is provided by a Keith, Blackman fan driven by a 50-h.p. Brush enclosed-ventilated induction motor. The air is drawn through a Cleworth-Wheal wet air filter which is driven by the fan motor through spur gearing. The switchgear, comprising one generator and three feeder panels, was supplied by Messrs. A. Reyrolle & Co.

Before the Anson pumping scheme was put into operation, official trials of the turbo-alternator were made on May 23rd, 1922. The specified conditions upon which the contractor's guarantee of steam consumption was based were:—

Steam pressure at stop valve	180 lb. per sq. in.
Steam temperature at stop valve ...	625 deg. F.
Vacuum, with cooling water at 60 deg. F.	28.75 in.

Owing to the temperature of the canal cooling water being, on the date of the test, somewhat higher than that stated above, the vacuum was lower than 28.75 in., but the steam temperature was higher. After correction for these variations, the result of the trial was as follows:—

Table I.

Load, kW	Vac., in.	Steam Consumption in lb. per kWh. Measured.	Corrected.	Guaranteed.
2,328	28.30	13.56	12.53	13.0
2,495	28.25	13.27	12.32	12.8
3,942	27.98	11.65	11.14	11.78
4,968	27.62	11.48	11.00	11.42
4,845	27.40	11.80	11.10	11.42

During the above series of tests, on loads ranging from 2,328 to 4,968 kW over a period of eight hours, the coal consumption was 2.26 lb. per kWh generated, the calorific value of the coal being 10,130 B.th.u. per lb. "as fired"; the thermal efficiency of the station was 14.85 per cent.

After the Anson pumping scheme was put into operation, further trials took place on November 22nd, 1922, and the following are the results obtained:—

Table II.

Load (average)	5,030 kW.
Steam pressure at turbine stop valve ...	166 lb. per sq. in.
Steam temperature at turbine stop valve	662 deg. F.
Vacuum (bar. 29.95 in.)	28.90 in.
Cooling water temperature:	
Condenser inlet	49 deg. F.
Condenser outlet	61 deg. F.
Condensate (average per hour)	52,100 lb.
Steam consumption (as measured) ...	10.36 lb. per kWh.

The test commenced at 10.30 a.m. and finished at 4.30 p.m., and during the trials the whole of the commercial load of the station was carried by the Brush-Ljungström set for a period of six hours. The load varied from 3,700 to 5,450 kW. The coal consumption was 1.92 lb. per kWh generated, its calorific value being 10,160 B.th.u. per lb. "as fired"; the thermal efficiency of the station was 17.49 per cent. No allowance on steam consumption was claimed by the makers for variation of load, and none is included in the above figures. The set has been in continuous operation since February, 1922. It was not overhauled or prepared for test prior to the trials being made.

As an indication of the performance of the plant over a weekly run, the actual recorded results for the weeks ending October 15th and November 5th, 1922, are given in Table III. They compare the performance before and after the Anson pumping scheme was brought into operation. During both weeks the Brush-Ljungström set only was running.

Table III.

	Week ending Oct. 15th	Week ending Nov. 5th
kWh generated	252,540	285,840
Maximum load	3,200 kW.	4,100 kW.
Load factor	47%	41.5%
Temperature of cooling water	78 deg. F.	47 deg. F.
Coal consumed	301 tons.	290 tons.
Calorific value of coal ...	10,050 B.th.u. per lb.	9,910 B.th.u. per lb.
Coal per kWh generated ...	2.67 lb.	2.35 lb.
Thermal efficiency ...	12.7%	14.6%

It will be observed that the station was operating on a higher maximum load, but a lower load factor during the week ending November 5th than it was during the week ending October 15th. It may be thought that the excellent results are due to the high load factors. Therefore, to avoid any such misconception it may be pointed out that the annual load factor of the Birchills station on the same basis is about 30 per cent., and that in order to attain this figure, under the varying conditions of general electricity supply, the weekly load factors must necessarily vary between 40 and 50 per cent. However, the records show that under very similar load conditions the thermal efficiency of the station was 12.7 per cent. for the week ending October 15th, 1922, and that after the Anson pumping station was put into operation the efficiency improved to 14.6 per cent. in the week ending November 5th, 1922. This greatly improved efficiency is in itself a sufficient indication of the success of the scheme.

Since the inauguration of the Birchills station, a steady extension of the 6,600-volt, three-phase feeders, and also 4-core, 400-volt distributors, has been carried on, and a gradual change-over of distribution from d.c. to a.c. has been taking place. Many large works in the borough are now taking a supply from the e.h.p. mains, which have also been extended outside the borough, under Fringe Orders, in order to supply various collieries.

It may be mentioned that the whole of the e.h.p. mains have been supplied and laid by Callender's Cable and Construction Co., Ltd., and an interesting fact is that the 3,300-volt cables laid by this company some thirteen years ago, which worked at that pressure for some five or six years, have successfully withstood a working pressure of 6,600 volts during the past seven years without breakdown or trouble, although they were originally designed for the lower pressure.

In conclusion, it should be pointed out that the above-mentioned trials are of considerable value, inasmuch as the details are the first that have been published of this particular size and make of machine, and we are indebted to both Mr. Howie and the Brush Electrical Engineering Co., Ltd., for permitting them to be made public.

The extensions were inaugurated on December 15th by Mr. W. J. Talbot, ex-chairman of the Corporation Electricity Supply Committee and managing director of the Talbot Stead Tube Co.

Mr. W. T. Comer (vice-chairman of the Electricity Supply Committee) mentioned that the working costs had been brought down to the lowest pre-war figures. The total capital expenditure on the undertaking had been £355,366, and the outstanding debt was £299,310, in respect of which they had £36,116 in sinking fund.

Mr. E. M. Lacey (consulting engineer) said that in 1913 Walsall had an obsolete power station, obsolete plant, and an obsolete transmission system. The total capacity of the plant was only 2,500 kW, and the coal consumption amounted to 13 or 14 lb. per kWh generated. The plant capacity was now 13,000 kW, whilst the coal consumption had decreased to less than 2½ lb. per kWh generated. He anticipated that in the future working costs, including capital charges, would not exceed about 0.6d. per kWh. The total cost of the power station, after including the price of two more boilers, which were still required, would be between £13 and £14 per kW.

LIGHTING AND POWER NOTES.

(*Continued from page 976.*)

Canada.—QUEBEC.—The Montreal correspondent of the *Daily Telegraph*, says that the Premier (Mr Taschereau), of the Province of Quebec, recently announced the early commencement of one of the greatest hydro-electric works in the history of Quebec Province, including the damming of the discharge from Lake Saint John head-waters, on the Saguenay River, which would ultimately develop over 1,000,000 horse-power. Mr. Taschereau stated that the work of constructing the dam would be started as soon as possible, and the first part of the project would be completed within two or three years, at a cost of $12,000,000, for developing 200,000 h.p., while the rest of the scheme would be completed later, eventually producing 1,000,000 h.p. Mr. Taschereau, in explaining the economic advantages to the Province of Quebec of this large electrical development, stated that the production of the first 200,000 h.p. would mean the saving to the firm of Price Brothers, Quebec, alone of $1,500,000 annually spent on coal.

BRITISH COLUMBIA.—The B. C. Electric Railway Co. is to erect an automatic sub-station this winter for the regulation of electrical energy distributed to Greater Vancouver, at a cost of $65,000.—*Reuter's Trade Service* (Vancouver).

Cardiff.—NEW PLANT.—Mr. Morley New, the city engineer, recently presented a report to the Electricity Committee with regard to the proposed installation of new plant in order to meet future requirements. The report involved an estimated capital expenditure of £42,410 for new plant, extensions, &c., at the Roath power station and the Hayes sub-station, and the [illegible] cooling tower with a capacity of 300,000 gallons per hour. This report was supplemented by a statement that the Great Western Railway Co. had definitely decided to install electrically-driven hydraulic pumps, and the communication of the chief electrical engineer of the company was looked upon, at his request, as an undertaking on the part of the company to take supplies from the Corporation for the plant. The proposal was to install 2,810 h.p., with the possibility of a further 650 h.p. shortly. Eventually the Chairman (Mr. G. Gough) and Messrs. E. Curran, F. Jones, and C. H. McCale were appointed as a special committee to report without delay on the whole question, in order that decisions might be taken by the City Council at the February meeting.

Carlisle.—NEW POWER STATION.—The City Council has decided to erect a new power station as the present undertaking is unable to meet the increased demands for electricity. The scheme was first considered three years ago, when the estimated cost of erecting the station was £200,000. Owing to [illegible] in the cost of building, &c., it is now estimated that the cost will be £150,000.

Clacton-on-Sea.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £8,000 for the installation of a Diesel engine and generator, together with [illegible] plant.

Continental.—RUSSIA.—A movement is on foot to extend the Shaturek electricity works near Moscow. New district stations, running on local peat fuel, to economise petroleum, are required to meet the growing demand of Moscow for electricity.

BAVARIA.—The Government has been voted a credit of 10 milliard marks for the construction of power stations. The total cost will be 21 milliard marks.

Denny (Stirlingshire). — PRICE REDUCTION.—The Town Council is reducing the charge for electricity for lighting from 7½d. to 7d. per kWh.

East Midlands Electricity District.—The scheme for the reorganisation of the supply of electricity in the above area previously submitted by the Conference of Municipal Electrical Undertakers has been modified, and the Commissioners give notice that they will hold a local inquiry at the Guildhall, Nottingham, on Tuesday January 23rd, 1923, at 10.30 a.m., and the following days, with reference to the modified scheme which provides for the formation of an Advisory Committee.

Copies of the said modified scheme may be obtained from W. J. Board, Esq., Guildhall, Nottingham, at a cost of 10s. each, and supplementary particulars in support of the scheme may also be obtained at a cost of 30s. each on application at the same address.

Irish Free State.—SWORDS (CO. DUBLIN).—The District Council has approved of a scheme for a public electricity supply, and has ordered application to be made for an Order and for sanction to a loan of £[illegible] to meet the expenditure.

London.—ST. MARYLEBONE.—*Price Reductions.*—As, in spite of reductions in charges already made, the year's net profits from the electricity undertaking is likely to be in excess of the need of the undertaking, the Electricity Supply Committee has drawn up a revised tariff, to take effect as from the end of the September quarter. This includes the following reductions: Lighting (flat rate), from 7d. to 6½d. per kWh; heating and cooking, from 1½d. to 1¼d. per kWh; power (maximum demand system), secondary charge reduced from 1½d. to 1d. per kWh; long-term agreements (business), kW charge increment reduced from 50 to 25 per cent., and secondary charges of 1½d., 1¼d., and 1d. reduced to 1¼d., ¼d., and ¾d. per kWh. These decreases will bring all charges down to very near the pre-war level.

BATTERSEA.—The Electricity Committee has recommended that the following reductions be made in the charges for electricity, as from the next reading of the meters:—Lighting, from 6d. to 5½d. per kWh; power (including heating and cooking), from 1¾d. to 1½d. per kWh.

Northern Ireland.—LONDONDERRY.—*Electricity Agreement.*—A satisfactory agreement has been reached between the Corporation and the North of Ireland Shipbuilding Co. on the question of charges for electric power, and the company has served notice that it will require a supply early in January.

Portpatrick (Wigtonshire). — PROPOSED ELECTRICITY SCHEME.—At a meeting of householders to consider a scheme for lighting the district by means of wind-driven plant, a representative of the Glasgow Electrical Engineering Co. explained the scheme. The estimated minimum charge for 10 lights would be £8 per consumer per annum. The representatives of the district are to communicate with the company.

Radcliffe.—LOAN SANCTIONED.—The Electricity Commission has sanctioned the borrowing of £4,435 for the provision of transformers, &c., at the Council's electricity works, in connection with a supply of electricity in bulk from the Lancashire Electric Power Co.

Rochester and Chatham.—PRICE REDUCTIONS.—The Kent Electric Power Co. is making the following reductions in the price of electricity from January 1st: For lighting, from 10d. to 9d. per kWh for the first 400 kWh per quarter and 7½d. beyond; for power from 3½ to 3d. per kWh.

South Africa.—JOHANNESBURG.—The Tramways and Lighting Committee proposes to accept the offer of the Victoria Falls Power Co. for the supply of electrical energy for a period of five years.

GRAHAMSTOWN.—The scheme for lighting the town by electricity has been put in hand, and it is anticipated that it will be completed by June, 1924. The estimated cost of carrying out the scheme is £33,000.

Torquay.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £20,500 for laying mains from the power station at Newton Abbot to Torquay.

United States.—NEW YORK.—In a recent speech in New York, Dr. C. P. Steinmetz urged the full development of the State's water-power resources. He said that the present total power consumption in New York State was 5,000,000 h.p., and of this only a third was produced by water-power. He estimated that at least 4,000,000 h.p. remained undeveloped, and compared the State with California, where nine-tenths of the power used was hydro-electric.

Vale of Leven.—ELECTRICITY SUPPLY.—The Dumbarton County Council is considering a request for supplying the district with electricity. The demand would be met by the Strathclyde Electricity Co.

Walsall.—MAINS EXTENSIONS.—The Electricity Committee has recommended to the Town Council that the mains be extended at a cost of £9,250, in order to provide work for the unemployed.

INFIRMARY LIGHTING.—Mr. V. Delebecque has been asked by the Guardians to prepare a specification for the electric lighting of the infirmary.

Weardale.—ELECTRICITY SUPPLY.—The Rural District Council has approved the proposal of the Electricity Committee for lighting the town by electricity.

Wigan.—YEAR'S WORKING.—There was a net profit on the electricity undertaking for the past year of £6,196, as compared with £12,897 for the year 1920-21.

Weymouth.—PRICE REDUCTIONS.—The Town Council has reduced the charge for electricity for lighting from 9d. to 8d. per kWh; for power, from 3d. to 2½d. per kWh; for heating, from 3d. to 2½d. per kWh; and for public lighting, from 4.8d. to 4d. per kWh.

Wimbledon.—RAPID EXPANSION.—The chief electrical engineer (Mr. A. E. McKenzie) has drawn our attention to the rapidly-increasing use of electricity in the borough. During the period from March 31st to November 30th this year no fewer than 980 new consumers were connected, apart from a waiting list of 300. The present rate of connection is from 75 to 80 a week, which is claimed to be a record for an undertaking of this size—about 4,800 kW. The output during the period mentioned was 4,302,210 kWh—an increase of 1,272,663 when compared with the equivalent period of 1921. The growing popularity of electricity is attributed to the low charges.

Woking.—Price Reduction.—The Electric Supply Co. has reduced the charge for electricity for lighting from 10d. to 9d. per kWh, as from the end of the Christmas quarter.

Yeovil.—Special Order.—The Yeovil Electric Light and Power Co., Ltd., has applied to the Electricity Commissioners for authority to generate and distribute electricity for all purposes within the borough.

TRAMWAY AND RAILWAY NOTES.

Northern Ireland.—Belfast.—The City Council has decided to lay a new tramway line connecting Queen's Road tramway, *via* Hamilton Road and Dee Street Bridge, with Connswater, at an estimated cost of £49,000.

Blackpool.—Year's Working.—The annual report of the general manager of the Corporation tramways (Mr. Charles Furness) for the year ended March 31st last records an income of £261,980, comparing with £284,622 in the preceding year. Working expenses amounted to £204,882, as against £240,299, leaving a gross profit of £57,098 (£44,323). Capital charges increased from £44,179 to £50,965, and the net result was therefore a profit of £6,133, considerably more than that of the previous year—£144. Of this balance £4,000 was transferred to reserve and £1,236 carried forward. A total of £87,942 was spent on capital account during the year, and practically all of this was devoted to reconstruction of the permanent way. The number of passengers carried fell from 35,701,693 to 31,986,171 and the car-mileage from 2,580,830 to 2,254,520.

Continental.—Germany.—According to the *Svensk Trafiktidning*, a telephone arrangement has been fitted on the high- and low-level railway at Hamburg, whereby the name of the next station is announced in each of the coaches before the train's arrival. This is the first use of this arrangement in Europe, although similar arrangements have been in vogue on many American lines for some time.

Haslingden.—Fares.—The Corporation has received notice from the Ministry of Transport that the increased tramway fares sanctioned in 1920 are ineffective after February 15th. It has been decided to ask the Ministry to allow the present fares to continue in force and to approve of penny stages.

India.—Bombay.—Sanction for the electrification of the following sections of the G. I. P. Railway has been given:—Victoria terminus to Thana, Victoria terminus to Kurla and to Bandra *via* the Harbour branch of the Mahim Chord. The cost of the electrification of the whole suburban system of the G. I. P. Railway will amount to Rs.260 lacs.—*Reuter's Trade Service* (Bombay).

Calcutta.—A dispute has occurred regarding the dismissal of an employé of the tramway company, and the cars ceased running on December 21st.

Uruguay.—Montevideo.—The Uruguayan Chamber of Representatives has before it a project for the electrification of the Northern tramways. If the project becomes law, the Government would be authorised to issue mortgage bonds on the undertaking to the extent of 3,500,000 dollars, Uruguayan gold, to be spent on the electrification.—*Railway Gazette.*

TELEGRAPH AND TELEPHONE NOTES.

Afghanistan.—Long-Distance Telephony.—The Ameer of Afghanistan is negotiating with the Government of India for the installation of a long-distance telephone service between Peshawar and Kabul. The telegraph line from Kabul to Jallalabad has been completed, and connection between Jallalabad and Peshawar is expected to be effected by the middle of February.—*Reuter.*

China.—New Radio Stations.—The two radio stations, with accessories, contracted for by the Chinese Government with the Marconi (China) Co., Ltd., in October last are in course of erection at Hami (Sinkiang) and Lanchow (Kansu). The contractors are already in receipt of the material required, and have despatched four experts and engineers to Hami to supervise the installation, and another four engineers to Lanchow to conduct preliminary surveys.

Cuba.—Reduced Cable Rates.—The Western Union Telegraph Co. has extended its night and week-end cable letter services to all parts of Cuba. Plain language messages can now be sent to the island at reduced charges.—*Westminster Gazette.*

Germany.—Radio Telegraphy.—A radio express telegraph service has been opened between Berlin and Budapest. This is said to be the first occasion upon which Siemens telegraph instruments giving a speed of about one hundred words per minute have been employed in an international radio service. —*The Times.*

New Zealand.—Telegraph Rates.—Reductions totalling £300,000 yearly are announced in postal and telegraph charges. From February 1st to send 12 words by telegram will cost 3d. instead of 1s.—*Financial Times.*

South Africa.—Automatic Telephones.—In connection with the Post Office construction grant last session of £400,000 and the Siemens' contracts for automatic switchboards at Maritzburg and Port Elizabeth, it is now proposed to extend the automatic telephone installations to rural and suburban districts, the small community experimental exchanges having been a marked success. It is probable that the Government's telephonic developments will be carried on for the next two or three years, and this must involve a large number of additional contracts.—*Reuter's Trade Service* (Capetown).

Storm Damage.—The gale on December 19th and 20th did much damage to telegraph and telephone lines; many wires in the Birmingham, Cambridge, Canterbury, Cardiff, Liverpool, Leeds, Maidstone, Manchester, Oxford, and Sheffield circuits were blown down, but no poles were reported down. Serious damage was also reported from the Continent, French and Italian circuits being considerably affected, while the Brussels and Dunkirk services were entirely dislocated.—*Evening News.*

Venezuela.—Telegraph Service.—A report by Mr. H. H. D. Beaumont, H.B.M. Minister, Caracas, dated September, 1922, on the economic and financial conditions of Venezuela discloses the fact that during 1921 the telegraph system was extended *via* Nutrias and Bruzual to El Amparo on the Colombian frontier and five new stations were opened: at San Lorenzo, Lagunillas, Santa Rita, Bruzual, and Palmarito. The total length of telegraph wire is 10,049 kilometres, with 218 stations. Radio stations now exist at Barquisimeto, 400 miles range; La Guaira, 400 miles range; Caracas, 300 miles range; Maracaibo, 300 miles range; Maracay, 300 miles range; Porlamar, 200 miles range; Puerto Cabello, 300 miles range; and San Cristobal, 400 miles range.

During the year a radio service with Trinidad (and thence by cable to Europe) was opened, the charge by the through rate to London being less than that charged by the French Cable Co. The latter, in anticipation perhaps of this competition, extended its service of deferred telegrams on November 1st, 1921, to the West Indies and Venezuela. A radio service between Venezuela and New York, *via* San Martin, has been established. Revenue from telegraphs has increased from Bs.468,257 in 1916-17 to Bs.1,010,364 in 1919-20, and Bs.1,131,754 in 1920-21. Expenditure in the last year was Bs.2,330,122, showing a deficit of nearly £50,000. Glass insulators of the type used in the U.S.A. are now being everywhere substituted for porcelain, as being free from certain inconveniences caused by the use of the latter, and much cheaper (less than one bolivar, compared with 60 cents each paid for porcelain insulators).

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—March 7th. Electricity Commissioners. Ash and dust extraction plant. (December 15th.)

January 24th. Victorian Railway Department. Insulated copper wire.*

January 31st. Three-phase a.c. motors, starting apparatus, and accessories for the Newport workshops (17 enclosed squirrel-cage motor sets, 2 h.p. to 20 h.p., two enclosed slip-ring motor sets, 25 h.p. to 30 h.p.).*

January 31st. Impedance bonds for power signalling; 100 three-position line relays; accumulators and accessories.*

January 8th. Postmaster-General's Department. Operators' calling devices. January 11th. Switchboard cable. January 17th. Telephone and telegraph apparatus. January 24th. Testing and telegraph instruments. February 22nd. Switchboard parts. March 1st. Telephone and telegraph parts. (December 22nd.)

Sydney.—January 29th. Municipal Council. Feeder protective apparatus for sub-stations.*

Newcastle (N.S.W.).—January 11th. Town Council. 750-kVA or, alternatively, one 1,000-kVA transformer voltage regulator.

Perth (W.A.).—March 1st. Government Tender Board. L.p. switchgear.*

Basford (Nottingham).—January 1st. Board of Guardians. Economiser. (December 15th.)

Belgium.—Belgian Military Buildings Department (Liège Rive-Droite Section) in Liège. Installation of electricity supply between the Military Sanatorium at Marchin-lez-Huy and the central electricity station.

January 10th. Office de l'Electricité, 25, Rue de la Charité, Brussels. 20 kilometres of heavily-insulated copper wire and 5 kilometres of copper cable.

January 13th. Municipal authorities of Saint-Gilles-lez-Bruxelles. The supply of armoured cable for d.c. transmission at less than 750 volts: 2,000 metres of 70 sq. mm. section, 1,000 metres of 16 sq. mm. section, and 7,000 metres of 19 sq. mm. section, also of 500 metres of lead-covered wire, 16 sq. mm. section, 15 kilos of bare copper 35 sq. mm. section, and 400 kilos ditto 10 sq. mm. section. Service de l'Electricité, 49, Rue de Bethléem, St. Gilles, Brussels.

Birmingham.—January 27th. Salvage and Stables Committee. Plant for the refuse destructor and salvage works. (December 15th.)

Bradford.—January 1st. Tramways Committee. Stores, including lamp fittings, insulating material, &c., for 12 months. Mr. R. H. Wilkinson, general manager of tramways, 7, Hall Ings, Bradford.

Cheadle and Gatley.—January 1st. Urban District Council. Sub-station switchgear and static transformer. (December 15th.)

Chile.—January 13th. State Railways. Covered copper wire, g.i. wire, g.i. cable, porcelain insulators, insulator pins, telegraph cords, &c.*

Egypt.—Alexandria.—January 17th. Ports and Lighthouses Administration. Stores, including electrical goods, for 12 months.*

Huntingdon.—January 3rd. Huntingdonshire County Council. New heavy-plate type battery, 400-420 amp. hours. (December 22nd.)

India.—Madras.—January 18th. Corporation. Eight 30-kVA, 3-phase transformers; h.p. switchgear; 15,000-V testing set; 700 30-ft. steel tubular poles; 10 tons h.d. copper wire, No. 8 gauge; 6 tons g.i. wire, No. 8 gauge; switchboard instruments. Specifications, &c., Revenue Officer, Corporation of Madras (Rs.1 per set.)

Manchester.—January 9th. Tramways Committee. Steel tramway poles. Mr. Henry Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Trafford Park Estates, Ltd. Reconstruction of the permanent way of the electric tramway in Trafford Park. Secretary, Estate Office, Trafford Park, Manchester.

South Africa.—Cape Town.—January 12th. City Council. 10,300 yd. h.p. and l.p. cable; three 150-kVA single-phase transformers; four 100-kVA ditto; three 40-kVA ditto.*

Spain.—Electrification of Trans-Pyrenean Railway.—The Ministro de Fomento has been authorised to invite tenders for the electrification of the Ripoll-Puigcerda railway, which runs across the Pyrenees. Particulars from Señor Ingeniero Jefe de la Segunda Division de Ferrocarriles, Calle de Balmes 32 (2o), Barcelona.—*Reuter's Trade Service* (Madrid).

Post and Telegraph Authorities, Madrid. 1,000 metres of telephone cable with ten pairs of conductors, 6,000 metres with 25 pairs, 3,500 metres with 50 pairs, and 1,000 metres with 100 pairs of conductors required in connection with the State telephone system.

Stoke-on-Trent.—January 10th. Electricity Department. Neutral earthing resistance. Twelve months' supply of static transformers, and sub-station switchgear. (See this issue.)

Uruguay.—Montevideo.—January 16th. State Electricity Works. 45,000 metres v.i.r. cable.*

Wolverhampton.—January 17th. Electrical Engineer's Department. One 5,000-kW turbo-alternator, condenser and auxiliaries. (December 15th.)

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*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Edinburgh. — Tramways Committee. The Committee recommends that a contract for 2,500 tons of tram rails be given to the Compagnie Anglo-Belge d'Importation et Export, Brussels, whose tender amounts to £19,375, as compared with £24,375 quoted by an English firm; tie bars (£1,278), Hadfields, Ltd.; track rail fishplate bolts (£437), Chas. Richards and Son, Ltd.

Government Contracts.—The following Government contracts were placed during November, 1922:—

Admiralty Contract and Inspection Department.

[illegible] & Co.
[illegible] Co., Ltd.
[illegible]; [illegible] General Electric Co., Ltd.
[illegible] Co., Ltd.
[illegible] Ltd.
[illegible] G. E. Taylor and Sons.

Air Ministry.

Condensers.—British Insulated & Helsby Cables, Ltd.
Electric sensitive drills.—F. Pollard & Co., Ltd.
Electrical conduit and conduit fittings (term contract).—General Electric Co., Ltd.; Stella Conduit Co., Ltd.
Motor switchgear, &c.—General Electric Co., Ltd.
Modified I.F. Receivers.—Muirhead & Co.
Thermo-ammeters.—Weston Electrical Instrument Co., Ltd.

Crown Agents for the Colonies.

Electric cable.—Callender's Cable & Construction Co., Ltd.
Telegraph material.—Siemens Bros. & Co., Ltd.
Wireless telegraph installation, &c.—Marconi's Wireless Telegraph Co., Ltd.

Post Office.

Testing, protective apparatus, &c.—Evershed & Vignoles, Ltd.
Leclanché battery boxes.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—Connolly's (Blackley), Ltd.; Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
E.S. conduit and fittings.—J. McDougall, Ltd.
E.L. fittings.—S. Heath & Sons, Ltd.
Insulators.—Buller's, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Earth plates.—Buller's, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Lead sleeves.—G. Farmiloe & Sons, Ltd.
H.d. copper wire.—R. Johnson, Clapham & Morris, Ltd.
Manufacture, supply and drawing-in and jointing cables.—Pontypool-Abergavenny: W. T. Henley's Telegraph Works Co., Ltd. Preston-Lancaster: W. T. Henley's Telegraph Works Co., Ltd. Leeds-Cattterick: Western Electric Co., Ltd. Catterick-Newcastle-on-Tyne: Johnson and Phillips, Ltd. Newcastle-on-Tyne-Jedbergh: Callender's Cable and Construction Co., Ltd. Jedbergh-Edinburgh: Siemens Bros. & Co., Ltd.
Lift (Monument Telephone Exchange).—W. Wadsworth Sons, Ltd.
Telephone exchange equipment.—Dale & Co. (Oxford Circus); Ormerod and Sons (Rochdale); Pocock Bros. (S.E.); United Kingdom Provisional Institution (Strand); and Basil Street Hotel (Knightsbridge, S.W.), Relay Automatic Telephone Co., Ltd.

H.M. Office of Works.

Engineering services.—Electric wiring Cricklewood Chart Factory.—Edmundson's Electricity Corporation, Ltd.
Electric wiring Windsor Castle.—T. Clarke & Co., Ltd.

Navan (Co. Meath).—Urban Council. Accepted:—
Installation of electrical house feeders.—Irish Electrical Construction Co., Dublin.

Southend-on-Sea.—Town Council. Accepted:—
Re-conditioning and installing three 900-kW Diesel engines at £3,700 each.—Belliss & Morcom.
Three d.c. dynamos for coupling to three 900-kW engines (£5,094).—Crompton & Co., Ltd.
Twelve 19-ft. lengths of copper busbar (£130).—Sydney, Son & Co.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Juvenile Christmas Lectures. At 21, Albemarle Street, W. At 3 p.m. On "Six Steps up the Ladder to the Stars," by Prof. H. H. Turner, F.R.S. Saturday, December 30th, "The Discovery of the Planet Neptune" (Lecture II); Tuesday, January 2nd, "Photographing the Stars" (Lecture III); Thursday, January 4th, "The Spectroscope and its Revelations" (Lecture IV); "Saturday, January 6th, "Two Great Streams of Stars" (Lecture V).

Institute of Transport.—Monday, January 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Air Transport," by Mr. F. Handley-Page.

Roentgen Society.—Tuesday, January 2nd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Ordinary meeting.

Institution of Railway Signal Engineers.—Wednesday, January 3rd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 3 p.m. Paper on "Rotary Interlocking Block," by Mr. A. Wallis.

Chelmsford Engineering Society.—Thursday, January 4th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Financial Considerations of Engineering," by Mr. J. R. Watson.

Physical Society of London and The Optical Society.—Wednesday and Thursday, January 3rd and 4th. At the Imperial College of Science, South Kensington, S.W. From 3 to 6 p.m. and 7 to 10 p.m. Annual exhibition. January 3rd, at 4 p.m., and January 4th, at 8 p.m. Lecture on "Reproduction of Colour by Photographic Processes," by Mr. W. Gamble. January 3rd, at 8 p.m., and January 4th, at 4 p.m. Lecture on "Recent Photo-Elastic Researches on Engineering Problems," by Prof. E. C. Coker, F.R.S.

Institution of Electrical Engineers.—Thursday, January 4th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Lecture on "Variable-speed a.c. Motors without Commutators," by Mr. F. Creedy.

Electrical Power Engineers' Association (Southern Division).—Friday, January 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Water and its Action on Steam Boilers," by Mr. J. H. Paul.

Junior Institution of Engineers.—Friday, January 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Wave Power Transmission," by Mr. W. Dinwoodie.

"Model Engineer" Exhibition. Opens Friday, January 5th. At the Royal Horticultural Hall, Westminster, S.W.

British Electrical Development Association.—Friday, January 5th. At Caxton Hall, S.W. At 7.30 p.m. Lecture on "Possibilities of the Immediate Future and Competition with Other Forms of Light and Heat," by Mr. J. W. Beauchamp.

The I.E.C. and Former Enemy Nations.—We learn from a letter written by the president of the French Electrotechnical Committee to the editor of *La Revue Générale de l'Electricité* that the five Germans who were present at the recent meetings at Geneva (reported in our last issue) were not on the same footing as the delegates from other nations; they were simply the guests of the Swiss committee.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following devices are asked for :—

Orsova reflectors for electric street lamps.
Edison electric pen (a reader desires to secure one).

NOTES.

Scientific Novelties.—The London University and other bodies have arranged an exhibition of scientific novelties, with the very laudable object of assisting the hospitals of London. The exhibition is to be held at King's College, Strand, and will run from December 28th to January 10th. On each day there will be given popular lectures by authorities on various subjects, and the list includes a number by electrical engineers and scientists. The exhibits are to be classed under six heads: Engineering, "wireless," physics, chemistry, biology, and geology. The charge for admission for adults will be 2s. 6d. in the afternoon and 2s. in the evening. Children will be admitted for a shilling.

Fatalities.—Two deaths from electrical causes have been reported from the Midlands recently. In the first case a young girl received a fatal shock from 350-V overhead supply wires at Accrington which had been brought down by the weight of snow upon them.

The other case was the death of a boy at Bacup who became entangled with some telephone wires which had been broken during a storm and had come into contact with wires carrying a current at a pressure of 230 V.

Anti-Dazzle Light Bill.—An Anti-Dazzle Light Bill, the *Daily Mail* is informed, will be introduced into Parliament during the next session by the Ministry of Transport. Its chief provisions will be: No lamp may be used with a forward illumination exceeding 150 ft. unless it complies with the anti-dazzle regulations. Lamps exceeding a forward range of 150 ft. must throw the main beam below the vision of pedestrians and drivers of other vehicles. There will also be a provision that cyclists must carry rear lamps. France is also considering means of stopping the dazzle-light nuisance, and unless some common policy is adopted it may mean that motorists wishing to visit France will have to buy new lamps. As to the need for dazzle-light regulations most motorists are agreed.

Appointments Vacant.—Instructor in electrical installation and wiring for the Kingston-on-Thames Technical Institute. See "Official Notices" to-day.

The Leicester Electricity Undertaking.—With reference to our description of this undertaking, it is stated on p. 978 of this issue that each boiler is fitted with a steel-tube economiser—an inaccuracy, as the Green economisers are fitted with cast-iron tubes.

Lectures.—At a meeting of the Edinburgh Electric Society, on December 8th, Mr. T. Orr lectured on "Power Transmission." The subject was treated from the mechanical aspect, and the author dealt with qualities and advantages of the varied classes of belts and gears now available. The different kinds of bearings and their purposes were described. Mr. Orr demonstrated models specially constructed for the lecture. On December 22nd, Mr. G. Mackintosh read a paper on "Common Telephone Faults," in which he described the most practical methods of tracing and repairing the failures of the everyday types of home and office telephones.

Glasgow and District Radio Club.—The club is having a highly successful season, the membership being now well over 200. A number of interesting lectures have been held. On December 14th Mr. A. F. Gray, a vice-president, demonstrated a two-valve set which he has constructed, using reactance into tuned anode, which is said to be almost necessary to comply with the Postmaster-General's regulations.

As "fading" in connection with transmission from the broadcast stations has been causing club members a considerable amount of trouble, six members arranged to listen-in specially to the full programme of the Manchester station on a particular night. The reports are being tabulated by Mr. Pick, one of the members of the committee, who is to open a discussion on the subject, and it is hoped to find some suitable grounds for further experiments later.

Long-distance Radio-Telegraphy. — "Wireless Service between Australia and Great Britain" was the subject, on December 19th, of a lecture by Mr. E. T. Fisk, managing director of the Amalgamated Wireless of Australia, Ltd., at a meeting of the Royal Colonial Institute. Sir John Cockburn presided, and, according to *The Times*, the lecturer said that direct communication between England and Australia was now practicable for twenty-four hours daily. The Australian Amalgamated Co., he said, had become a national undertaking, which enjoyed the freedom of policy and efficiency of organisation which inherently distinguished a public company from a Government department. The company undertook to carry all classes of messages between Great Britain and Australia at a charge not exceeding two-thirds of the existing cable rates. The Australian high-power station would be erected near Sydney or Melbourne, and operated direct from the heart of the city. At the capital cities of the other States feeder stations would deal with all traffic between these States and the main trunk station. A third service would provide communication between Australia and the surrounding Pacific Islands; a fourth would communicate with ships at sea, and a fifth would link up isolated inland settlements. When these services were fully established extensions of the main trans-ocean service would be undertaken to link up Australia directly with all the countries of importance in Europe, Asia, Africa, and America. When other Dominions, such as India and South Africa, had established suitable high-power stations the company would be ready immediately to conduct inter-Dominion services. With regard to New Zealand, it was not yet decided whether she would communicate direct with Great Britain, or would establish a feeder station in connection with the Australian main service.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—Informal Meetings Section.—At the meeting of the Informal Section, on December 18th, Mr. J. R. Bedford was in the chair, when Mr. E. E. Sharp opened a discussion on "Time Switches." He said the periods of the clocks were practically standardised now at 1, 14, and 45 days' run. For the one-day run a cheap type of clock might be used, because small time-keeping errors could be adjusted daily, but a rigid framework and a dust-proof case were essential. For the longer runs the switch had to be put "on" automatically, as well as "off" and the double operation commonly had to be done twice or more daily. The clock must, therefore, be a powerful one, and with good makes a maximum error of 2½ minutes a week was guaranteed. Mr. Sharp exhibited some excellent lantern slides showing various clock and switch parts. He explained the safeguards for wear, escapement, compensation and temperature variation, &c., and also for sound electrical contacts; the oil break was easily incorporated in the clock operation, and he had supplied for years time switches up to 400 amperes, 600 volts, single pole, and 300 amperes, three pole. Mr. Sharp held the opinion that electrically-wound clocks were not commercially practicable, nor did he favour the ingenious "Solar" device for time setting by cams shaped to the earth's orbit, and correspondingly controlling the lighting. It required different cams for every 50 miles of latitude. He claimed a life of 20 years or more for time switches under normal conditions, and instanced an installation of 1,700 by which, after all allowance for repayment of loan, interest and maintenance, a saving of £4,000 in four years was effected. He told of having to devise applications to new conditions at the rate of 300 a year.

Fourteen members took part in the discussion.

North-Eastern Centre.—The January meetings of the Centre will be held at Armstrong College, Newcastle-on-Tyne, as follows: January 8th, at 7.30 p.m., visit and address by the president (Mr. Frank Gill, O.B.E.). January 22nd, at 7.15 p.m., lecture by Mr. F. Creedy on "Multispeed and Cascade Induction Motors."

Irish Centre.—Mr. Frank Gill, O.B.E., President, lecturing on telephony before the Irish Centre, Dublin, referred to the great development of the telephone in America and Denmark. The trade of Ireland was greater than that of Denmark, but in the latter country there were 262,000 telephones in use, while in the Irish Free State the number was only about 20,000, although the populations of the two countries were practically identical. In Denmark there were 8¼ telephones for every 100 of the population, and in Ireland 1.63 telephones for every 100 people. During the past 22 years telephones had increased by 890 per cent. in Denmark, and in Ireland by 360 per cent., and the figures in Denmark were practically identical with those of America. He did not see why Ireland should be behind Denmark in making the telephone an auxiliary in the promotion of industry. Traffic followed the lines as they ran, and the Government of the State should see to it that help was given for adequate development.

Junior Institution of Engineers.—A paper on "Oil Film Lubrication and its Application to the Michell Thrust Block" was delivered by Mr. J. Ward, B.Sc., on December 8th. The history of the Michell thrust block was outlined and examples of its application were mentioned. The British Admiralty had adopted the Michell thrust block exclusively in its battleships. In H.M.S. *Hood* the shaft h.p. was 36,000 and the thrust taken by a single collar was 100 tons. The main object of the paper was the application of the oil film to lubrication under extreme loads, and the author took as a base the investigations of Prof. Osborne Reynolds and the development of the Michell Mathematical Extension. Several models kindly lent by Messrs. Michell Bearings, Ltd., were exhibited, showing different designs of Michell bearing.

Midland Section.—Dr. C. C. Garrard delivered his presidential address on "The Economics of Engineering" on December 12th. He pleaded that engineering societies and institutions should, in their corporate capacity, discuss the economic questions lying at the foundation of their work—the problem of unemployment, and the avoidance of industrial strife. Professional engineers might do a great deal of good by evolving some form of arbitration in the engineering industry which would be acceptable both to the employers' associations and the trade unions.

Association of Engineers-in-Charge.—The following are the arrangements for the new year:—

January 10th.—"The Selection of Fuels and Their Application," by Mr. A. Fleming Browne.
January 20th.—Social and dance.
February 10th.—Social and dance.
February 14th.—"Hydraulic and Electric Lifts," by Mr. C. H. J. Day.
March 14th.—"Scientific Instruments in the Rubber House," by J. B. C. Kershaw.
April 11th.—"Military Bridge Building Under Fire," by Col. C. E. P. Sankey, R.E. (ret.).
April 14th.—Social and dance.
The annual dinner will take place in March.

Society of Engineers.—Among the awards made by the Society for papers read or published during 1922 are: President's Gold Medal to Dr. C. V. Drysdale, O.B.E., for his papers on "The Testing of Small Electrical Plant"; Society Premium (value three guineas) to Mr. A. S. E. Ackerman, B.Sc. (Eng.), for his paper on "The Physical Properties of Clay" (fourth paper); Clarke Premium (value five guineas) to Mr. R. C. Hill, of the Gloucestershire Engineering Society (associated with the Society of Engineers), for his paper on "The Submersible Pump"; and Geen Premium (value five guineas) to Mr. A. G. Short, of the Birmingham Association of Mechanical Engineers (associated with the Society) for his paper on "Heating."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

It is announced that Sir John Dewrance, K.B.E., has resigned from the Advisory Committee to the Department of Overseas Trade.

St. Marylebone Electric Supply Committee has re-elected Ald. J. A. G. Beaumont chairman, and Ald. Duncan Watson vice-chairman, for the ensuing year.

The Council has also confirmed the appointments of these gentlemen as its representatives upon the Conference of Local Authorities Owning Electricity Undertakings in Greater London, and the Wages Conference of Local Authorities (Greater London), for the year ending March 31st, 1923.

Mr. V. Delebecque has commenced practice as a consulting electrical, mechanical, and radio engineer, at Ash Villa, Sandwell Street, Walsall, and he desires to receive catalogues.

Preston Corporation Tramways Committee has recommended the appointment of Mr. Henry Clayton as general manager and engineer of the Corporation Tramways undertaking, in succession to Mr. J. F. Simpson, who takes up his new appointment as borough electrical engineer in the new year. The two positions were previously merged.

Obituary.—Mr. W. H. Madden.—The death has occurred of Mr. W. H. Madden, chairman of the Kilmallock (Co. Limerick) Electric Light & Power Co.

NEW COMPANIES REGISTERED.

Inventions Developments, Ltd. (186,517).—Private company. Registered December 19th. Capital, £1,050 in 1,000 preference shares of £1 each and 600 ordinary shares of 1s each. To adopt agreements with A. L. Ingram, S. G. Wybrow, and A. Slatter for the acquisition of the patents and rights in connection therewith, and a business not particularly described. The provisional directors are: S. G. Wybrow, A.M.I.E.E., Royal Aircraft Establishment, South Farnborough, Hants., electrical engineer; A. Slatter, M.I.E.E., Sardinia House, Kingsway, W.C.2, electrical engineer. Registered office: Sardinia House, Kingsway, W.C.2.

Yeovil Electric Light and Power Co., Ltd. (186,456).—Private company. Registered December 15th. Capital, £10,000 in £1 shares. The objects are as indicated by the title. The first directors are: A. N. Rye, C. Tudor Hearn, Bolitho Eade, Colonel A. M. F. L. Gripper, 8801, Lodge, Malbrook Road, Putney, S.W.; W. E. Brandreth, 37, London Road, High Wycombe, Bucks; C. H. Jones, "Coniston," Shortlands Grove, Shortlands, Kent. Qualification £50. Remuneration fixed by the company. Secretary: H. Jeffree. Registered office: Bond Street Chambers, 11, Tothill Street, Westminster, S.W.

White & Mantle, Ltd. (186,403).—Private company. Registered December 14th. Capital £1,000 in £1 shares. To adopt an agreement with A. L. White for the acquisition of the business of electrical engineers now carried on by him at 27, Red Lion Street, W.C. The first directors are: A. L. White, 27, Red Lion Street, W.C., electrical engineer; A. Bampton, 27, Red Lion Street, W.C., engineer; W. F. Mantle, 14, Grange Road, West Ealing, engineer.

The British Broadcasting Co., Ltd. (186,424).—Registered as a "public" company on December 15th, with a nominal capital of £100,000 in 100,000 cumulative ordinary shares of £1 each. The said shares confer on the holders thereof the right to receive out of the profits of the company a fixed cumulative dividend at 7½ per cent. per annum on the amounts paid up or credited as paid up thereon, but not to any further or other participation in profits. The rights of the cumulative ordinary shares in the original capital may not be altered, or in any manner affected, except in accordance with clause 61 of the original articles of association. The said clause provides that, subject to the previous approval of H.M. Postmaster-General for the time being, the holders of the said shares may at any time and from time to time, whether before or during liquidation, by an extraordinary resolution passed at a meeting of such holders, consent on behalf of all the holders of shares of the class to the issue or creation of any shares ranking equally therewith or having any priority thereto, or to the abandonment of any preference or priority or of any accrued dividend or the reduction for any time or permanently of the dividends payable thereon, or to the amalgamation into one class of the shares of any two or more classes, or to the division of shares of one or more class or classes into shares of different classes, or to any alteration in the memorandum of association, varying or taking away any rights or privileges attached to the said cumulative ordinary shares, or to any scheme for the reduction of the company's capital affecting such shares in a manner not authorised by the articles, or to any scheme for the distribution (though not in accordance with legal rights) of assets in money or in kind in or before liquidation, or to any contract for sale of the whole or part of the company's property or business, determining the way (though not in accordance with legal rights) in which the purchase consideration shall be distributed, and generally consent to any alteration, contract, abrogation of rights and privileges, compromise or arrangement which the persons voting thereon could, if *sui juris* and holding all the shares of the class, consent to or enter into, and such resolution shall be binding on all the holders of the shares of the class.

Article 61 is not to be read as implying the necessity for such consent in any case in which, but for such article, the object of the resolution could have been effected without it under the general provisions of the articles. The written consent of the holders of three-fourths of the class shall have the same effect as an extraordinary resolution passed at a meeting of the holders of the shares and of the class.

The objects of the company are: To acquire from H.M. Postmaster-General a licence, in such form and subject to such terms and conditions as he may from time to time prescribe, for the erection, establishment, and operation within the United Kingdom of Great Britain and within Ireland, of stations as a public utility service for the "broadcasting" supply to the public, by means of wireless telephony and/or wireless telegraphy of news, information, concerts, lectures, educational matter, speeches, weather reports, theatrical entertainments and any other matter which for the time being may be permitted by or within the scope or ambit of the said licence; to equip and install the said stations with all requisite or convenient plant and machinery, and to carry on (only so far as may be necessary or convenient for the furtherance of the objects of the company) the business of ironfounders, mechanical and electrical engineers, brass founders, metal workers, tool makers, wood workers, builders, &c.

The shares may be allotted or disposed of as the Board may determine, provided that the Board shall not, without the previous written approval of H.M. Postmaster-General for the time being, allot more than 50,006 shares in the initial capital to the following six companies or their nominees, *viz.*:—

Marconi's Wireless Telegraph Co., Ltd.
Metropolitan-Vickers Electrical Co., Ltd.
Radio Communication Co., Ltd.
British Thomson-Houston Co., Ltd.
General Electric Co., Ltd.
Western Electric Co., Ltd.

and that the Board shall, up to a total of 39,994 shares, issue to applicants, being *bona fide* British manufacturers of wireless apparatus other than the above six companies, the full amount of shares (not exceeding 10,000 to any one such applicant) for which such applicants may apply.

The minimum cash subscription on which the directors may proceed to allotment is £7.

The Board may, without assigning any reason, decline to register any transfer of shares.

The directors are to number not less than seven nor more than nine. Six of the directors are to be nominated by the six companies above named. Such nominated directors (called "representative" directors) may appoint an additional director, to be known as the "permanent chairman director." In the event of the representative directors failing to appoint the permanent chairman director within three weeks after the incorporation of the company, and so often as a vacancy occurring in the office of permanent chairman director shall not be filled up by the representative directors within three weeks of the occurring thereof, H.M. Postmaster-General for the time being may, on the request of two representative directors, appoint the permanent chairman director. The first directors are:—Godfrey Chas. Isaacs, Marconi House, W.C.2, director of "Marconi" companies; John Gray, Crown House, Aldwych, W.C.2, director of Shielton, Ltd., Corbel, Ltd., and the Hotpoint Electric Appliance Co., Ltd.; Henry M. Pease, Norfolk House, W.C., managing director of Western Electric Co., Ltd.; Sir William Noble, Magnet House, Kingsway, W.C., director of General Electric Co., Ltd., and Walker-Western Co., Ltd. Major Basil Binyon, 34-5, Norfolk Street, W.C.2, managing director of Radio Communication Co., Ltd., and director of Mullard Radio Valve Co., Ltd., C. F. Elwell, Ltd., Radio Press, Ltd., and London Radio College, Ltd.; Archibald McKinsley, 4, Central Buildings, The Broadway, S.W., Metropolitan-Vickers Electrical Export Co., Ltd., Cosmos Lamp Works, Ltd., and Vickers Australia, Ltd.; Lord Gainford, Headlam Hall, Gainford, Durham.

The remuneration of directors is to be £200 each per annum (£500 for the chairman), free of income tax. The registered office is at 15, Savoy Street, W.C.2.

Bowyer-Lowe Co., Ltd. (186,475).—Private company. Registered December 18th. Capital, £800 in £1 shares. To carry on the business of electricians, mechanical and general engineers, woodworkers, manufacturers of and dealers in apparatus, machinery and appliances, convenient for the application of electricity, &c. The first directors are: A. E. Bowyer Lowe, Veloce, South View, Letchworth; H. W. Widgery, Canonleigh, Broadway, Letchworth (both permanent subject to holding one-fifth each of the issued share capital) with £160 each per annum as directors' fees, together with a salary of £500 per annum so long as they devote their whole time and attention to the company's affairs. They shall be joint chairmen and preside at alternate meetings while owners in equal shares of not less than half the issued share capital. Secretary: H. W. Widgery. Solicitors: H. M. Heckford, 19, Leys Avenue, Letchworth, Herts.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Mitchell's Electrical and Wireless, Ltd.—Satisfaction in full on December 1st, of debentures dated January 16th, 1922, securing £550.

Battiscombe & Harris, Ltd.—Particulars filed of £10,000 debentures authorised November 14th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Reed's Patent Engine Co., Ltd.—First mortgage debenture dated December 12th, 1922, to secure £500, charged on freehold and leasehold property, and the company's undertaking and other property, present and future, including uncalled capital (if any). Holder: F. J. Reed, Hythe, Southampton.

Frederick Braby & Co., Ltd. (2,537c).—Return dated August 31st (filed November 7th), 1922. Capital, £660,000 in £2,500 ordinary, 17,500 preference, and 6,000 employés' shares of £10 each. 39,500 ordinary, 14,500 preference, and 3,988 employés' shares taken up. £566,880 paid. £13,000 considered as paid. Mortgages and charges, £43,475.

British Arc Welding Co., Ltd. (108,759).—Return dated August 23rd, 1922. Capital, £50,000 in £10 shares. 1,474 shares taken up. £12,740 paid. £2,000 considered as paid. Mortgages and charges, nil.

City of Oxford Motor Services (formerly City of Oxford Electric Tramways, Ltd.).—Satisfaction to the extent of £1,500 on December 7th, 1922, of charge dated February 20th, 1914, securing £46,000.

Porlock and District Electric Supply Co., Ltd.—Mortgage dated December 1st, 1922, to secure £400 charged on "The Stores," Porlock, Somerset. Holder: C. Blackford, Porlock.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £6,200 on December 7th, 1922, of charges dated March 24th, 1911, November 13th, 1912, and March 11th, 1915, securing £250,000.

Stuart Turner, Ltd.—Mortgage on "Broad Gate" publichouse, Henley-on-Thames, dated November 16th, 1922, to secure all moneys due or to become due from the company to L.C.W. and Parr's Bank.

Pacific and European Telegraph Co., Ltd. (36,683).—Return dated November 14th, 1922. Capital, £100,000 in £10 shares. All shares taken up. £4 per share called up. £40,000 paid. Mortgages and charges, £66,500.

CITY NOTES.

Fuller's United Electric Works, Ltd.

The third ordinary general meeting was held on December 21st at Winchester House, E.C., Mr. George Fuller presiding. In proposing the adoption of the report the chairman said the shareholders had so recently had the affairs of the company carefully explained at the various meetings which had been held that it was unnecessary for him to go into any details on that occasion. It was expected that the sanction of the High Court would be given next January to the scheme of reorganisation which had been arranged, when the new financial arrangements would come into operation. He would like to take that opportunity of personally thanking the shareholders for the way in which they had met the difficult problems that had come before them. He felt sure that their confidence would be ultimately justified. During the past few months the directors had thoroughly overhauled the organisation of the business, with results which had been very encouraging. Great economies had been effected; changes had been made in the personnel; and the general efficiency of the business had been greatly improved. Although trade conditions in the country were still far from good he was pleased to say that the encouraging conditions of their own business, which commenced in the autumn, had been maintained. With the economies they had effected and the improved financial conditions under which they expected to carry on they had every hope that the business would resume its old successful and profitable condition.

Mr. F. J. Gordon seconded the motion, and the report was adopted.

British Columbia Telephone Co., Ltd.

The *Financier* reports meetings of debenture holders and shareholders of this company, which were held in London on December 8th to consider resolutions approving an amalgamation with another company of the same name. Sir J. Leigh Wood, K.B.E., explained that the company was incorporated under the laws of the Province of British Columbia, and it was proposed to amalgamate with a company incorporated under the laws of the Dominion of Canada. The resolutions would regularise the system which had been in operation during the last three or four years.

Mr. G. H. Halse, the president of the company, said that when telephones were first started in British Columbia every little town had its own system, and there were no long-distance lines. About 1900 the present company had been formed with a provincial charter to unite those systems into one company. From a small beginning the company had grown to be an important undertaking, able to supply the whole of British Columbia with a telephone service, and doing a large business with the United States.

Anglo-Argentine Tramways Co., Ltd.—Sir George A. Touche, Bart. (chairman) presided at a special meeting of holders of the second preference shares on December 19th, which was called to give effect to the scheme outlined in our issue of December 15th. The chairman explained in some detail the circumstances which had necessitated this method of dealing with arrears of dividend, and the requisite resolution was adopted unanimously. The proposals were again approved at a subsequent extraordinary general meeting, at which, also, the alteration of the basis of the directors' remuneration was agreed to.

Constantinople Telephone Co.—An announcement appeared in *The Times* of December 22nd, signed "J. E. Kingsbury, Representative in the United Kingdom," stating that the coupons on the 6 per cent. obligations and the 6 per cent. certificates, due January 1st, 1923, are payable on or after that date at the Imperial Ottoman Bank, 26, Throgmorton Street, London, E.C.2.

Claud Hamilton, Ltd.—According to the *Financial Times*, a dividend of 5 per cent. for the year is recommended, carrying forward £18,363, after writing off depreciation, and subject to E.P.D. and corporation tax.

Pinchin, Johnson & Co., Ltd.—The usual dividend at the rate of 6¼ per cent. per annum, less tax, on the preference shares for six months to December 31st is announced.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., less income tax, upon the issued capital.

Marconi's Wireless Telegraph Co., Ltd.—Interim dividend of 5 per cent., less tax, upon the ordinary shares.

Eastern Telegraph Co., Ltd.—Interim dividend of 10 per cent. per annum, free of tax, on the ordinary stock.

Cork Electric Tramways and Lighting Co., Ltd.—Dividend of 7½ per cent., less tax, on the preference shares for the eighteen months ended December, 1921.

W. & T. Avery, Ltd.—Interim dividend of 5 per cent., less tax, on the ordinary shares.

C. A. Vandervell & Co., Ltd.—The directors report a loss of £205,734 for the year ended March, 1922. The directors hope at an early date to place before the shareholders proposals for the situation that his arisen as the result of this and the loss of the previous year.

Crompton & Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended September, 1922.

STOCKS AND SHARES.

Wednesday Evening.

With only three full working days in the present week, the Stock Exchange did not expect to find anything like active business conditions prevailing, and the anticipation is fully justified. A main feature of the markets continues to be the strength of shares of the home electricity supply companies. The public are taking a more lively interest in the market owing to the confidence felt in regard to increased dividends to be declared in respect of the current six months. The table showing the yield per cent. on the principal shares, as worked out in our list, is the object of careful examination.

In the market it is claimed that Brompton ordinary are still amongst the cheapest shares of their class, though the yield in their case is barely 6 per cent. on the money. City Lights pay nearly 6¼ per cent. allowing for the accrued dividend, County of London ordinary barely 5¼ per cent., Westminsters 6¼ per cent., and St. James's a little less. These returns on the money are worked out upon the basis of the middle prices given in the Stock Exchange Official List, but would-be buyers know to their disappointment that shares cannot often be obtained at the figures given, though the few sellers who come in are pleasantly disappointed at getting either the middle prices, or very near them. This simply shows the strength of the market and the difficulty which exists of buying shares in this department. After the way in which the industry has suffered during the war years, the change during 1922 has come as a pronounced relief, and, although the prophet will walk warily in venturing to estimate what are likely to be the chances in the future, the prosperity of the electricity supply industry during the present twelve months has been striking enough to warrant the assumption that market values are not likely to show much decline.

Kensington ordinary have risen to 8, and London Electrics are 1/16 higher at 2 15/16. It is now anticipated that the London Electric Co. will be amongst those announcing a higher dividend, and there would be a good deal of satisfaction at this company taking its place amongst the concerns that pay their shareholders a better rate than 4 per cent. Possibly a certain misconception has arisen in regard to the London Electric Co., but the fact remains that the Brighton Railway contract has hitherto done little to raise the London to a high rank amongst the other undertakers, and the fact of the dividend having been on a very modest scale has given rise to mild doubt as to how far these big contracts yield more than a comparatively modest profit.

Edmundsons have issued a good report, and the shares are harder, the ordinary changing hands up to 2¼. The Urban figures are awaited with interest, and the improvement in the status of such companies begins to attract more general attention. Electric Supply Corporations have changed hands up to 18s. 3d. General Electrics rose 1s. to 18s. British Aluminium lost three pence at 16s. middle. British Insulated rose to 12s., to revert to 11s. 3d. Siemens look a firmer market, though the price is nominally unchanged at 2s. 10½d. The company's 10 per cent. preference are on offer at 30s. 9d., with

1s. dividend included in the price. This makes the yield to a buyer, to-day, £6 13s. 6d. per cent. on the money. The 4½ per cent. debenture stock has risen to 90 on a demand from holders who had stock drawn at 100 in the middle of this month.

India Rubber 5 per cent. bonds, with interest due in March and September, can be bought at 94½, giving £5 6s. on the money, without taking into account redemption at 100 in March, 1926. Callender's 7½ per cent. "B" preference at 25s., c.d., January and July dividends, give 6 per cent. London Electric Wire and Smiths 7½ per cent. preference at 23s. 6d. afford a six guineas yield.

Marconis again hardened to 2¼, and Canadians have advanced to 10s. 9d. The Anglo-American stocks hold their rises. The only change in the Eastern division is ⅛ decline in Globe Telegraph ordinary.

Some of the holders of Anglo-Argentine Tramways first preference are exchanging into the second preference, and the movements in the prices reflect this "straddle." Mexicans are steady, the only quotable change is a gain of 2 points in Mexico Tramways seconds, to 58½. British Columbia Railway issues have not altered. Amongst the new stocks, Marconi debenture is higher at 3¼ premium, and the new County of London ordinary, now 12s. 6d. per cent., have gone up to 6s. 6d. premium.

The rubber market exhibits no particular vitality. Iron, coal and steel shares, after their sharp rises, are disposed to react on profit-taking by earlier buyers who preferred to sell rather than to pay for their stock at the end of the year. Babcock & Wilcox, for this reason, eased off to 3 7/16. Armstrongs and Wilcox maintain most of their recently-acquired strength.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Dec. 23, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	10½	—	£5 17 1
Charing Cross Ordinary	8	9	7¾	—	5 16 2
do. do. do. 4½ Pref.	4½	4½	4⅛	—	5 7 5
Chelsea	6	6	6¾	—	4 9 0
City of London	14	14	2⅛	—	6 7 10
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1⅛	+ 6d.	5 8 6
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	8	+ ½	6 5 0
London Electric	2½	4	2⅛	+ ⅛	4 3 6
do. do. 6 per cent. Pref.	6	6	5⅝	—	5 17 1
Metropolitan	7	7	6½	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4⅜	—	5 9 1
St. James' and Pall Mall	12	12	9⅜	—	6 6 4
South London	7	7	4⅞	—	5 18 0
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	7⅜	—	6 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102½	—	5 17 1
do. Def.	1½	34/6	29¼	—	6 5 0
Chile Telephone	6	6	6¼	—	4 16 0
Cuba Sub. Ord.	7	7	■	—	8 15 0
Eastern Extension	10	10	10½	—	5 4 0
Eastern Tel. Ord.	10	10	190⅜	—	5 5 0
Globe Tel. and T. Ord.	10	10	19⅛	— ⅛	5 5 0
do. do. Pref.	6	6	11⅛	—	5 7 10
Great Northern Tel.	24	22	28⅜	—	7 13 0
Indo-European	10	10	35½	—	7 1 0
Marconi	25	15	2¼	+ ⅛	6 15 6
Oriental Telephone Ord.	12	12	2⅞	—	*5 4 0
United R. Plate Tel.	8	■	7⅜	—	*5 6 8
West India and Panama	Nil	Nil	10/-	—	Nil
Western Telegraph	10	10	19	—	*6 6 3
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	50½	—	8 15 8
do. District	Nil	1	45	— ¼	2 4 9
Underground Electric Ordinary	Nil	Nil	2⅛	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	81⅛	— ⅛	7 3 0
do. do. 2nd Pref.	Nil	5½	44⅛	— ⅛	5 17 9
do. do. 5 per cent. Deb.	5	5	80½	—	6 2 8
Brazil Tractions	Nil	Nil	48	—	8 6 8
British Columbia Elec. Rly. Pcs.	5	5	78½	—	6 7 5
do. do. Preferred	5	93/-	76⅜	—	*6 3 6
do. do. Deferred	3	124/-	87½	—	*7 0 6
do. do. Deb.	4½	4½	78½	—	5 8 3
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½	—	6 2 8
do. 5 per cent. Bonds	Nil	Nil	58½	+ 2	Nil
Mexican Light Common	Nil	Nil	21½	—	Nil
do. Pref.	Nil	Nil	51½	—	Nil
do. 1st Bonds.	Nil	5	67	—	7 8 2
Manufacturing Companies.					
Babcock & Wilcox	15	16	3⅜	— ⅛	4 12 6
British Aluminium Ord.	10	5	16/-	— 3/6	6 3 6
British Insulated Ord	15	15	2¼	—	6 13 4
Callenders	15	15	2⅛	—	6 17 0
do. 6½ Pref.	6½	6½	1¼	—	5 15 7
Crompton Ord.	10	5	16/-	—	6 13 4
Edison-Swan	10	Nil	2/6	—	Nil.
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	12	—	7 5 6
English Electric	8	5	15/9	—	6 7 0
do. do. Pref.	6	6	18/3	—	6 10 6
Gen. Elec. Pref.	6⅜	6½	21/9	—	5 19 6
do. Ord.	10	5	1/6	+ 1	5 11 6
Henley	15	15	2⅜	—	6 11 8
do. 4½ Pref.	1⅛	1½	4⅛	—	5 2 10
India-Rubber	1½	—	11/3	—	—
Metr.-Vickers Pref.	6	6	2⅛	—	6 11 2
Siemens Ord.	10	10	1⅝	—	—
Telegraph Con.	20	20	25⅛	—	*4 11 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, December 27th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	6½d.	...
a Ammoniac, Sal ... per ton	£62	...
a Ammonia, Muriate (large crystal) ,,	£48	...
a Bisulphide of Carbon ... ,,	...	...
a Borax ... ,,	£30	...
a Copper Sulphate ... ,,	£26 15s.	...
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a ,, Perchlorate ... ,,	7½d.	...
a Shellac ... per cwt.	£17 15s.	...
a Sulphur, Sublimed Flowers ,,	£9	...
a ,, Lump ... ,,	£9 2s. 6d.	...
a Soda, Chlorate ... per lb.	3¾d.	...
a ,, Crystals ... per ton	£6	...
a Sodium Bichromate, casks per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£100	...
b ,, Wire ... per lb.	1/9 to 2/6	...
b ,, Sheet ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£166	...
Grade II ... ,, ,,	£122	...
Grade III ... ,,	£68	...
c Brass (rolled metal 9" to 12" basis) per lb.	9½d.	...
c ,, Tubes (solid drawn) ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ,,	9½d.	...
c Copper Tubes (solid drawn) ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£96	...
c ,, Sheet ... ,,	£96	...
c ,, Rod ... ,,	£96	...
d ,, (Electrolytic) Bars ... ,,	£71 15s.	45s. inc.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£81 15s.	45s. inc.
d ,, ,, H.C. Wire per lb.	10½d.	¼d. inc.
f Ebonite Rod ... ,,	3/6	...
f ,, Sheet ... ,,	3/-	...
n German Silver Wire ,,	2/6	...
h Gutta-percha, fine ... ,,	12/6	...
h India-rubber, Para fine ... ,,	1/1½	...
l Iron Pig (Cleveland Warrants) ... per ton	92s. 9d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£24	...
g Lead, English Pig ... ,,	£27 10s.	5s. inc.
g Mercury ... per bot.	£12 to £12 2s. 6d.	...
e Mica (in original cases) small ... per lb.	8d. to 8/-	...
e ,, ,, medium ... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain rastrings ,,	1/2	...
p ,, drawn bars and rods ,,	1/3	...
p ,, rolled strip & sheet ,,	1/9½	...
p ,, wire ... ,,	1/8½	¼d. inc.
o Platinum ... per oz.	£26	£2 inc.
d Silicium Bronze Wire ... per lb.	1/0⅜	...
r Steel, Magnet, in bars ... ,,	10d.	...
n Tin, Block (English) ... per ton	£181 10s. to £182	£6 inc.
n ,, Wire, Nos. 1 to 16 ... per lb.	8/2	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Physical and Optical Societies' Exhibition.—This exhibition, which is to be held on Wednesday and Thursday, January 3rd and 4th, 1923, at the Imperial College of Science, South Kensington, will be open in the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.). Mr. W. Gamble will give a lecture on "Reproduction of Colour by Photographic Processes" at 4 p.m. on January 3rd and at 8 p.m. on January 4th. Prof. E. C. Coker, F.R.S., will give a lecture on "Recent Photo-Elastic Researches on Engineering Problems" at 8 p.m. on January 3rd and at 4 p.m. on January 4th. All the lectures will be illustrated with experiments. Over 50 firms are exhibiting scientific apparatus, and a number of experimental demonstrations have been arranged. Invitations to attend have been given to members of the Institutions of Electrical Engineers, Mechanical Engineers, the Chemical Society, the Faraday Society, the Wireless Society of London, and the Röntgen Society. Admission in all cases will be by ticket only, and therefore members of the Societies mentioned desiring to attend the exhibition should apply to the secretary of the Society to which they belong. Others interested should apply direct to Mr. F. E. Smith, O.B.E., F.R.S., hon. secretary of the Physical Society, Admiralty Research Laboratory, Teddington, Middlesex.

Tramway Fares in Marks.—The Cologne tramway administration, a local newspaper says, has made a Christmas present to the inhabitants by a further increase in fares. Single tickets are now 100 marks each and transfer tickets 120 marks, while foreigners are required to pay 250 marks for a ticket.

ESTIMATING OFFICE ORGANISATION.—IV.

By MAJOR J. C. CONNAN, B.Sc., A.M.I.E.E.

Overhead Charges.—It is extremely important that a reasonably accurate knowledge of the overhead charges of a business should be known, as they are generally allowed for by the use of a multiplier to the actual net self cost, and consequently any error in their calculation will be greatly enlarged in the final estimates. The multiplier used will generally be based on an analysis of the overhead charges incurred during a period of six months or, at the very outside, of 12 months, and is therefore already somewhat out of date when actually used. However, this is not of serious importance if the figure has been carefully calculated in the first instance, as it can easily be modified should the charges have changed during the intervening period.

It can be readily understood that, for no two firms, even when of the same size, will these charges be equal, as they depend to such a great extent on the ability of the manager to run the business economically, as well as the completeness with which each firm is provided with equipment.

The overhead expenses of a firm are sometimes described as all those expenses which are incurred in getting business. However, this is hardly wide enough, and they may be more accurately defined as those expenses which cannot be definitely charged up to any one job. They comprise:—1. Interest on capital employed in the business. It will be necessary to pay interest on the capital employed if this has been borrowed, and even if the contractor has himself provided the capital he should still allow for the payment of the interest which the money could earn if employed elsewhere. To be strictly correct, the figure used for the rate of interest should be that current in the money market on the date of the analysis, but usually it is sufficient to allow 5 per cent. 2. Salaries. This covers the salaries of all the office staff (bookkeepers, estimating and erecting engineers, clerks, typists, &c.), salesmen, a salary for the owner if he gives his time to the business, and a proportion of the foremen's wages. It is to the interests of the firm to keep a certain number of foremen continuously on its books, and, in fact, to treat them as staff. This enables experienced, trustworthy men to be chosen who quickly get to know the methods of work of the engineers, and consequently give a consistency to all the work done by the firm. The whole of their wages need not be put to overhead charges, but only that portion of them which cannot be charged up to any job. The same might be done in the case of the erecting engineer's salary, but as the amount of time which he spends on any one job is comparatively short, and as a good deal of his time must be spent in the office, the distinction is hardly worth the expense necessary to get the items out, and consequently it is more satisfactory to charge up the whole of his salary to this account. 3. Travelling expenses and other out-of-pocket expenses incurred by the owner, salesmen, engineers, &c., whilst on the firm's business. 4. Rent, rates, and taxes. This should include offices, stores, and workshops where used. 5. Heating, lighting, and water for offices, stores, and workshops, except when already included under 4. 6. Repairs to buildings, except when included under 4. 7. Stationery. This includes office books, letter paper, data sheets, estimate forms, typewriting materials, pencils, ink, &c., blue prints and drawings when obtained outside, printing of letter paper, &c. 8. Postage, telephone, and telegrams. Separate items should be kept for these, as they are a fruitful source of waste. 9. Advertisements. This includes advertisements in trade journals, local papers, &c., as well as all expenses attached to printing and sending out of leaflets, catalogues, &c. 10. Office cleaning. The expenses incurred for a charwoman, window cleaning, touching up office furniture, &c. 11. Insurance. All insurance premiums should be booked here, including those for health (to cover National Health Insurance), fire, burglary, accidents to workmen (to cover workmen's compensation), strikes, glass breakage, and personal insurance for owner to cover accidents. 12. Technical and trade papers. A certain number of suitable trade journals will be taken in by every office, and the subscriptions for these should be booked here. 13. Staff expenses. Christmas presents or other bonuses paid to the staff and not already included under salaries. 14. Training apprentices. Any expenses involved in training an apprentice should be included here. 15. Bad debts. The amount involved will entirely depend on the care with which orders are accepted, and will be very different for various firms. With care it should not exceed 1 per cent. of the turnover. 16. Legal expenses. These may be necessitated by the recovery of bad debts, accidents to workmen, disputes arising out of the interpretation of contracts, &c. Under this heading should also be included all charges for information concerning the standing of firms, &c., obtained from information bureaux, detective agencies, &c. 17. Association fees. This includes fees paid to contractors' associations or other technical bodies of which the owner or any of the staff may become members for business reasons. 18. Maintenance charges. This item is to cover charges under contracts having a guarantee or maintenance clause. If it is necessary to estimate this item, allow, for a moderate-sized business, five hours per week for one man. 19. Repair charges. This should include:—(*a*) Repairs to tools, ladders, handcarts, &c.; (*b*) repairs to office furniture; (*c*) repairs to bicycle or car if kept for business purposes. 20. Depreciation. Write off each year:—(*a*) 33⅓ per cent. cost of tools; (*b*) 25 per cent. cost of bicycle or car; (*c*) 20 per cent. cost of office furniture; (*d*) percentage for depreciation of stock. The amount will depend on the class of stock kept, the quantity, and the rapidity with which it is turned over. This item should also allow for breakages of material and for providing samples for tests, &c., unless these can be charged to the customer.

The sum of the amounts obtained for the above items will give the total overhead charges for the period used in their calculation. There are three methods in which these overhead charges may be expressed:—1. As a percentage of the turnover during the above period: (*a*) constant percentage, and (*b*) variable percentage. 2. As a percentage on the wages actually expended on the contracts executed during the period. 3. Similar to 2, but together with a percentage on the cost of material used on the contracts. To apply this percentage to the estimate, it is only necessary to add the percentage found to the corresponding quantity in the estimate, which would be for:—1. (*a* or *b*) Total self cost. 2. Estimated labour cost. 3. Estimated labour and material costs separately. (*Net costs being used.*)

The first method is the one most commonly employed, and is quite straightforward in its application. Some firms consider that the expenses involved in obtaining the smaller jobs are relatively more heavy than those of getting the large work, and that consequently in applying the figure to an estimate a variable percentage should be made, the figure taken depending on the size of the job. It will be found, however, that this method will involve the loss of practically all the smaller work unless all contractors in the district use the same percentages, a circumstance which is extremely unlikely to happen without agreement amongst the contractors. It is not a method, therefore, which is likely to be much used.

As the amount of repair work relatively to new work may vary considerably in any one business during the course of a year, it is sometimes considered more correct to employ method 2. Whether this method is able to give more consistent results than the first is extremely doubtful, but if applied throughout the office for all work will give quite as good results, and is no more laborious to apply.

Method 3 is an amplification of method 2, and as the percentages of items 1-20 to be applied to labour and material respectively are arbitrarily chosen, it possesses no advantage over the former method, and need not, therefore, be further considered.

From the above it would appear that method 1 (*a*) is the one most easily applied and one which gives results as accurate as any of the others.

HINTS ON RADIO MERCHANDISING.*

BY W. F. CROSBY.

During the past eight or ten months the radio industry in America has gone forward by unparalleled leaps and bounds, and there are many lessons that may be derived by other countries where the radio craze has just started. In the first place, America has always had a certain number of firms devoted almost exclusively to the manufacture of radio apparatus for amateur use. These firms were pretty well scattered and competition was not keen, but the grade of apparatus turned out was very carefully designed, as a rule, and built in accordance with good engineering practice.

However, with the advent of radio broadcasting, business men and manufacturers were quick to grasp the money-making possibilities of radio, and many factories, which had been used for other lines of manufacturing, were turned over, almost exclusively, to the making of radio apparatus of all descriptions. Most of the winter season the market was absolutely barren of good radio apparatus, with the result that all sorts and conditions of parts and sets were turned loose in great haste. Needless to say, practically all this material was of inferior design or simply a cheap copy of some already successful make. This sort of manufacturing did a great deal of harm to radio, the average small dealer not knowing enough about the business to distinguish between good and bad apparatus.

The result of this was that people who had recently become interested and did not know the good from the bad, bought almost anything that they could lay their hands on. The new manufacturers were swamped with orders, and every day saw new firms being started for the manufacture of radio apparatus. The beginner, who had just purchased the parts for his set, or the set complete, soon found out that the set that he had was not of the best quality, and consequently he very quickly became disgusted with what he had and usually either dropped out of the field entirely or disposed of what he had waited until a later date, when he knew he would be able to buy the right sort of apparatus.

Many of these new firms entered the business without any technical knowledge whatsoever, and many of them did not even take the trouble to hire a more or less experienced amateur to lend them a guiding hand. They went at the business absolutely blindly, and took a chance on what they were about to make. Other firms employed the services of some young man who thought that he might possibly, some day, become a radio engineer at the expense of the firm hiring him. From actual observation, it has been found that these young men usually stayed with a firm long enough to get one good set working. They might waste three or four months in useless experimenting where an experienced engineer would have known exactly what to do at the very start. This cost the employers quite a sum of money for apparatus as well as the time spent, and usually the set when put on a commercial basis was not much good for the reception of radio broadcasting. This did not happen in every case, but it did occur so often that the dealers became suspicious of every salesman who came into their stores.

The better class of radio manufacturers went at this in an entirely different manner. Here the procedure was to hire a staff of good men under an experienced radio engineer. In this way a research department was kept constantly on the job, with the result that this type of manufactured set was usually far in advance of the others. New types of apparatus were designed in this way, and from these very laboratories we have secured some of our finest radio apparatus.

Business men, who realise the possibilities in the merchandising of radio apparatus, would find it advisable to give some study to the subject, although this does not mean that any preparation is necessary in the fundamentals of wireless telegraphy or electricity. It is essential for the dealer to be able to explain the principles of wireless and also the uses and operation of the instruments that he has for sale, and to be able to order intelligently the special requirements of his customers, who will want more and more parts and accessories as their interest in radio increases.

Many merchants, who do not have the time to devote to this study, delegate it to some member of their organisation who is specially adapted to the work, and these individuals are placed in charge of the radio department. Such a manager who is equipped for the work can do much to develop interest in the business by the formation of clubs, lectures, &c.

The radio store should be arranged attractively as well as conveniently, and its location should be carefully thought out. Nearly all of the buyers first wish to hear the set that they are about to buy in operation, and the wise dealer has a section of the store wired up in such a way that any piece of apparatus may be easily and quickly tested out. In this way the purchaser will have confidence in what he is buying, and will return again and again for other apparatus that may be needed. Some of the stores have arranged small booths along one wall having on exhibition at all times radio sets that they are handling. These are arranged in such a way that by the throwing of a switch it is possible for the customer to listen and compare any of the sets on exhibition. This has proved a great advantage to some of the stores, and it seems to be very popular with the public. One of the largest of these stores has a man specially engaged, who knows radio, and he delivers a short talk every half hour to whoever happens to be on hand. It frequently happens that his audience mounts up to thirty or forty people during one of these talks, and many sales are made in this way. This speaker starts in at one end of a long shelf on which all of the sets are placed, and delivers a few minutes' talk on each one, telling exactly what it is used for and demonstrating its tuning qualities as well as the loudness of the signals. In all, there are about eight sets in this unique exhibition, and it is said that this firm does the largest retail business of any in the Metropolitan section. The store was thronged from the start with eager buyers, and in time as the news spread it was noticed that many who had been there before came back and brought their friends with them.

A feature of the radio business which, so far, has not been gone into very deeply by any of the manufacturers or dealers, is the sale of receiving sets to the farmers who are located far from the usual centres. Through the New England section, as well as some of the Western States, certain firms have sent out salesmen equipped with light automobiles and having a set installed and working on the machine. The aerial, in a case of this type, was usually made so that salesmen could toss a weighted cord over the limb of some nearby tree, using this, in turn, to hoist one end of the aerial some feet above the ground. The other end ran directly to a connection on the car, and then the car was backed off until a span of possibly one hundred feet of wire was in use. This made a highly successful aerial when connected to the proper receiving set, and the ground connection was usually made to a convenient hydrant or, if no hydrant was handy, the salesman drove a piece of iron pipe into the ground and had his ground wire connected to this. Such an outfit as this would arrive at some small country town on a Saturday morning and the set be rigged up, as described above, at some prominent corner or wherever the village authorities would permit. The crowds of farmers from surrounding territories coming into the town for the evening would be attracted by this radio outfit, and if the salesman knew his job he would usually be able to take many orders. His duties would be, not only to tickle the crowd with a demonstration of the music in the air, but also to tell them how the time signals, weather reports, and stock prices were given out every day and night. The farmer was quick to grasp the advantages of knowing the latest prices of his products, and usually his family had a great deal to say about the attractiveness and educational features of the rest of the programme. It seems that this scheme could be carried out in almost any section of the world, provided the broadcasting stations were installed and operated.

Sooner or later the radio enthusiasts are going to be educated to the point where they will be able to distinguish very easily the difference between good and bad apparatus, and the dealer who knows what to avoid in the first place, and stocks up on good apparatus only, will be the man who stays in business and secures the profits. A few hints about the design of apparatus will not be out of place here.

* From *Export* (U.S.A.).

In the first place it has been found that any coil of wire used in a receiving set that is made with shellac, varnish, or paint, to hold wires in place, is usually far inferior to the same piece of apparatus made up without any of these adhesives. The reason for this is that the shellac or varnish makes an imperfect insulation or dielectric, with the result that the distributed capacity is too high, consequently lessening the efficiency of the piece of apparatus. Another point that may be well worth investigating is the type of insulation used in the set or the parts thereof. A great many pieces of radio apparatus are made up on a base form of some insulating compound, the difference being in the fact that there are all sorts of compounds, some of which are insulating and some are not. Others are of such composition that a small blow will cause them to chip and crack or completely fall apart. In variable condensers it sometimes happens that there are end pieces made of some sort of insulating compound, arranged in such a way that they form bearings for the movable shaft. Unless the compound is of tough mixture, or suitable bearings of metal are inserted, the shaft will soon wear down the compound, getting the condenser out of alignment and making it useless.

The bane of the American radio man, as well as of a great many dealers, has been the poorly made crystal set. Manufacturers got the idea that a set of this type could be built in great quantities and sold by the thousand, thereby reducing cost both at the plant and to the consumer. These sets, owing to the extreme cheapness of price, cannot be tested out as they should be, and the fact that they are made for cheapness shows that certain essential parts have been eliminated in order to reach the desired end. Experience has shown that these cheap crystal sets are incapable of close tuning, and it frequently happens that the owner of such a set, while listening to a broadcasting programme, will find that he is unable to hear any more of the music owing to the fact that some ship or commercial station is transmitting in code and the set is unable to tune out the unwanted station. It must be remembered that in order to get results, a set must be equipped with several controls, otherwise such an outfit will be interfered with by every station in its radius.

One of the greatest mistakes, and one well worth avoiding, is the advertisement of a guarantee of the distance at which a set will receive messages. The experienced radio man when he sees an advertisement of this type at once brands the advertiser as either a fake or one who does not know his business. If the advertiser will only stop to think the thing over, he will realise how ridiculous it is to state on paper how far his set will work. Weather conditions, the location of the receiving station, the height and length of the aerial, the skill of the operator, and the power of the transmitting station are all vital factors that cannot be ignored. In actual operation a set will not act the same in any two localities, and for that matter it will not act exactly the same any two nights running. The atmosphere is constantly changing, with the result that the distance from which messages may be received is also changing. In summer the range of the set will be greatly reduced owing to the fact that there is a great deal more atmospheric electricity in the air than there is in the winter, and this variation taking place every day, to a certain extent, is just enough frequently to spoil all calculations as to what a set will do. Any radio man will vouch for this statement, that though he has the best receiving set possible, there is no telling how far the set will receive. It is like asking: "How far can a dog howl?" with just about as much sense connected with it. If a manufacturer is willing to tell you how far his set will receive, you may rest assured that he is new at the game, and probably doesn't know what he is talking about.

One of the most important parts of any receiving set is the receivers, or head sets, as they are sometimes called, and it must be remembered that here again the small dealer is liable to run into trouble. The average receiver that is manufactured to-day is not suitably designed for the extremely loud signals coming from a good set with amplifiers. Head 'phones are made primarily to receive faint sounds, and when overloaded, and forced to give out several hundred times the sound that they are designed for, it frequently happens that they either burn out or the diaphragms are bent. This diaphragm is the only moveable part of the receiver, and it is held in place rigidly over a magnetic field but only a few thousandths of an inch away. The incoming signal varies the current flowing through the magnetic field, consequently strengthening or weakening the magnet as the case may be. As the magnet gets stronger the diaphragm is drawn toward it, and it is this deflection of the diaphragm that actually turns out the sound waves that we hear. If the signal is too loud, the extreme movement of the diaphragm will cause it to hit the magnet, thereby making the rattle or tinny sound so often heard in the receiver, and also in a loud speaker using a receiver of this type. There are a few makes of receivers suitable for this sort of work, but the regular power loud talker is what should be used wherever loud signals are wanted.

There are many more little things such as this that may mean success or failure to the concern about to enter the radio field, but they cannot all be taken up at this time. The dealer is cautioned to use good practical sense in selecting what apparatus he intends stocking. Watch out for constructional details, and above all beware of the freak pieces of apparatus that are being placed on the market nearly every day. The great growth of radio in America may serve to give many lessons to other countries where the broadcasting business is about to be started or has not gained such a foothold as it has here.

ELECTRICAL EXPORTS OF THE UNITED STATES.

Below are given the values (and quantities where available) of electrical machinery and appliances exported from the United States of America during 1921, showing the principal countries of destination. For purposes of comparison the figures for 1920 are added, and notes of increases or decreases are made.

	1920	1921	Inc. or Dec.
Batteries.—	Dol.	Dol.	Dol.
Total	6,634,000	3,832,000	- 2,802,000
To Norway	79,000	21,000	- 58,000
,, Great Britain	469,000	285,000	- 184,000
,, Canada	1,834,000	1,103,000	- 731,000
,, Cuba ...	406,000	160,000	- 246,000
,, Argentina	448,000	294,000	- 154,000
,, Chile	64,000	98,000	+ 34,000
,, China	147,000	66,000	- 81,000
,, Australia	365,000	185,000	- 180,000
,, New Zealand	227,000	172,000	- 55,000
,, British South Africa	251,000	97,000	- 154,000
,, British India	230,000	84,000	- 146,000
,, Brazil	190,000	66,000	- 124,000
,, Mexico	302,000	325,000	+ 23,000
,, Spain ...	206,000	76,000	- 130,000
,, France	114,000	26,000	- 88,000
Carbons.—			
Total	1,478,000	434,000	- 1,044,000
To Italy	63,000	—	- 63,000
,, Norway	16,000	—	- 16,000
,, Great Britain	74,000	58,000	- 16,000
,, Canada	938,000	234,000	- 704,000
,, Mexico	52,000	20,000	- 32,000
,, Japan	132,000	53,000	- 79,000
Dynamos or generators.—			
Total	7,796,000	7,942,000	+ 146,000
To France ...	615,000	215,000	- 400,000
,, Belgium	73,000	104,000	+ 31,000
,, Spain ...	282,000	337,000	+ 55,000
,, Italy ...	245,000	134,000	- 111,000
,, Norway	161,000	17,000	- 144,000
,, Great Britain	152,000	119,000	- 33,000
,, Canada	700,000	672,000	- 28,000
,, Mexico	209,000	480,000	+ 271,000
,, Cuba ...	637,000	776,000	+ 139,000
,, Argentina	71,000	163,000	+ 92,000
,, Brazil	193,000	413,000	+ 220,000
,, Chile	315,000	154,000	- 161,000
,, Uruguay	70,000	4,000	- 66,000
,, Colombia	86,000	44,000	- 42,000
,, Peru ...	40,000	96,000	+ 56,000
,, China	714,000	553,000	- 161,000
,, Hong Kong	104,000	12,000	- 92,000
,, India	798,000	377,000	- 421,000
,, Japan	1,403,000	1,755,000	+ 352,000
,, Australia ...	167,000	327,000	+ 160,000
,, British South Africa	70,000	303,000	+ 233,000
Fans.—			
Total No. ...	72,200	63,700	- 8,500
$ ...	1,365,000	1,270,000	- 95,000
To Canada, No.	11,000	10,000	- 1,000
$...	116,000	122,000	+ 6,000
,, Argentina, No.	6,000	4,500	- 1,500
$ ...	138,000	90,000	- 48,000
,, China, No.	4,000	4,150	+ 150
$... ...	83,000	110,000	+ 27,000
,, British India, No. ...	16,000	16,000	—
$ ...	344,000	433,000	+ 89,000
,, Cuba, No.	10,000	7,000	- 3,000
$ ...	192,000	150,000	- 42,000
,, Mexico, No.	3,000	3,500	+ 500
$	68,000	77,000	+ 9,000
Heating and cooking apparatus.—			
Total ...	1,801,000	1,637,000	- 164,000
To Norway ...	198,000	16,000	- 182,000
,, Great Britain	152,000	172,000	+ 20,000
,, Canada ...	346,000	255,000	- 91,000
,, Japan	79,000	91,000	+ 12,000
,, Argentina	108,000	180,000	+ 72,000
,, Australia	139,000	110,000	- 29,000
,, Mexico	112,000	195,000	+ 83,000
,, Brazil	132,000	103,000	- 29,000

	1920 Dol.	1921 Dol.	Inc. or Dec. Dol.
Insulated wire and cables.—			
Total	8,209,000	8,574,000	+ 365,000
To Belgium	75,000	41,000	32,000
,, Denmark	58,000	23,000	35,000
,, France	102,000	134,000	32,000
,, Netherlands	298,000	155,000	143,000
,, Norway	592,000	28,000	564,000
,, Portugal	38,000	10,000	28,000
,, Spain ...	78,000	75,000	3,000
,, Sweden	125,000	2,343,000	+ 2,218,000
,, Great Britain	450,000	274,000	176,000
,, Canada	271,000	197,000	74,000
,, Mexico	586,000	655,000	69,000
,, Cuba ...	944,000	741,000	203,000
,, Argentina	465,000	278,000	187,000
,, Brazil	1,267,000	670,000	597,000
,, Chile	136,000	243,000	+ 107,000
,, Colombia	98,000	106,000	+ 8,000
,, Peru	165,000	112,000	53,000
,, Uruguay	55,000	69,000	+ 14,000
,, China	562,000	440,000	122,000
,, Japan	49,000	110,000	+ 61,000
,, British India	186,000	286,000	+ 100,000
,, Australia	55,000	156,000	+ 101,000
,, New Zealand	80,000	163,000	+ 83,000
,, Dutch East Indies ...	112,000	122,000	+ 10,000
,, Philippine Islands	431,000	175,000	256,000
,, British South Africa	34,000	83,000	+ 49,000
Interior wiring supplies and fixtures.—			
Total ...	3,386,000	1,849,000	- 1,537,000
To Norway	43,000	3,000	40,000
,, Canada	957,000	348,000	609,000
,, Mexico	209,000	232,000	+ 23,000
,, Cuba	379,000	205,000	174,000
,, Argentina ...	163,000	116,000	47,000
,, Brazil ...	252,000	110,000	142,000
,, Australia ...	101,000	121,000	+ 20,000
Metal filament lamps.—			
Total No. ...	16,143,000	10,920,000	- 5,223,000
$ ...	4,052,000	3,149,000	- 903,000
To Italy, No.	330,000	12,000	318,000
$	81,000	5,000	76,000
,, Canada, No.	3,907,000	747,000	- 3,160,000
$	974,000	171,000	803,000
,, Peru, No.	240,000	378,000	+ 138,000
$	65,000	106,000	+ 41,000
,, Mexico, No.	1,146,000	1,442,000	+ 296,000
$	317,000	457,000	+ 140,000
,, Cuba, No.	2,074,000	954,000	- 1,120,000
$	606,000	290,000	316,000
,, Argentina, No.	683,000	1,380,000	+ 697,000
$	153,000	392,000	+ 239,000
,, Brazil, No.	2,249,000	1,137,000	1,112,000
$	465,000	302,000	163,000
,, Australia, No.	479,000	1,111,000	+ 632,000
$	117,000	266,000	+ 149,000
,, British South Africa, No.	245,000	218,000	27,000
$	69,000	70,000	+ 1,000
Lamps, arc	25,000	13,000	12,000
,, *carbon filament*	115,000	125,000	+ 10,000
Magnetos, spark plugs, &c.—			
Total ...	3,601,000	1,314,000	- 2,287,000
To Italy	144,000	2,000	142,000
,, Great Britain	365,000	70,000	295,000
,, Canada	1,030,000	367,000	663,000
,, Argentina	186,000	146,000	40,000
,, India	210,000	40,000	170,000
,, Japan	126,000	50,000	76,000
,, Australia	161,000	77,000	84,000
,, New Zealand	119,000	21,000	98,000
,, British South Africa	108,000	23,000	85,000
,, Mexico	79,000	60,000	19,000
Motors.—			
Total ...	13,422,000	15,444,000	+ 2,022,000
To France	701,000	525,000	176,000
,, Great Britain	1,240,000	601,000	639,000
,, Canada	2,404,000	1,443,000	961,000
,, Mexico	398,000	872,000	+ 474,000
,, Cuba	972,000	946,000	26,000
,, Brazil	447,000	585,000	+ 134,000
,, China	557,000	736,000	+ 179,000
,, India	477,000	988,000	+ 511,000
,, Japan	1,485,000	1,655,000	+ 169,000
,, Belgium	481,000	444,000	260,000
,, Italy	122,000	84,000	322,000
,, Spain	72,000	391,000	+ 319,000
,, Argentina	78,000	903,000	+ 685,000
,, Australia	660,000	2,374,000	+ 1,714,000
,, New Zealand	253,000	325,000	+ 72,000
,, Philippine Islands	156,000	232,000	+ 76,000
,, British South Africa	217,000	660,000	+ 443,000

	1920 Dol.	1921 Dol.	Inc. or Dec. Dol.
Meters and measuring instruments.—			
Total ...	2,677,000	2,726,000	+ 49,000
To Canada ...	489,000	310,000	179,000
,, Argentina ...	66,000	74,000	+ 8,000
,, Brazil	132,000	104,000	28,000
,, China ...	148,000	128,000	+ 20,000
,, Japan ...	441,000	537,000	+ 96,000
,, Italy ...	102,000	16,000	86,000
,, New Zealand ...	48,000	81,000	+ 33,000
,, Australia ...	111,000	306,000	+ 195,000
,, Mexico ...	96,000	194,000	+ 98,000
Rheostats and controllers.—			
Total ...	708,000	1,044,000	+ 336,000
Switches and accessories.—			
Total ...	4,439,000	4,033,000	406,000
Telegraph apparatus.—			
Total ...	714,000	1,011,000	+ 297,000
To Great Britain ...	66,000	68,000	+ 2,000
,, Sweden	—	441,000	+ 441,000
,, Canada	84,000	71,000	13,000
,, Japan	73,000	60,000	13,000
Telephones.—			
Total ...	3,899,000	4,799,000	+ 900,000
To France	27,000	95,000	+ 68,000
,, Italy	132,000	16,000	116,000
,, Netherlands ...	10,000	160,000	+ 150,000
,, Spain	129,000	46,000	83,000
,, Norway	20,000	79,000	+ 59,000
,, Spain	129,000	46,000	83,000
,, Belgium	133,000	179,000	+ 46,000
,, Sweden	1,000	249,000	+ 248,000
,, Switzerland ...	98,000	113,000	+ 15,000
,, Great Britain ...	276,000	358,000	+ 82,000
,, Canada ...	810,000	640,000	170,000
,, Brazil ...	408,000	301,000	107,000
,, Mexico ...	52,000	127,000	+ 75,000
,, Argentina ...	111,000	131,000	+ 20,000
,, Colombia ...	62,000	115,000	+ 53,000
,, British India ...	73,000	120,000	+ 47,000
,, China ...	234,000	121,000	113,000
,, Japan ...	76,000	233,000	+ 157,000
,, Dutch East Indies...	143,000	210,000	+ 67,000
,, Australia	188,000	620,000	+ 432,000
,, New Zealand ...	77,000	150,000	+ 73,000
Transformers.—			
Total ...	4,803,000	7,988,000	+ 3,185,000
To France ...	125,000	643,000	+ 518,000
,, Italy ...	30,000	347,000	+ 317,000
,, Netherlands ...	18,000	2,000	16,000
,, Spain	331,000	450,000	+ 119,000
,, Norway	283,000	152,000	131,000
,, Peru	67,000	150,000	+ 83,000
,, Mexico ...	214,000	497,000	+ 283,000
,, Brazil	565,000	628,000	+ 63,000
,, Chile	60,000	321,000	+ 261,000
,, China	330,000	712,000	+ 382,000
,, Japan	455,000	1,082,000	+ 627,000
,, Canada ...	167,000	265,000	+ 98,000
,, Australia	254,000	1,017,000	+ 763,000
,, India	748,000	251,000	497,000
,, New Zealand ...	66,000	264,000	+ 198,000
,, British South Africa	58,000	203,000	+ 145,000
All other electrical machinery and appliances (except locomotives).	32,868,000	28,632,000	- 4,326,000
Grand total of electrical machinery and appliances (except locomotives).	102,000,000	95,818,000	- 6,182,000
Locomotives, electric—			
Total ...	880,000	2,121,000	+ 1,241,000

Lecture.—On December 12th Dr. W. Clow, M.A., B.Sc., gave a lecture on "The Medical Aspects of Electricity" before the Paisley Association of Electrical Engineers. The speaker commenced by observing that there was probably no activity of animal mechanism which was not accompanied by a demonstrable difference of potential. He then spoke of the possibilities of X-rays both for examination and curative treatment, and from this proceeded to high-frequency currents and ionisation, and illustrated his remarks by means of lantern slides.

The "Hydro" Lamp.—The Hydro-Electric Power Commission of Ontario announces that it has developed a lamp in a number of sizes, with a tested life of 1,500 hours, which is 50 per cent. longer than that of the usual types. This is being supplied in large and small quantities to the Commission's consumers.

FAILURES OF RESIDENT ENGINEERS AND CONTRACTORS.

A Joint meeting of the National Association of Supervising Electricians and of the Association of Engineers-in-Charge, to discuss the problem of "Where the Electrical Contractor and the Resident Engineer fail respectively in dealing with Electrical Plant," was held at St. Bride's Institute, London, on November 28th. Mr. W. E. Highfield, president of the N.A.S.E., occupied the chair; Capt. A. E. Penn (Association of Engineers-in-Charge) dealt with the problem from the point of view of the resident engineer; and Mr. T. H. Windibank (N.A.S.E.) put the case on behalf of the electrical contractor.

Captain Penn dwelt at some length on the necessity for an electrical contractor, when dealing with installations of electrical plant, to seek out the resident engineer and work with him. He pointed to the difficulty in which the resident engineer was often placed as the result of the contractor receiving instructions from a secretary, or someone who knew little about the work. The resident engineer should be the man to inform the contractor as to what work was required to be done, and should draw up a proper specification embodying all the essential details. Taking it for granted that that specification had been drawn up, it was very necessary that the contractor should interview the resident engineer with regard to the carrying out of the work. If such a course were not adopted by the contractor this was where he failed in the first instance; there was friction at some time, and the proceedings were hampered from the commencement.

This was to be deplored, as the contractor might have made known some other proposition to the management which appeared plausible to them and feasible to him, owing to his imperfect insight into the conditions prevailing. Discussing the tendency on the part of some employers to consider that the plant which a contractor had installed was so simple and fool-proof that they could dispense with a resident engineer (the contractor having promised to look in once a month to see that things were going all right), Capt. Penn said that there was generally trouble through the failure of the contractor to be conversant with the details governing the efficient working of the whole system. A contractor should be a contractor only, and not a consultant, adviser, manufacturer, supervisor, &c., to the detriment of others who had had special training in the various phases of engineering.

The contractor, having obtained a contract for the installation of plant, probably at a cut price, might not see eye to eye with the resident engineer with regard to details. The contractor was concentrating on how the money was running out, whilst the engineer was considering what trouble the contractor was leaving behind. The manufacturer often failed in neglecting to follow up the operation of his machinery, and it was seldom that the contractor was able to locate trouble effectively, even though he might have the design of a particular machine at his finger tips, but there were exceptions.

The contractor sometimes adopted a high-handed attitude towards the resident engineer. So long as the job was secured the contractor generally declined to worry about the views of the resident engineer, and too often the customer was given the impression that the resident engineer could not be expected to understand the special apparatus. On the other hand, some firms adopted the policy that their apparatus was automatic, and required no maintenance. Capt. Penn considered that both were wrong, and that the resident engineer should take over all new plant immediately it was in running condition.

The contractor also failed in his service to the customer by cutting prices to the lowest limit to secure work, whilst another point of criticism was the practice of contractors to sub-let work to local firms, with only part-time supervision by the main contractors. The resident engineer had to make up for want of supervision, and might have difficulty in persuading the sub-contractors to see his point of view.

Mr. T. H. Windibank, speaking for the contractor, said that he had to deal with widely divergent types of resident engineers. He divided them into three classes, namely: (1) the resident engineer who was always under the direction of a consulting engineer; (2) the resident engineer who had the control of the technical side, and who was responsible to his firm in both advisory and executive capacities; and (3) one who had to accept dictation from a non-technical source. With regard to the second and third types, there was frequently to be encountered a sad lack of vision, generally evidenced by a tendency to under-estimate the future demand, and a desire to perpetuate an old fetish by introducing second-hand plant. He mentioned cases where improvements had been recommended by contractors, but had not been carried out, with the result that the resident engineers concerned had failed to get the greatest efficiency. During the progress of installation the resident engineer should always be at hand; it was to his advantage, as well as that of the contractor.

As to driving a plant, Mr. Windibank [illegible] every machine in a works should be catalogued [illegible] resident engineer with the power required. Makers' [illegible] was generally under-estimated, was often accepted without question. The maintenance of plant when handed over provided the resident engineer with the opportunity to make or mar the contractors' reputation. Insufficient care was given to the log book, in fact, more often than not it did not exist. Too much reliance was placed on insurance companies' reports, which were frequently belated, and varied in value in true ratio to the competency of the inspector. Standardisation had many advantages, but required handling temperately, otherwise it was naive to impede progress. The faults alleged against resident engineers, said Mr. Windibank, could be ascribed generally to incompetency, dogmatism, or limitations. With incompetents the only course was education. The dogmatic resident engineer was generally a competent man, but many years in a rut had made him distrustful of modern developments and a source of anxiety and trouble to manufacturers and contractors. The remedy in this case lay in the open discussion of daily troubles and innovations, facilities for which were offered by the Association of Engineers-in-Charge. The third cause, that of limited authority, was the outcome of unsatisfactory economic relations between engineer and employer, and emphasised the demand for recognition of engineers-in-charge as a class.

A long discussion followed, in the course of which many experiences were related, by electrical contractors and engineers-in-charge, of incompetency or efficiency on the part of both.

Co-operation was the keynote of the whole discussion. It was pointed out that the resident engineer generally was of a conservative turn of mind, because he was concerned with the constant running of the plant when installed, whereas the contractor was more liable to try to push new things forward.

Mr. C. A. Pickle said that at the present time the lowest tender was likely to be successful, and contractors were liable to cut prices too much; the engineer knew what the work could be done for, and he had difficulty in seeing that the contractor did the job properly.

Mr. J. Carter referred to a case in which he was instructed to give special supervision to a man (who was not an electrical contractor) who had cut his price, because it was realised that he could not possibly do the work for the price at which he had contracted to do it, and it was "skimped." The result was that Mr. Carter would not pass his work. It was condemned by the board, and the man was stopped. He (Mr. Carter) fancied, however, that the same sort of thing could be found with electrical contractors sometimes.

Many speakers complained that when an engineer drew up a specification, and tenders were received, acceptance often rested with a non-technical board, who went for the lowest price without further consideration. It was pointed out that there were legal difficulties in connection with drawing up specifications.

The Chairman said that in the case of large new works it was almost impossible to draw up a specification to cover every legal point.

Mr. H. D. Wilkinson, dealing with non-technical boards, said it was wrong to ask an engineer to draw up specifications and then select tenders without asking for his advice.

A difficulty mentioned by Mr. Carter was that supervising electricians lacked mechanical knowledge, and that was where the resident engineer should be consulted.

Mr. F. T. Alldread, following this up, agreed, that although the resident engineer was often a good man mechanically, he was not an expert in other branches. Such troubles would be got over if the firm would call in an expert who, after consulting the resident engineer, would draw up a specification.

Mr. A. J. Stiling said that contractors would always keep to specifications, except where unforeseen difficulties arose and changes were mutually agreed upon. The contractor could not always be blamed for acting as a consultant if he did not know of the existence of the resident engineer. The necessity for the resident engineer to witness tests of machinery to be installed was also emphasised. Thus he would get to know the contractor, and would have an opportunity of seeing new work on the test bench at the same time.

Mr. Windibank, replying, agreed that electricians were weak on mechanics, but pointed out that one of the strong points in connection with the N.A.S.E. programme was education; also joint meetings with the Association of Engineers-in-Charge were very instructive, and he looked forward to many more in the future. It was the curse of the electrical industry that there was a crowd of men who called themselves "engineers" taking jobs at any price, and comfortably going bankrupt before they were finished. Referring to the slow progress of the electrical industry in this country during the last thirty years, as compared with other

countries, he said that the industry had had to fight British conservatism.

Capt. Penn, in the course of a short reply, said, with regard to specifications, that if engineers could not put on paper what they wanted definitely they should not interfere, but should call in a consultant.

RADIO-TELEPHONY.

In connection with the Engineering Exhibition that was held at Cardiff recently under the auspices of the South Wales Institute of Engineers, a conference was held at the same time at which several papers were read and discussed. Mr. David E. Roberts, president of the South Wales Institute of Engineers, occupied the chair.

Mr. E. Ogden, assistant Post Office engineer, Cardiff, read a paper on "Wireless Telephony," which was keenly followed by those in attendance.

The author explained what radio telegraphy was and how the transmitting and receiving apparatus functioned by means of a number of analogies, dealing with the subject from a more or less elementary point of view, after which, with the aid of apparatus that had been lent for the purpose, a demonstration of the reception of Morse signals and telephony was given by Mr. Abel Sanderson.

Capt. C. Crompton, superintending engineer, G.P.O., Cardiff, in opening the discussion, pointed out that the introduction of broadcasting had rendered it necessary to prescribe, to a certain extent, the wave length band in which amateurs might operate. The absence of this regulation in America had produced great confusion and it should be a matter of faith and honour in this country to see that the control regulations were strictly adhered to. The arrangements which had been made for them were very generous and if they were not properly adhered to, then further restrictions would be imposed and the great freedom which amateurs enjoyed to-day in their experimental work would be further cut down. They were placed virtually on their trial, and he would emphasise the fact that the authorities had means of tracking down offenders, no matter in what out of the way place they might be operating. The day would come when the evil doer would be tracked down and stopped altogether. Those who broke the regulations were not only doing a disservice to their brother amateurs, but also to our commercial service.

Mr. Widdowson said it seemed to him that if amateurs were going to do any good at all it meant spending a great amount of money.

Mr. George Franse and Mr. J. H. P. Berthor also took part in the discussion, after which Mr. Ogden, referring to the question of interference, explained that the ordinary amateur was not allowed a transmitting licence. There had been a few issued, but he did not think there would be many more, unless the amateur showed conclusively that he knew what he was talking about and that he was sufficiently conversant with the theory of the subject not to interfere with other stations. An amateur could receive on any wave length, but if he did not do so with discretion he would interfere with other amateurs and also with the commercial service. One valve and a crystal were sufficient if they did not want to go to much expense, though they could get far better results by using two valves and a crystal. There were a number of good books on the subject, but for general all-round knowledge the Admiralty book was extremely useful. Those thinking of building a set, he would advise to be careful of the new broadcasting licence which now bore the stamp of the British Broadcasting Co. By taking out that licence they undertook to use that apparatus only, they would not be able to go to an ordinary dealer and buy anything.

TINPLATE MACHINERY.

Visitors from West Wales were much in evidence at the Engineering Exhibition, Cardiff, on November 22nd, a large number having journeyed to the city to listen to an address on the above-named subject at the South Wales Institute of Engineers. So keen was the interest taken in the lecture that the discussion was adjourned and resumed at a special meeting at Swansea on December 4th, when the Melingriffith tinplate works were visited.

Mr. H. Spence Thomas, in the course of his address, which was illustrated with a kinematograph film, remarked, *inter alia*, that regarding the motive power, he had an open mind on the relative merits of steam and electricity. Some firms [illegible] figures with regard to coal consumption and, in comparing steam and electricity, they might be horrified at the high consumption of energy for driving mills by electricity, but it was only fair to say that if one used electricity it eliminated capital cost in the shape of boilers, steam pipes &c., and the cost of firing and removal of ashes, both very difficult and trying problems. One had to make due allowance for those things, but as far as he could see the cost of running the plant electrically was roughly about double that of the coal consumption alone. Whether the cost of labour and inconveniences of making steam, depreciation of boilers, superheaters, economisers, the upkeep of plant, and so on, were equivalent to about double the cost of the fuel itself was a matter for every one to work out for himself. That was the main point, in his view, as regarded a comparison between electricity and coal consumption. As to the cost of electrical plant, one would be told by the people who sold generators that they could "make the juice" for an extraordinarily low figure. If one took a supply of electricity from a power company or corporation, one would have to pay about 1d. per kWh on a tinplate works load. If one could make one's own electricity for ½d. per kWh, with coal at today's prices, one would halve the cost, of course. The point was, which was the correct figure per kWh, and how one paid for the energy. The great advantage of the electrical drive was that one could tell with certainty whether the mills were level or out of line, and whether anything was the matter; while with a steam drive it was difficult to tell which particular mill was wrong.

During the discussion users of the electrical drive in South Wales tinworks said that it more than held its own with the steam drive, but it was complained that the maximum demand charges were excessive. It would pay tinworks to provide their own power rather than pay these charges, said one speaker.

Mr. J. C. Howell (Llanelly) explained that his experience showed that there was very little difference in the motive power being either electricity or steam.

THE FARADAY SOCIETY.

Acidity of Natural Waters and their Action on Metals.

A paper recently read by Dr. W. R. C. Atkins before the Faraday Society, although describing work which, in its origin, is far removed from engineering practice, contained several considerations that will be of interest as bearing on corrosion and on the etching of metals as practised by metallographers in studying their structure. Modern physical chemists measure acidity in terms of the concentration of hydrogen ions (the symbol p_H, commonly adopted, stands for the reciprocal of the logarithm of the hydrogen ion concentration). Dr Atkins's paper is a record of numerous measurements of p_H made with various natural waters, such as rain, river and sea water, under various conditions and after various treatments, and some of the results will be of inteerst to boiler engineers. It transpires that the practice obtaining with some engineers who use very soft water of adding a small quantity of sea water to their boilers at intervals, bringing p_H up to 11 or more, has the effect of increasing alkalinity, and so rendering the iron relatively immune from rust. This immunity is found to be due to the fact that the p_H value is too high for any appreciable quantity of ferrous hydroxide to exist in solution, while the amount of carbon dioxide in solution as acid is also vanishingly small. In ordinary iron, however, the oxidation of the traces of compounds of sulphur present may result in the production of sufficient acid to increase corrosion. The reason why copper is not attacked by atmospheric carbonic acid is that its hydroxides are not appreciably soluble at the hydrogen ion concentrations normally found in natural waters.

It is concluded that in general a metal is not appreciably dissolved by an acid unless the concentration of hydrogen ions suffices to dissolve its hydroxide. No matter how great the acidity as determined by titration may be, no action takes place unless a suitable p_H value is reached. For action of a selective character, therefore, it is theoretically possible to have such a p_H value as will result in the attack of one metal by the acid, whilst the other is left intact; but again the action would be very brief when using a strong acid or a strong base.

Since the effect of dilution is much less in the case of the weak acids and bases their action remains more uniform at low concentrations than is the case with strong acids and bases. Their value as etching reagents seems to be connected with this property. It is suggested that even the action of polishing powders may not be purely mechanical.

Ionisation within the Molecule.

At the same meeting Prof. T. M. Lowry, in a very suggestive paper, drew attention to the fact that the electronic formulæ now used by chemists, based on the theory of octets (the

so-called Lewis-Langmuir atom) has made it necessary to postulate a condition of intra-molecular ionisation in a large number of compounds where the charges on the nuclei are not balanced by the enveloping electrons. The present paper deals particularly with inorganic compounds, and Dr. Lowry's suggestion explains very aptly the relative stability of the oxy-acids, such as the chloro-, sulphur-, and the phosphor-acids. The conception also leads to a novel explanation of the acidifying properties of oxygen.

STREET LIGHTING.

RECENT DEVELOPMENTS AND MODERN REQUIREMENTS.

A DISCUSSION on the above subject took place at a meeting of the Illuminating Engineering Society on December 12th, the chair being taken by Mr. A. P. Trotter.

MR. HAYDN T. HARRISON read an introductory paper referring to the great importance of good public lighting in promoting order and safety in the streets. The burden of rates was mentioned as one reason why progress was delayed. But improved street-lighting did not always mean increased expenditure. The development of fast motor traffic had revolutionised street-lighting requirements. If vehicles and pedestrians were made visible to drivers by effective public lighting, over-powerful headlights would become less needed. Mr. Harrison declared his adherence to the method of classification based on measurements of minimum horizontal illumination. He pointed out that the classification of streets on this basis by the Joint Committee in this country and by the Street Lighting Committee of the N.E.L.A. in the United States were in close accord. It was therefore surprising to find that in America it had been decided to specify the type of lamp rather than the result in the form of illumination it was desired to obtain.

The speaker also pointed out the fundamental importance of methods of spacing street-lighting units. As the distance apart of posts was usually many times their height, the illumination midway between the lamps was necessarily low. Hence the need for using very powerful lamps and accentuating the candle power at angles slightly below the horizontal. Recent developments were illustrated by reference to two recently-introduced devices, the "Holophane" prismatic street lantern and Mr. Harrison's "longitudinal" system of lighting.

The paper was followed by a contribution by MR. L. GASTER on "Street Lighting and Safety." A number of slides were shown illustrating the methods of screening adopted during the war, and the consequent "patchy" illumination under the lamps. Statistics had been obtained showing a marked increase in street accidents during the period 1913-1916, and it was evident that the diminished public lighting was one contributory cause. Statistics on accidents in seven American cities, with a combined population of over seven millions, had confirmed this conclusion. It was estimated that 17.6 per cent. of accidents occurring at night were due to inadequate lighting. The present time, when many firms were in need of work, and widespread unemployment was giving rise to much concern, appeared opportune for putting in hand street-lighting improvements, which would in any case become necessary later on. In conclusion, Mr. Gaster summarised the chief requirements of street lighting from the safety standpoint, dwelling on the desirability of avoiding glare and excessive contrasts and aiming at uniformity of effect. Well-diffused private lighting should also be encouraged, as this was a valuable supplement to public lighting. The lighting of roads—particularly main thoroughfares and important arteries of traffic—was not a parochial but a national matter. It appeared that the time had come when public lighting, like the upkeep of road surfaces, should be supervised by an appropriate central authority and conducted on a uniform plan.

The discussion was opened by DR. CLAYTON SHARP, who has been intimately associated with street lighting improvements in the United States. Dr. Sharp referred to the ornamental lanterns made up of diffusing glass, which had become usual in America. The provision of a certain horizontal illumination was one important factor, but not the only one. A specification describing completely the nature of the lighting fittings to be adopted was necessary. Special appliances had been devised for testing the candle-power of the lamp *in situ*, and it must be recognised that accurate measurement of illuminations of the order of 1/100 foot-candles was extremely difficult. A feature had been the setting aside of a complete length of road where experiments with various systems of lighting could be tried out. The tests were not confined to measurements of candle-power and illumination, but were also directed to ascertaining freedom from glare. Experiments had also been made to ascertain how well the illumination would reveal obstacles on the road.

MR. FRANK BAILEY considered that measurements of illumination were of fundamental importance as a test of street-lighting conditions. Authorities were apt to complain of the cost of street-lighting, but did they sufficiently realise its benefits? There were many narrow streets in the city where traffic was crowded, and where extensions and widening of the road would cost enormous sums. In such cases a great improvement could be made by introducing better lighting which would facilitate more rapid movements of traffic.

CAPT. W. J. LIBERTY (City of London), MR. S. B. LANGLANDS (Glasgow), and MR. R. DAVISON (Newcastle-on-Tyne) referred to street-lighting developments in their respective districts, and MR. J. G. CLARK mentioned "visibility" as the determining factor in street-lighting. He was not satisfied that perfectly uniform illumination was desirable in this respect.

MR. H. L. THOMSON (Chairman of the Lighting Committee of the City of Westminster) expressed his belief that candle-power was the best basis on which to frame lighting contracts. It was not desirable that *all* light should be concentrated on the roadway. The illumination of the façades of important public buildings was a useful feature, and in this field the co-operation of the architect would be welcome.

MR. HAYDN T. HARRISON briefly replied to the discussion, and the Chairman announced that the next meeting would be held on January 16th, when there would be a discussion on "The Need for Suitable Training in Illuminating Engineering."

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STUPHENS, Patent Agents, 285, High Holborn, London, W.C.1.

33,361. "Cathode ray oscillographs." F. R. F. Ramsay. December 6th.
33,402. "Tramway rails." T. Brooks. December 7th.
33,417. "Aerial and antenna systems for wireless telegraphy, &c." H. Morris-Airey and C. Seymour. December 7th.
33,421. "Transmission of audible code signals for fire alarms." C. Smith and G. J. Sutton. December 7th.
33,425. "Electron discharge devices." Western Electric Co., Ltd. December 7th. (United States, July 29th.)
33,430. "Receiving apparatus for wireless signaling." H. P. P. Rees. December 7th.
33,440. "Method of treating electro-conductive and moisture-bearing materials." E. M. Crowther, W. B. Haines, and Sir E. J. Russell. December 7th.
33,453. "Signalling apparatus for railways, &c." Westinghouse Brake and Saxby Signal Co., Ltd. December 7th.
33,466. "Automatic calling selectors for telephone installations." L. d'Haenens. December 7th. (Belgium, December 9th, 1921.)
33,468. "Method of operating electric tools." Central Electric Tool Co. December 7th. (United States, January 4th.)
33,470. "Receiving tuners for wireless apparatus." R. Rutherford. December 7th.
33,476. "Apparatus for automatic adjustment of electrical potential of grids, &c., of thermionic valves." W. J. Rickets. December 7th.
33,477. "Electrical ignition, &c., systems." L. Renault. December 7th. (France, September 22nd.)
33,493. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. December 7th.
33,507. "Electric transmission." A. M. Taylor. December 8th.
33,521. "Magnetos." R. C. J. Boaler. December 8th.
33,526. "Shackle and pin for colliery trams, &c." R. S. Butler. December 8th.
33,534. "Electric switches." F. H. M. Swinburne. December 8th.
33,555. "Means for flattening current waves of pulsating direct current." C. A. H. Haighton. December 8th. (Holland, December 10th, 1921.
33,566. "Electrical device for dimming lights and warming carburettor on motor-cars, &c." J. L. Strang. December 8th.
33,569. "Two- or three-electrode condenser." A. H. Norman, J. F. R. Shand, and R. F. Shand. December 8th.
33,578. "Telephone attachments." A. N. Pass. December 8th.
33,583. "Gear for agitating and circulating liquid in dye vats, &c." English Electric Co., Ltd. December 8th.
33,587. "Manufacture of fused quartz by electric furnace." Soc. Anon. Quartz et Silice. December 8th. (France, December 16th, 1921.)
33,588. "Manufacture of fused quartz by electric furnace." Soc. Anon. Quartz et Silice. December 8th. (France, December 16th, 1921.)
33,602. "Locking means for securing electric lamps in sockets." H. G. Farr. December 8th.
33,603. "Magnets." W. B. Sayers. December 8th.
33,604. "Electric transformers." M.L. Magneto Syndicate, Ltd., and G. K. Morris. December 8th.
33,609. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). December 8th.
33,610. "Speed indicators." British Thomson-Houston Co., Ltd., and A. P. Young. December 8th.
33,614. "Primary cells." A. C. Goolden, D. J. Macnaughton, and H. Moore. December 8th.
33,615. "Multiple-way selector switch." F. H. Madsen. December 8th.
33,616. "Clamping device for electric switchboards." F. H. Madsen. December 8th.
33,621. "Means for starting arc in arc lamps." C. B. Mitcalfe-Dale and A. J. Packham. December 8th.
33,650. "Electric lamp globes." J. J. F. Sloan. December 9th.
33,655. "Telephonic transmission of images, &c." J. Dimsdale and J. Kean. December 9th.
33,661. "Electric arc projectors." H. S. Webster. December 9th.
33,684. "Variable electric condensers." L. N. Hall. December 9th.
33,691. "Grid leaks and like electric resistances." A. F. Chapman. December 9th.
33,694. "Electric devices for controlling flow of liquids." A. G. Jackson. December 9th.
33,696. "Sealing and protecting ends of electric conductors." A. E. Frankling and W. J. Spencer. December 9th.
33,700. "Dynamo electrical machines." British Thomson-Houston Co., Ltd., and A. P. Young. December 9th.
33,702. "Magneto-electric generators." G. E. Barnsto. December 9th.
33,713. "Electric switches." J. A. Crabtree. December 11th.
33,720. "Electric lock." J. W. Hanson and J. G. Hawkes. December 11th.
33,721. "Electric couplings." W. A. Eastway. December 11th.
33,735. "Electric oven." F. Hoppe. December 11th.
33,747. "Galvanic batteries or cells." W. H. Edridge. December 11th.
33,754. "Means for transmitting and receiving wireless messages." F. W. V. Fitzgerald. December 11th.
33,775. "Receiving apparatus for wireless signalling." H. P. P. Rees. December 11th.
33,784. "Speed-controlling devices for trains." E. Rodenhouse. December 11th.

33,804. "Electrical ... Park. December 11th.

33,806. "Locking apparatus for ... December 11th.

33,822. "Trolley poles &c." ... December 11th.

33,847. "Automatic ... current, ... &c." ... December 12th.

33,844. "Distributors, commutators, &c." J. S. Foley. December 12th.

33,856. "... &c." ... December 12th. 1921.

33,889. "Illuminated advertising devices." ... and G. Spencer, ... Ltd. December 12th.

33,892. "... of internal-combustion engines." F. E. Morriss. December 12th.

33,905. "Electrical indicating instru... & Vogtlin, Ltd., ... December 12th.

33,917. "... of dynamo-electric machines." British Thom... and C. J. Sarjeant. December 12th.

33,926. "Reception of wireless signals." A. L. A. Petty. December 12th.

33,927. "Electro-magnetic indicating dev... W. Leake and Tyer and Co., Ltd. December 12th.

33,929. "... J. Gordon. ... 12th.

33,931. "... H. Waller. December 12th.

33,937. "Galvanic batteries." ... Ltd., and W. D. Wilde. December 12th.

33,938. "Spark plugs." A. E. White (Brewster Goldsmith Corporation). December 12th.

33,939. "Spark plugs." A. E. White (Brewster Goldsmith Corporation). December 12th.

33,940. "Spark plugs." A. E. White (Brewster Goldsmith Corporation). December 12th.

33,941. "Electric filter circuits." A. G. Lee. December 12th.

33,949. "Rectifying devices." A. R. Angus. December 12th.

33,950. "... showing ... production of electricity, &c." F. Horridge. December 13th.

33,978. "Combined electrical fitting ... therefor." J. N. Robson. December 13th.

34,012. "... December ...

34,015. "Intervalve coupling transformers and inductances." E. Redpath. ... 13th.

34,019. "Tram rails, &c." E. T. Wood and W. B. Wright. December 13th.

34,020. "Ignition systems for internal-combustion engines." H. E. Fellows. December 13th.

34,032. "Rotors for dynamo-electric machinery." K. Baumann, T. H. Charlton, G. A. Juhlin, J. A. Kuyser, and Metropolitan-Vickers Electrical Co., Ltd. December 13th.

34,045. "Electric heating devices." C. G. Nobbs and W. W. Nobbs. December 13th.

34,046. "Remote control of electrically-actuated apparatus." L. H. Peter, B. H. Peter, and Westinghouse Brake and Saxby Signal Co., Ltd. December 13th.

34,049. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. December 13th.

34,053. "Dynamos, electric motors, &c." J. R. Pullon and G. H. Tatham. December 13th.

34,072. "Lead-covered cables for electric transmission." A. M. Taylor. December 14th.

34,074. "Automatic telephone ... J. Berry, and Siemens Bros. and Co., Ltd. December 14th.

34,082. "Thermionic valves." C. S. Morris. December 14th.

34,094. "Electric generators or ... amos for motor-vehicle lighting." F. Dunn. December 14th.

34,097. "Magnetic ... and controlling apparatus." C. L. Sumpter. December 14th.

34,098. "Switch mechanism for electric lighting installations." C. Sugden. December 14th.

34,125. "Electric condensers." A. Onwood. December 14th.

34,133. "Connections for wireless receiving apparatus." C. F. ... Ltd., ... G. Mittell. December 14th.

34,141. "Electric motor-control systems." Metropolitan-Vickers Electrical Co., Ltd. December 14th. (United States, December 17th, 1921.)

34,156. "Asynchronous induction machines." T. Torda. December 14th. (Hungary, May 10th.)

34,162. "... and electric lighting unit for motor vehicles." ... Kist. December 14th.

34,173. "Variable-speed ... British Thomson-Houston Co., Ltd. December 14th.

34,174. "... changers for dynamo-electric machines." British Thomson-Houston Co., Ltd., H. C. Hastings, and C. J. Sarjeant. December 14th.

34,175. "Sound-emitting apparatus." British Thomson-Houston Co., Ltd., J. H. Butcher, and A. P. Young. December 14th.

34,176. "Amplifiers." British Thomson-Houston Co., Ltd. December 14th. (United States, December 14th, 1921.)

34,181. "Method of transmitting pictures to a distance." Picturadio Corporation. December 14th. (United States, June 13th.)

34,182. "Electro-magnetic sound receiving and producing devices." C. W. Clarabut. December 14th.

34,183. "Electro-magnetic sound receiving and producing devices." C. W. Clarabut. December 14th.

34,186. "Registering telephonic conversations." S. Brociner and E. Freund. December 14th. (Austria, December 15th, 1921.)

34,192. "Variable condenser." S. H. Green. December 15th.

34,200. "Electric apparatus for production of peroxides of nitrogen." F. ... December ...

34,214. "Means for controlling head-lights." B. L. Roberts. December 15th.

34,215. "Magnetic hand hammer." H. J. Dale. December 15th.

34,219. "Arrangement for locking electric light bulbs, &c." S. J. Edbrooke. December 15th.

34,220. "Burglar, &c., alarm." C. Couch. December 15th.

34,233. "Combined filament rheostat and crystal detector." F. H. Blaxley and E. E. Peace. December 15th.

34,234. "Terminals, &c., for high-voltage electrical apparatus." F. Coates and A. Reyrolle & Co., Ltd. December 15th.

34,238. "Burglar alarm." W. H. Llewellyn. December 15th.

34,245. "Electrical heating apparatus." J. R. Quain. December 15th.

34,247. "... and W. J. Cocke. ... 15th.

34,248. "Asynchronous induction ... December 15th (Hungary, September 20th.)

34,... "... coupling units for electric incandescent ... H. Broadbent and H. M. Edwards. December 15th.

34,250. "... for electric incandescent ... H. Broadbent and H. M. Edwards. December 15th.

34,266. "Electric switches." Rolls-Royce, Ltd., and F. H. Royce. December 15th.

34,... "... for dynamos or motor-cycles, &c." S. G. Muir and E. G. Pyne. December 15th.

34,... "... induction motors." T. Torda. December 15th. ... June 3rd.)

34,276. "Thermally-actuated electric switches." C. French and E. French. December 15th.

34,279. "... telegraphy." L. J. Clarke. December 15th.

34,296. "Polyphase asynchronous motors." F. Ernstein. December 15th.

34,298. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and H. C. Hastings. December 15th.

34,299. "Head attachment gear for telephone receivers, &c." British Thomson-Houston Co., Ltd., J. H. Butcher, and A. P. Young. December 15th.

34,307. "Encasing or lagging pipes, electric cables, &c." F. J. Commin. December 15th.

34,313. "Electric terminal connector." J. Gell. December 15th.

34,316. "Asynchronous induction machines." T. Torda. December 15th. (Hungary, October 21st.)

34,362. "Thermionic discharge devices." Radio Communication Co., Ltd., and E. H. Robinson. December 16th.

34,363. "... to high frequency signalling systems, &c." Radio Communication Co., Ltd., and E. H. Robinson. December 16th.

34,374. "... for charging accumulator cells." A. R. Angus. December 16th.

34,379. "Electric drive for gramophones." V. E. Antrique. December 16th.

34,385. "Induction coils, ... &c." H. C. Barker. December 16th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken

1920.

26,960. "... perforators." A. C. Booth and A. S. Willcox. June 1st, 1921. (189,474

1921.

17,937. "... clutches." P. R. Jackson (Sperry Gyroscope Co. June 1st, 1921. (189,483.)

19,937. "Electric hand drills." I. Sweetland. July 25th, 1921. (189,484.)

20,763. "Electric heaters." A. Selvatico. August 4th, 1921. (189,497.)

22,317. "Commutators or rotary ignition current distributors for internal-combustion engines." J. Judge. August 23rd, 1921. (189,500.)

22,657. "Magneto-electric generators." W. P. Thompson (Splitdorf Electrical Co.). August 26th, 1921. (189,509.)

22,861. "Direction-finding apparatus for use in wireless telegraphy." L. G. Preston, Dr. B. Hodgson, C. E. Horton, and G. W. Harris. August 29th, 1921. (189,516.)

23,168. "Method of mending electric resistance elements." N. Carrico and F. C. Hughes. September 11th, 1920. (169,157.)

23,229. "Electric couplings." W. Thompson. September 1st, 1921. (189,541).

23,437. "High-frequency telegraphy and telephony." Ges. für Drahtlose Telegraphie and Dr. H. Gewecke. September 29th, 1920. (169,691.)

23,938. "Electric switches, particularly for use with electrically-heated irons." C. W. Denny. September 8th, 1921. (Cognate applications 26,125/21 and 6,202/22.) (189,573.)

23,974. "Acoustical apparatus for telephonic communication." Signal Ges. September 27th, 1920. (169,438.)

23,980. "Testing devices for electric ignition systems." J. H. Runbaken and W. Torrance. September 8th, 1921. (189,574.)

24,442. "Portable electrically-driven combination tools." F. Pooley, F. C. Austin, and W. L. Wreford. September 14th, 1921. (189,576.)

24,562. "Method of protecting polyphase supply circuits on the occurrence of an earth connection." Akt. Ges. Brown, Boveri et Cie. September 16th, 1920. (169,175.)

25,597. "Electric terminals." Efandem Co., Ltd., and J. Eaton. September 16th, 1921. (189,577.)

24,642. "Electro-mechanical motion-transmitting devices for automobiles or the like." T. A. T. Rydberg. July 26th, 1921. (183,789.)

25,719. "Galvanic batteries." G. Oldham and J. Oldham. September 29th, 1921. (Cognate application 17,734/22.) (189,589.)

25,798. "Operating mechanism for electric switches." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1921. (189,591.)

26,302. "Electrical control systems, particularly adapted for lifts, haulage gear, and the like." Electric Control, Ltd., and O. Ellefsen. October 5th, 1921. (189,594.)

27,367. "Supports or holders for electric conductors." A. Wiseman and J. W. Harris. October 15th, 1921. (189,604.)

27,741. "Railway rail chairs for holding bull-head conductor rails upright without keys or other fastenings." R. S. Proud. October 19th, 1921. (189,616.)

27,934. "Overload trip retarding or delaying device for electric circuit breakers or automatic switches." Electric Construction Co., Ltd., and F. W. Close. October 21st, 1921. (189,617.)

30,183. "Clamping arrangement for sheet metal stator teeth of electrical machines." Maschinenfabrik Oerlikon. November 17th, 1920. (171,688.)

31,147. "Terminal ends for electric wires and cables." L. F. Summers. November 22nd, 1921. (189,641.)

32,160. "Wireless telegraph receivers." L. B. Turner. December 1st, 1921. (189,646.)

32,876. "Electric starting motor for internal-combustion engines." C. A. M. Buckley. December 7th, 1921. (189,652.)

33,128. "Ignition devices for use in explosion motors." F. L. Eldridge. December 9th, 1921. (Cognate applications 9,321/22 and 21,403/22.) (189,656.)

33,701. "Safety vents for electric motor cases, switch boxes, junction boxes, and the like." Electric Construction Co., Ltd., and F. W. Close. December 15th, 1921. (189,664.)

1922.

482. "Trolley wheels for electric current collectors." C. H. Bird. January 6th, 1922. (189,678.)

1,651. "Electric fuses, cut-outs, or the like." Siemens Bros. & Co., Ltd., and H. G. Wood. January 19th, 1922. (189,684.)

2,277. "Automatic electric fuse switches." Bayerische Elektrizitäts-Industrie Rott & Co. January 25th, 1921. (174,617.)

3,645. "Wireless telegraph receivers." L. B. Turner. February 8th, 1922. (189,693.)

5,509. "Electric soldering irons." J. F. Cocuilh. June 15th, 1921. (181,680.)

5,749. "Electric heated laundry irons." H. Booth. February 27th, 1922. (189,704.)

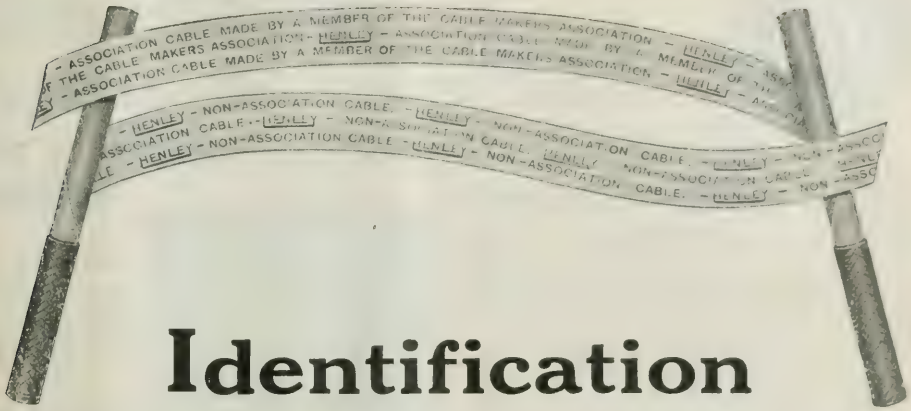
11,401. "Telephone cables." Johnson & Phillips, Ltd., and G. C. Pearson. April 22nd, 1922. (189,716.)

13,442. "Electric circuit controllers." British Thomson-Houston Co., Ltd. (General Electric Co.). May 12th, 1922. (189,720.)

14,648. "Electric torches." M. Goodfellow and Ever Ready Co. (Great Britain), Ltd. May 24th, 1922. (189,724.)

22,500. "Electrically-controlled valve-gears for reciprocating steam engines." O. Simmen. August 24th, 1921. (185,111.)

31,360. "Electric signalling over cables." B. Davies and Eastern Telegraph Co., Ltd. June 23rd, 1921. (Divided application on 17,234/21.) (189,733.)



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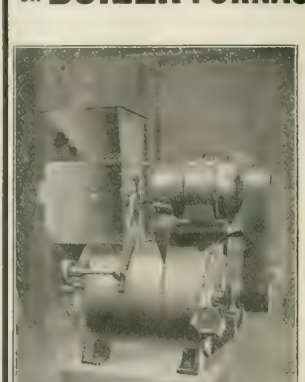
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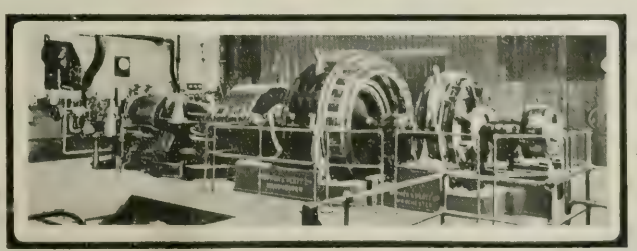
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ANNFIELD PLAIN (Co. DURHAM).—Business premises, Flint Hill, Dipton, for [illegible]. Particulars from [illegible] Grove, Lanchester.

HERTON [illegible]

AYR [illegible]

BARNSLEY [illegible] George Haigh.

BERWICK-ON-TWEED.—Extensions, Hide Hill, for the Bank of Martin's [illegible]

ENFIELD [illegible] Bungalow, Knebworth Road; detached house, Jameson Road; D. B. Sceats, Devonshire Square. Detached house, Clavering Walk; Culpin & Bowers. Shop, St. Leonards Road; detached house, Terminus Avenue; J. E. Maynard, Collington Avenue. Offices, Chepbourne Road; detached house, Holmsdale Road; detached house, Richmond Road; J. H. Lye, Station Road. Detached house, Piemont Gardens; R. W. Featherstone. Bungalow, [illegible] Normanhurst Hotel; J. S. D. Hicks. Detached house, Hartfield Road; W. [illegible] & Bellow, Devonshire Road.

CARLISLE.—Business premises and house, for Mr. Gaddes; Taylor Scott, architect, 36, Lowther Street.

[illegible] for the erection of Kirk Sandall; trustees.

DRIFFIELD (YORKS.).—Alterations to Keys Hotel; licensee.

EDINBURGH.—Dr. Elsie Inglis Memorial Hospice, between Spring Gardens and King's Park, for the committee; secretary. Reconstruction of shops, 36 and 42, Nicolson Street into show-rooms and commercial depôt, for Edinburgh Royal Blind Asylum. Extension to West (Flour) Mills, Colinton; the manager. Factory and showroom in Semple Street; Mr. J. R. Alexander. Extension, for North British Distillery Co., Ltd., Wheatfield Road; the manager. New church at Bingham Village Asylum £8,000); H. O. Tarbolton, architect. Conversion of cable car depôt into [illegible] for the erection costs £8,000), city architect.

EPSOM.—Central school (£8,000), for Surrey E.C.; the clerk, Kingston-on-[illegible]

FIFESHIRE.—Public hall at Rathillet; H. V. Newman, architect.

GIRVAN.—Electric lighting installation, M'Master Hall, for the T.C.; the clerk

GLASGOW.—New hospital (£80,000); Mr. James Macfarlane, chairman, Royal Infirmary

HALIFAX.—Business premises, King Edward Street, for Woolworth & Co., Ltd. John Mackintosh Memorial Cottage Homes; Lumb and Walton, architects, 19, Clifton Street, Blackpool, or Medley Hall, resident architect, 1, Harrison Road, Halifax.

HANLEY (STAFFS.).—Rebuilding of Upper Hanley United Methodist church; pastor.

JARROW.—Roman Catholic church in east end of town; Rev. H. Mackin, rector, St. Bede's R.C. Church.

KENDAL.—Alterations 10, Finkle Street, for Stokers, drapers.

LEEDS.—Additions to "Nelson Inn," Holbeck; Garside and Pennington, architects, Pontefract. Erection of First Church of Christ Scientist, Headingley; Schofield & Berry, architects, 15, Park Row.

LEICESTER.—Conversion of premises, Gallowtree Gate, into telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W.

LINTHWAITE (YORKS.).—Houses, for the U.D.C.; the surveyor. Cotton doubling shed, for J. W. Varley.

LIVERPOOL.—Church at Blundellsands; Rev. G. E. Jones, St. Michael's Church, Blundellsands.

LONDON (BARNES, S.W.).—Extensions to St. Mary Magdelen's parish hall; Speechley & Smith, architects.

(BELLINGHAM).—Licensed premises, Randlesdown Road, for Barclay, Perkins & Co., Ltd., brewers.

[illegible] Rebuilding of post office, Hazelwood Street; Secretary, H.M. Office of Works (Contracts branch), King Charles Street, London, S.W.1

LONDON (GREENWICH, S.E.).—Refuse disposal depôt and plant, for the B.C. (£7,350); the surveyor.

(ELTHAM, S.E.).—Housing scheme, for Woolwich B.C.; borough surveyor, Woolwich.

S. (LEYTON).—Congregational Sunday schools, for Grange Park church; pastor.

(MERTON, S.W.).—School, for Surrey E.C.; the clerk, Kingston-on-[illegible]

(M[illegible] S.W.).—School (£16,000), for Surrey E.C.; the clerk, Kingston-on-Thames.

(S[illegible] Norwood, S.E.).—Extension of Holmesdale Road Baptist church; Rev. W. H. Pratt, pastor.

[illegible] Nurses' home; H. V. Ashley, architect.

MACCLESFIELD.—Conversion of premises into chapel and additional wards, for the Board of Guardians; A. E. Bradburn, architect.

MARGATE.—Showrooms and office, Albert Garage, Albert Road; W. B. Wilkins. Bakery and shop, Dane Road, for R. A. Harris.

MELTON MOWBRAY.—Conversion of Egerton Brewery, Snowhill, into factory, for Mr. Clarke.

MILNROW.—Public conveniences and electricity transforming station. Edmund Street; surveyor to U.D.C.

MIRFIELD (YORKS.).—Additions to "Navigation Tavern"; licensee.

MOTHERWELL.—Clothing factory, Parkhead Street (£10,000), for W. D. Ford. Additions at County Hospital (£50,000); Cullen, Lochhead & Brown, architects.

NEWCASTLE-ON-TYNE.—Underground conveniences at Burton Street; city surveyor.

OLDHAM.—Scouts' institute, near Leesfield schools; Rev. E. Wolfe, vicar.

OSSETT.—Housing scheme, Sowood Avenue site; borough surveyor. Extension of Progress Engineering works, Dewsbury Road; the manager.

PENISTONE (YORKS.).—Additions to offices. P. A. Hinchliffe, architect, 14, Regent Street, Barnsley.

PRESTON.—Church, Hesketh Bank; Austin & Paley, architects, Lancaster.

REIGATE (SURREY).—Extensions to laundry and plant, for the Board of Guardians; the clerk.

ROCHDALE.—Additions, Marland hospital; borough surveyor.

RUDGWICK.—Roman Catholic church at Lynwick; priest-in-charge.

RYDE.—Additions to the County Hospital; Ball & Sons, architects. Extensions, Waverley Hotel, for F. Band; E. R. Osborne, architect.

SALFORD.—Alterations to Union infirmary, Stott Lane, Pendleton; W. T. Gunson & Son, architects, 10, Marsden Street, Manchester.

SHREWSBURY.—Improvements at the Orthopædic hospital; secretary.

SKIPTON.—Housing scheme; surveyor to U.D.C.

SLAITHWAITE.—Housing scheme; surveyor to U.D.C.

SPENBOROUGH (YORKS.).—Three electricity sub-stations, for the U.D.C.; R. Castle & Son, architects, Midland Bank Chambers, Cleckheaton.

STUARTON.—Conversion of premises into guildhall and offices, with electric lighting work, for the T.C.; W. Macrae, town clerk.

STURRY (CANTERBURY).—Thirty houses, for the Chislet Colliery Co., Ltd.

SUTTON-IN-ASHFIELD.—Business premises, Brook Street, for Crompton, Outram Street Dairy, Crown Street, for J. Hardwick.

THURLSTONE (YORKS.).—Church and Sunday schools, for the trustees of Spring Vale Primitive Methodist church.

UDDINGSTON.—Masonic hall, for St. Bryde Lodge; William Baird, architect, Bellshill.

WAKEFIELD.—Housing scheme, Portobello estate, for T.C.; P. Morris, architect, Town Hall Chambers.

WALTON-ON-THAMES.—Extensions at pumping station, for the Metropolitan Water Board; engineer to the Board.

WESTCLIFF-ON-SEA.—Hall, for Beebell Avenue Primitive Methodist church (£2,000); trustees.

WEYMOUTH.—Concert hall (£10,000), for the T.C.; the clerk.

WORCESTER.—Re-erection of Rhydd Court, Henty Castle, residence of T. Oram

WOKINGHAM.—Bank, Broad Street, for the London Joint City and Midland Bank, Ltd.

YORK.—Extension of County Hospital; secretary. Twenty-nine houses, for the T.C.; F. W. Spurr, architect, Guildhall.

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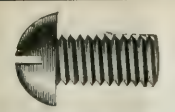
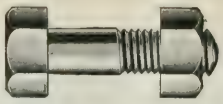
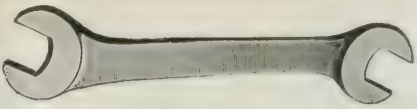
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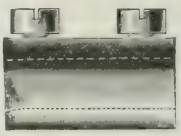
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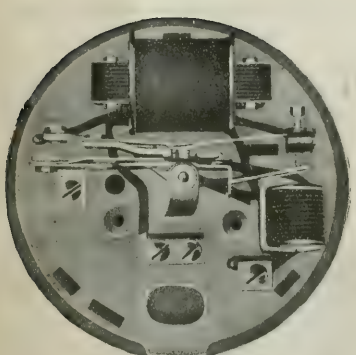
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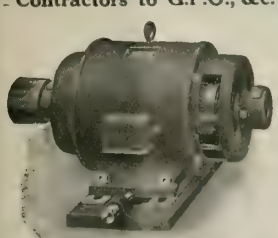


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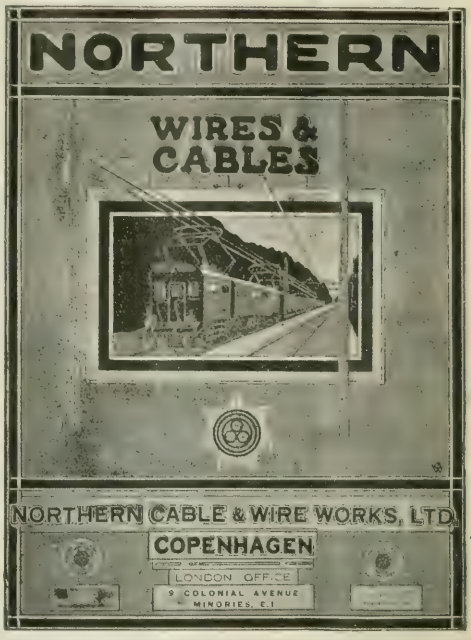
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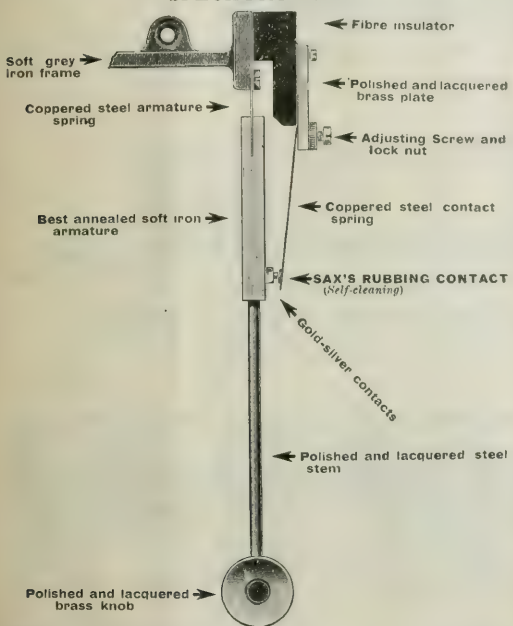
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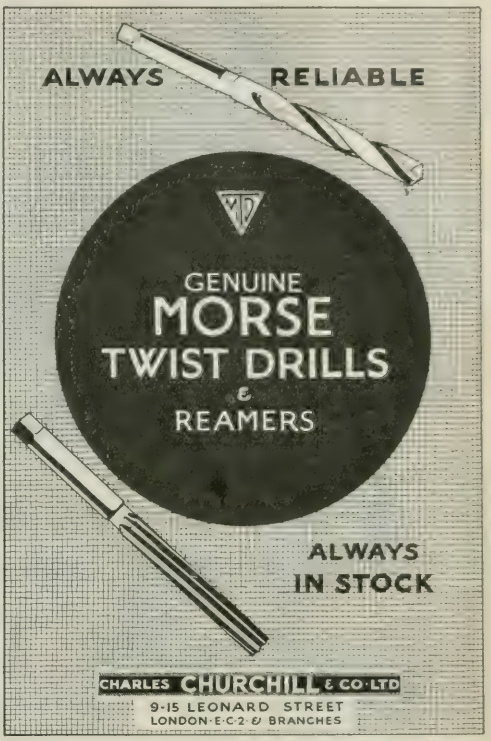
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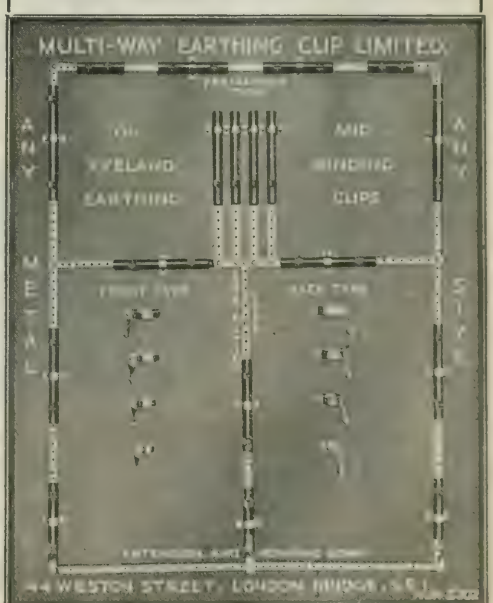
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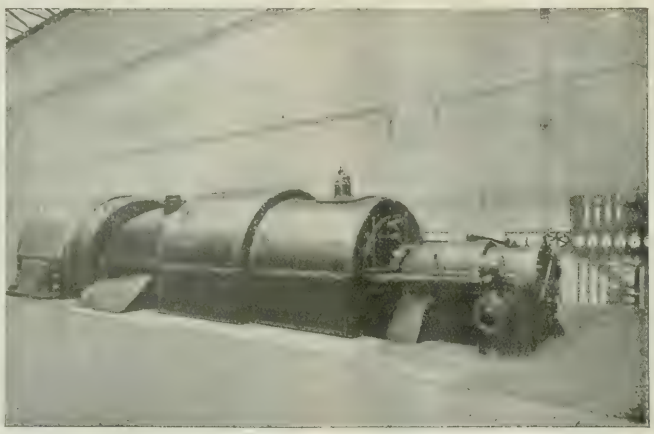


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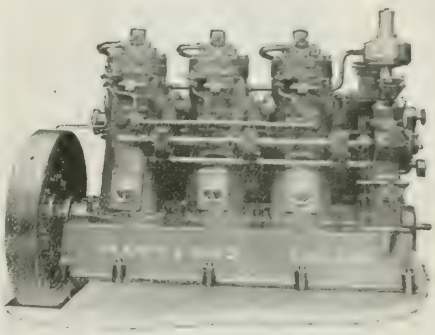
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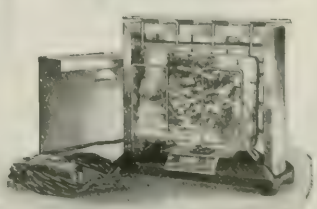
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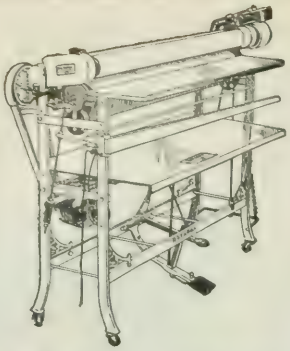


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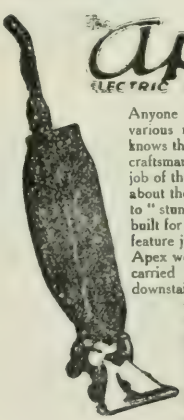
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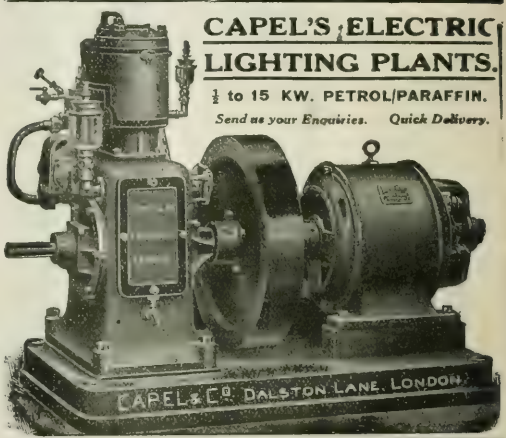
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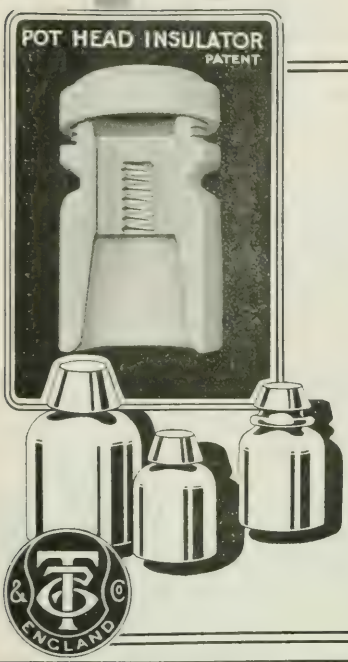
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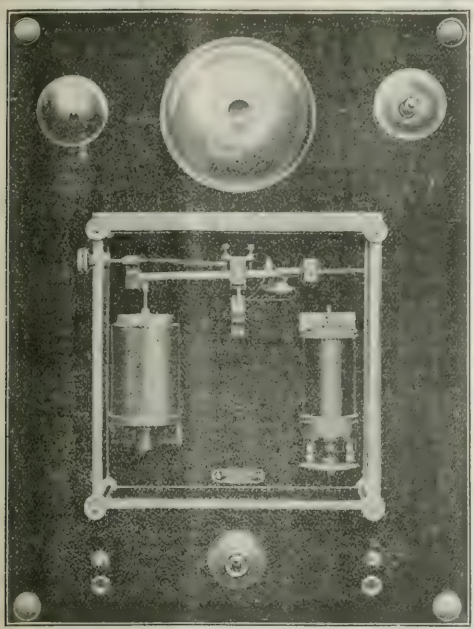
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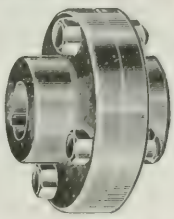
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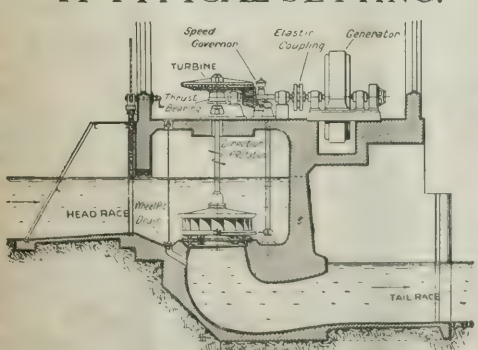
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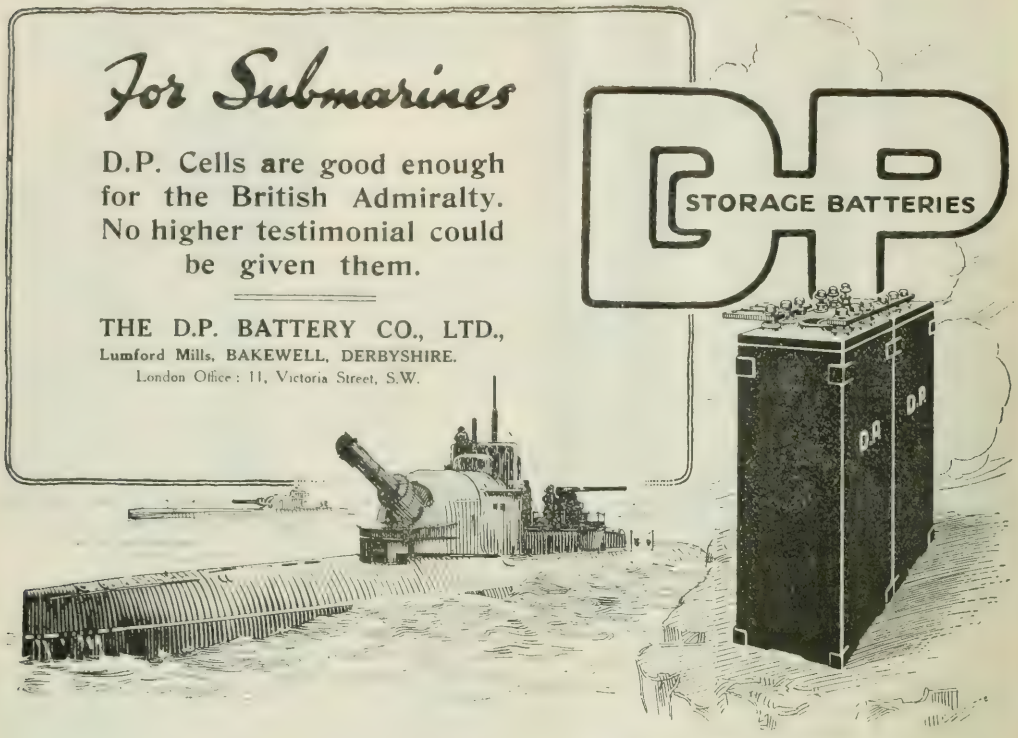
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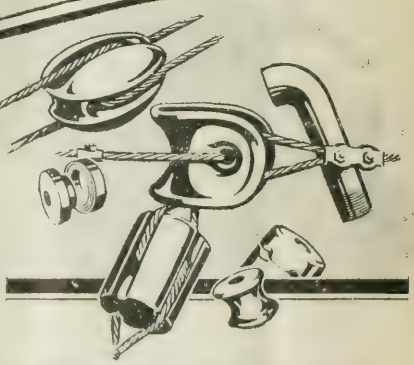


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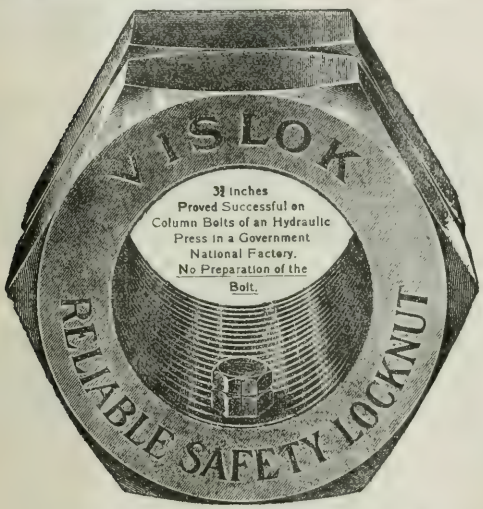
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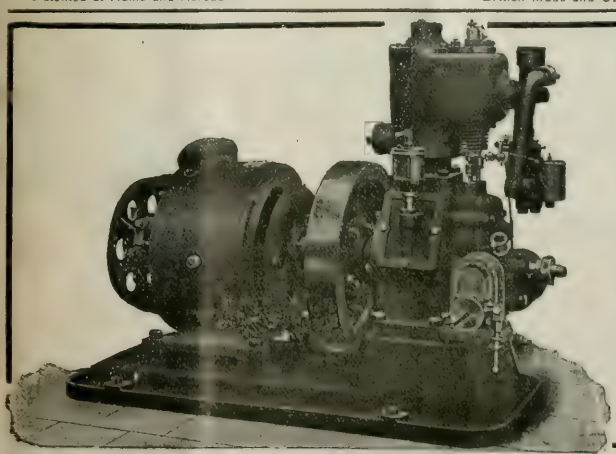
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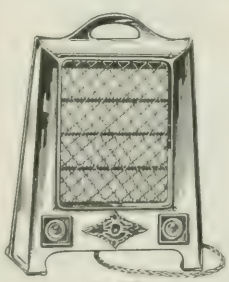
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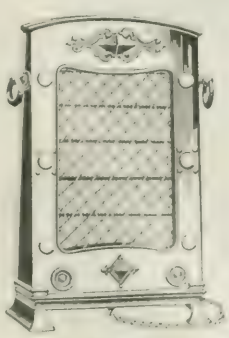
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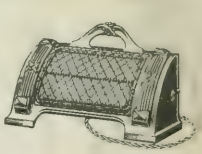
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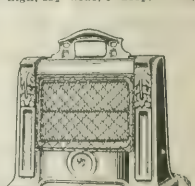
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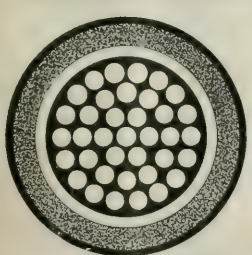
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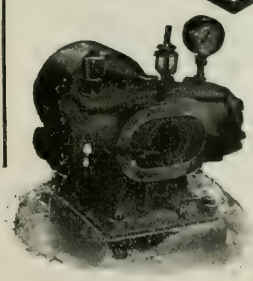
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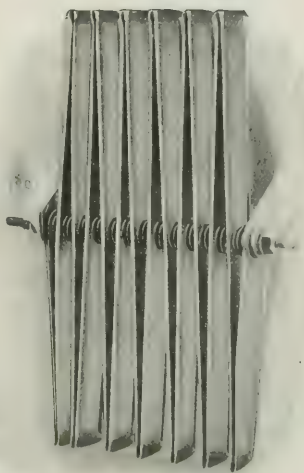
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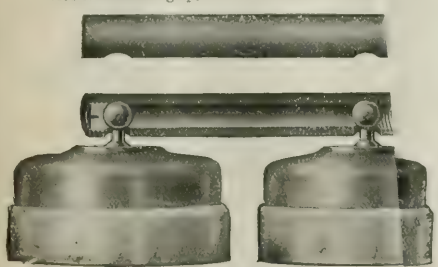
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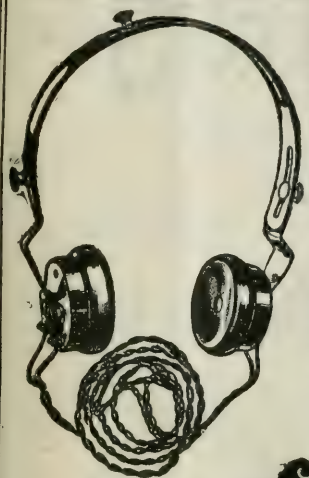
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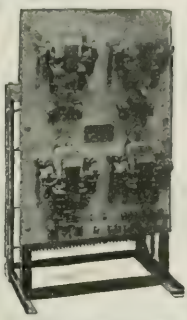
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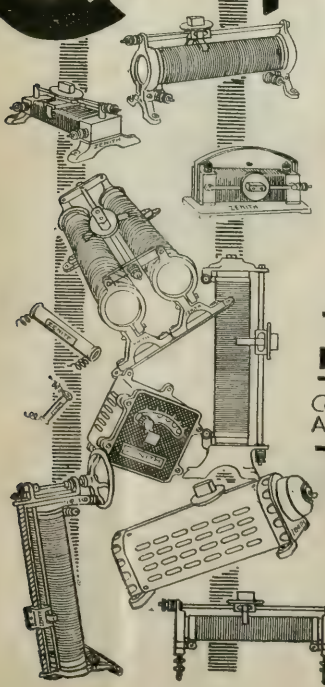
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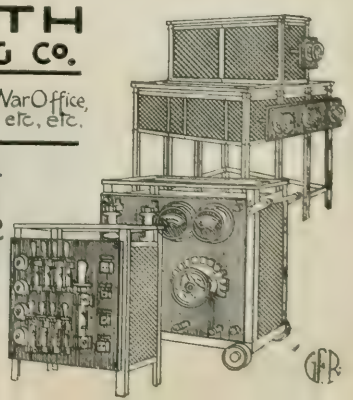


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